



COIMBATORE INSTITUTE OF TECHNOLOGY

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CIVIL AERODROME POST, COIMBATORE-641 014, TAMILNADU, INDIA

Criteria 1 Curricular Aspects

Key Indicator: 1.3 Curriculum Enrichment

1.3.2: Number of certificate/value added courses/Diploma Programmes offered by the institutions and online courses of MOOCs, SWAYAM/e-PG Pathshala/ NPTEL and other recognized platforms

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2.	Syllabus of 2022 – 2023
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ADVANCED CONCEPTS IN FLUID MECHANICS

PROF. SUMAN CHAKRABORTY
PROF. ADITYA BANDOPADHYAY
IIT Kharagpur
Mechanical Engineering

TYPE OF COURSE : New | Core | UG
COURSE DURATION : 12 weeks (29 Jul'19 - 18 Oct'19)
EXAM DATE : 16 Nov 2019

INTENDED AUDIENCE : B. Tech/M. Tech/MS/B.Sc./M.Sc./PhD students of all disciplines and teachers of undergraduate Fluid Mechanics

INDUSTRIES APPLICABLE TO : Oil Companies (IOCL, SHELL, BPCL and others), Automobile and Aviation companies (GE, AIRBUS, TATA Motors and others)

COURSE OUTLINE :

This is a course which deals with advanced concepts in Fluid Mechanics. The course emphasizes the fundamental in underlying fluid mechanical principles and application of those principles to solve real life problems. There is a well-balanced coverage of physical concepts, mathematical operations along with examples and exercise problems of practical importance.

ABOUT INSTRUCTOR :

Prof. Suman Chakraborty is a Professor in the Mechanical Engineering Department of the Indian Institute of Technology (IIT) Kharagpur, India, and Indian National Academy of Engineering Chair Professor. He is also currently the Head, School of Medical Science and Technology at IIT Kharagpur. He has research interests in the area of Microfluidics and MicroNano scale transport processes, including their theoretical, computational, and experimental modeling, encompassing the underlying fundamentals as well as bio-medical.

Prof. Aditya Bandopadhyay is currently an Assistant Professor in the Mechanical Engineering Department at Indian Institute of Technology Kharagpur, India. His research interests include micro- and nanofluidics, transport through porous media, and electrohydrodynamics. He completed his Dual Degree from IIT Kharagpur (Insitute Silver Medal) in 2012 and received his Ph.D. from IIT Kharagpur in 2015.

COURSE PLAN :

Week 1: Essential Mathematical Foundations

Week 2: Kinematics of Fluid Flows

Week 3: Dynamics of Inviscid Flows

Week 4: Potential Flows

Week 5: Integral forms of Conservation Equations: Reynolds Transport Theorem

Week 6: Dynamics of Viscous Flows: Derivation of Navier-Stokes Equation

Week 7: Exact Solutions of Navier-Stokes Equations for Fully Developed Laminar Flows and some Unsteady Flows

Week 8: Laminar Boundary Layers

Week 9: Instability; Introduction to Turbulence

Week 10: Turbulence (contd.); Fluid flow about Immersed bodies

Week 11: Geophysical Fluid Dynamics

Week 12: Creeping Flows; Microscale Fluid Flows



NATURE AND PROPERTIES OF MATERIALS- AN INTRODUCTORY COURSE

PROF. ASHISH GARG

Department of Sustainable Energy Engineering
IIT Kanpur

PRE-REQUISITES : 12th standard science background

INTENDED AUDIENCE : UG and PG students of science and engineering of non-materials related background.

INDUSTRY SUPPORT : Materials related companies

COURSE OUTLINE :

The course is first part of the broader course on Introduction to Nature of materials and would be suitable for undergraduate and postgraduate students of every branch of science and engineering. The first part of this course will focus on essentials of crystallography, crystal structures of different classes of materials, structure determination and defects in materials.

ABOUT INSTRUCTOR :

Prof. Ashish Garg is Professor of Materials Science and Engineering at IIT Kanpur. Details of his research and teaching can be accessed on home.iitk.ac.in/~ashishg/

COURSE PLAN :

Week 1 : Introduction and Basic crystallography

Week 2 : Symmetry

Week 3 : Crystal Systems, Bravais Lattices and Miller Indices, Interstices

Week 4 : Structure of Metals and Alloys

Week 5 : Structure of Ceramics

Week 6 : Structure of Polymers

Week 7 : Structure Determination: X-ray diffraction

Week 8 : Defects in Materials



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C Programming And Assembly Language

By Prof. Janakiraman | IIT Madras

Learners enrolled: 31779 | Exam registration: 1816

Introduction



ABOUT THE COURSE :

Students who complete their bachelors degree (BE/ BTech) in computer science or electrical engineering do extensive course work in Microprocessors and then in C programming. However, what is missing in the current curriculum is to explicitly establish the link between the two. Specifically we look at how a C program is translated to assembly language and how it eventually gets executed on a microprocessor. Through, animations we show what happens in the stack, data and code segment, of the microprocessor when a C program is executed.

Summary

Course Status :	Completed
Course Type :	Elective
Duration :	4 weeks
Category :	◦ Computer Science and Engineering
Credit Points :	1
Level :	Undergraduate
Start Date :	21 Aug 2023
End Date :	15 Sep 2023
Enrollment Ends :	21 Aug 2023
Exam Registration Ends :	15 Sep 2023
Exam Date :	28 Oct 2023 IST



PREREQUISITE: Any Interested Learners

PREREQUISITES: Students are expected to have done a course on C programming and Microprocessors

INDUSTRY SUPPORT: Almost all software companies and many hardware companies

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This is an AICTE approved FDP course

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Course layout

WEEK 1: Introduction to Microprocessors and Assembly language Programming

- Microprocessor Architecture
- Machine Language Execution sequence in a MuP
- Memory in a microprocessor
- Instruction Set
- ADDRESSING SCHEMES
- MOV
- ARITHMETIC AND LOGICAL INSTRUCTIONS
- FLAG REGISTER
- STACK INSTRUCTIONS
- CALL and RET
- HARDWARE LOOPS

WEEK 2: Introduction to C and Inline Assembly

- Data types and their sizes
- Simple examples of Inline assembly
- ALU operations
- String length
- Multiplication using repeated addition
- Swap two variables in C


 variables in inline Assembly
 swap two variable in C
 write code to swap the two variables using a function
[\(https://swayam.gov.in/\)](https://swayam.gov.in/)

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WEEK3: Compiling C to Assembly Language
 Compiling a simple program to Assembly – first order
https://swayam.gov.in/c_details/NPTEL

Prologue
 Epilogue
 Local variables

WEEK4: C++ and Some special Functions
 C and C++ at assembly language level
 Recursion vs Loops with factorial as example
 Special functions
 memcpy
 strlen

Books and references

1. "The C Programming Language" by BRIAN W. KERNIGHAN and DENNIS M. RITCHIE, Second Edition
2. "The INTEL Microprocessors – Architecture, Programming and Interfacing", by Barry B. Brey 8th Edition

Instructor bio



Prof.
Janakiraman

IIT Madras

Prof. Janakiraman Viraraghavan is an Assistant Professor at the Department of Electrical Engineering, IIT Madras and is part of the Integrated Circuits and Systems (iCS) group. His research interests include porting machine-learning algorithms on to hardware and statistical analysis in VLSI. He also has a keen interest in Microprocessors and Programming in general.



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The exam is optional for a fee of Rs. 1000/- (Rupees one thousand only).

Date and Time of Exams: **28 October 2023** Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.

Registration url: Announcements will be made when the registration form is open for registrations.

The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.

Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE

Average assignment score = 25% of average of best 3 assignments out of the total 4 assignments given in the course.

Exam score = 75% of the proctored certification exam score out of 100

Final score = Average assignment score + Exam score

YOU WILL BE ELIGIBLE FOR A CERTIFICATE ONLY IF AVERAGE ASSIGNMENT SCORE $\geq 10/25$ AND EXAM SCORE $\geq 30/75$. If one of the 2 criteria is not met, you will not get the certificate even if the Final score $\geq 40/100$.

Certificate will have your name, photograph and the score in the final exam with the breakup. It will have the logos of NPTEL and IIT Madras. It will be e-verifiable at nptel.ac.in/noc (<http://nptel.ac.in/noc>).

Only the e-certificate will be made available. Hard copies will not be dispatched.

Once again, thanks for your interest in our online courses and certification. Happy learning.

- NPTEL team



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Cloud computing

Week 1: Introduction to Cloud Computing

Week 2: Cloud Computing Architecture

Week 3: Service Management in Cloud Computing

Week 4: Data Management in Cloud Computing

Week 5: Resource Management in Cloud

Week 6: Cloud Security

Week 7: Open Source and Commercial Clouds, Cloud Simulator

Week 8: Research trend in Cloud Computing, Fog Computing

Week 9: VM Resource Allocation, Management and Monitoring

Week 10: Cloud-Fog-Edge enabled Analytics

Week 11: Serverless Computing and FaaS Model

Week 12: Case Studies and Recent Advancements



CONTROL SYSTEMS

PROF. C.S. SHANKAR RAM

Department of Design Engineering
IIT Madras

INTENDED AUDIENCE : Undergraduate engineering students (electrical engineering, electronics engineering, mechanical engineering, aerospace engineering, chemical engineering, automobile engineering)

PRE-REQUISITES : 2nd year undergraduate students in engineering. Prefer that they have completed a course on engineering mathematics that teaches complex variables and Laplace transform.

INDUSTRIES APPLICABLE TO : Automotive companies

COURSE OUTLINE :

Course Objective: To provide a basic understanding of the concepts and techniques involved in designing control schemes for dynamic systems. Learning Outcomes: At the end of this course, one should possess in-depth knowledge of concepts from classical control theory, understand the concept of transfer function and use it for obtaining system response, analyze dynamic systems for their stability and performance, and design controllers (such as Proportional-Integral-Derivative) based on stability and performance requirements.

ABOUT INSTRUCTOR :

Prof. C. S. Shankar Ram is currently a professor in the Department of Engineering Design, Indian Institute of Technology Madras, Chennai, India. He received his Bachelor of Engineering (B. E.) in Mechanical Engineering from Motilal Nehru Regional Engineering College, Allahabad, India, and his M. S. and Ph. D. from Texas A&M University, USA. His research interests are in the areas of dynamics and control with applications to automotive and transportation systems. He teaches courses on Control Systems, Fundamentals of Automotive Systems and Control of Automotive Systems at IIT Madras.

More details can be found at: <https://ed.iitm.ac.in/~shankarram/>

COURSE PLAN :

Week 01 : Introduction to Control, Classification of Dynamic Systems, Closed Loop Control System with Feedback, Mathematical Preliminaries – Complex Variables, Laplace Transform.

Week 02 : Standard Inputs, Free and Forced Response, Transfer Function, Poles and Zeros.

Week 03 : Response to various Inputs, Effect of Poles, Notion of Bounded Input Bounded Output (BIBO) stability.

Week 04 : Effect of Zeros, Closed Loop Transfer Function, Dynamic Performance Specification, First Order Systems.

Week 05 : Second Order Systems, Unit Step Response of Underdamped Second Order Systems, Concepts of Rise Time, Peak Time, Maximum Peak Overshoot and Settling Time.

Week 06 : Controllers – Proportional (P), Integral (I) and Derivative (D) Blocks, Examples of PID controller design.

Week 07 : Routh's Stability Criterion, Use in Control Design, Incorporation of Performance Specifications in Controller Design, Analysis of Steady State Errors.

Week 08 : Root Locus and its Application in Control Design.

Week 09 : Frequency Response, Bode Plots, Nyquist Plots.

Week 10 : Nyquist Stability Criterion, Relative Stability – Gain and Phase Margins.

Week 11 : Control System Design via Frequency Response – Lead, Lag and Lag-Lead Compensation.

Week 12 : Case Studies.



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Data Base Management System

By Prof. Partha Pratim Das, Prof. Samiran Chattopadhyay | IIT Kharagpur

Learners enrolled: 23746



Databases form the backbone of all major applications today – tightly or loosely coupled, intranet or internet based, financial, social, administrative, and so on. Structured Database Management Systems (DBMS) based on relational and other models have long formed the basis for such databases. Consequently, Oracle, Microsoft SQL Server, Sybase etc. have emerged as leading commercial systems while MySQL, PostgreSQL etc. lead in open source and free domain.

Summary

Course Status :	Completed
Course Type :	Core
Duration :	8 weeks
Category :	<ul style="list-style-type: none"> ◦ Computer Science and Engineering ◦ Programming
Credit Points :	2
Level :	Undergraduate/Postgraduate
Start Date :	24 Jan 2022
End Date :	18 Mar 2022
Enrollment	07 Feb 2022
Ends :	
Exam Date :	27 Mar 2022 IST



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in the details, they share a common set of models, design paradigms and Query Language (SQL). In this background, the course covers the structure, the organizations, concepts and principles of DBMS's, data analysis, database design, data modeling, database management, data & query optimization, and database implementation. More specifically, the course introduces relational data models; entity-relationship modeling, SQL, data normalization, and database design. Further it introduces query coding practices using MySQL (or any other open system) through various assignments. Design of simple multi-tier client / server architectures based and Web-based database applications is also introduced.

INTENDED AUDIENCE : Students from all disciplines can enroll for this course.

PRE-REQUISITES :1. Procedural and / or Object-Oriented Programming (C / C++ / Java / Python)

2. Data Structures
3. Algorithms

INDUSTRY SUPPORT : DBMS is so fundamental that all companies dealing with systems as well as application development (including web, IoT, embedded systems, data mining, machine learning) have a need for the same. These include – Microsoft, Samsung, Xerox, Yahoo, Google, IBM, TCS, Infosys, Amazon, Flipkart, etc.

Course layout

Week 1: Course Overview. Introduction to RDBMS

Week 2: Structured Query Language (SQL)

Week 3: Relational Algebra. Entity-Relationship Model

Week 4: Relational Database Design

Week 5: Application Development. Case Studies. Storage and File Structure

Week 6: Indexing and Hashing. Query Processing

Week 7: Query Optimization. Transactions (Serializability and Recoverability)

Week 8: Concurrency Control. Recovery Systems. Course Summarization.

Books and references

Text Books / Basic Material

- Database System Concepts by Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, 6th Edition, McGraw-Hill Education, 2010.
- Presentations used in the Course

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ed) Material



(<https://swayam.gov.in/>)



Instructor bio
(https://swayam.gov.in/nc_details/NPTEL)



**Prof. Partha
Pratim Das**

IIT Kharagpur

Prof. Partha Pratim Das received his BTech, MTech and PhD degrees in 1984, 1985 and 1988 respectively from IIT Kharagpur. He served as a faculty in Department of Computer Science and Engineering, IIT Kharagpur from 1988 to 1998. In 1998, he joined Alumnus Software Ltd as a Business Development Manager. From 2001 to 2011, he worked for Interra Systems, Inc. as a Senior Director and headed its Kolkata Center. In 2011, he joined back to Department of Computer Science and Engineering, IIT Kharagpur as Professor. Dr. Das has also served as a Visiting Professor with Institute of Radio Physics and Electronics, Calcutta University from 2003 to 2013.

Dr. Das is currently the Head of Rajendra Mishra School of Engineering Entrepreneurship, the Professor-inCharge of the upcoming Research Park of IIT Kharagpur at Rajarhat, Kolkata, and the Joint Principal Investigator of National Digital Library of India project of MHRD.

Dr. Das has taught several courses in Computer Science including Software Engineering, Object-Oriented Systems, Programming and Data Structure, Compiler Design, Design and Analysis of Algorithms, Information System Design, Database Management Systems, Computational Geometry, Principles of Programming Languages, Embedded Systems, and Image Processing. Jointly with 2 others, he has also offered a course on Introduction to Design of Algorithms under the T10KT program of NME-ICT, MHRD (<https://www.facebook.com/t10kt.algorithms/>) to nearly 7000 teachers. Further, Dr. Das has been offering Programming in C++ and Object-Oriented Analysis and Design in NPTEL-NOC. Both courses are regularly attended by thousands of students.

Dr. Das has published over 40 technical papers in international journals in areas of Digital Geometry, Image Processing, Parallel Computing and Knowledge-based Systems. In 2013 he has co-authored a research monograph titled Digital Geometry in Image

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Artificial Intelligence (IUPRAI).

'ress). His current interests include Human-

ons, Computer Analysis of Indian Classical About Swayam (<https://swayam.gov.in/about>) | All Courses |

Engineering, Compiler Technology, and Technology Enabled

Learning. Dr. Das is a member of Association of Computing

Machinery (ACM), The Institute of Electrical and Electronics

Engineers (IETE), and Indian Unit for Pattern Recognition and

Artificial Intelligence (IUPRAI).



**Prof. Samiran
Chattopadhyay**

Samiran Chattopadhyay obtained his B Tech and M Tech degree in 1987 and 1989 respectively from IIT Kharagpur. He obtained his PhD degree from Jadavpur University in 1993. He served as a faculty in the Department of Computer Science and Engineering, Jadavpur University from 1989 to 1993. In 1993, he moved to industry and joined back the same department in Jadavpur University as an Associate Professor in 1997. Since 2001, he is a Professor of Information Technology in Jadavpur University.

Dr. Chattopadhyay is also a visiting fellow of the University of Northumbria, Newcastle upon Tyne UK. He was an adjunct faculty at IIT Kharagpur for the Distributed Systems course and a visiting faculty member for the MTech course by IIT Kharagpur which was offered in distance learning mode.

Dr. Chattopadhyay has more than two decades of experience of serving reputed Industry houses including Mindware, Computer Associates TCG Software, Interra Systems India Ltd. He is also a project consultant of the prestigious National Digital Library Mission of Government of India.

Dr. Chattopadhyay has taught several courses in Computer Science including Software Engineering, Object-Oriented Systems, Programming and Data Structure, Compiler Design, Design and Analysis of Algorithms, Information System Design, Database Management Systems, Ad hoc Wireless Networks, Cloud Computing. Dr. Chattopadhyay has been a co-faculty in Database Management Systems in NPTEL-NOC.

Dr. Chattopadhyay has published over 60 technical papers in international journals in the areas of Wireless Networks, Network Security, Machine learning applications. He has co-authored a

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 h titled 'Digital Geometry in Image
 book titled 'Data Structures through C' and
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 'Data Structures through C'. His current research interests include
 Network Security, Machine learning, Wireless network and
 Embedded computing..

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Course certificate

The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.

The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).

Date and Time of Exams: **27 March 2022** Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.

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CRITERIA TO GET A CERTIFICATE

Average assignment score = 25% of average of best 6 assignments out of the total 8 assignments given in the course.

Exam score = 75% of the proctored certification exam score out of 100

Final score = Average assignment score + Exam score

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Initiative by : Ministry of Education (Govt of India)



DESIGN FOR QUALITY, MANUFACTURING AND ASSEMBLY

PROF. SARAVANA KUMAR

Department of Mechanical Engineering
IIT Madras

PROF. PALANIAPPAN RAMU

Department of Mechanical Engineering
IIT Madras

TYPE OF COURSE : New | Elective | UG/PG

COURSE DURATION : 8 weeks (29 Jul'19 - 20 Sep'19)

INTENDED AUDIENCE : B.E/B.Tech, M.E/M.Tech,
M.S, B.Sc, M.Sc, PhD

EXAM DATE : 29 Sep 2019

INDUSTRIES APPLICABLE TO : Fiat Chrysler Automotive, Daimler India, Cyient, Saint Gobain

COURSE OUTLINE :

In the context of product design, it is very important to appreciate the limitations of a design from manufacturing and assembly perspective and to produce high quality products at low cost. This course will introduce methods that can provide guidance to design teams in simplifying product structure to reduce manufacturing and assembly costs, quantify improvements and how robust design concepts can be used for ensuring quality. This course aims at introducing the need to account for variability, mathematically represent it, formulate it and control it. Concepts such as quality, robustness, six sigma and orthogonal array will be discussed.

ABOUT INSTRUCTOR :

Prof. Saravana Kumar is interested in development of representational and computational tools for virtual and physical prototyping applied to arrive at solutions to design problems. Some of the specific research areas include CAD and 3D data acquisition technologies: geometrical modelling schemes, X-ray tomography, photogrammetry and image-based modelling systems, and rapid prototyping.

Prof. Palaniappan Ramu research interest revolves around optimization and treating uncertainties in product and process design to obtain reliable, robust and quality designs. Most of his work is focused on reduction of computer or physical experiments, building better metamodels, intelligently explore design space and enable better predictions and optimal designs under uncertainties.

COURSE PLAN :

Week 01 : Introduction, course expected outcomes, discussion on quality

Week 02 : Measuring quality: Quality loss function. Discussion on robustness, six sigma concepts

Week 03 : Quantifying robustness: Signal to Noise Ratio, problem formulation using SNR. Design of experiment discussions

Week 04 : Orthogonal array, linear graphs, triangular tables, finding optimum combinations. Case studies

Week 05 : Design for Manufacturing: over the wall design, most influential phase in design, best practices in injection molding and sheet metal working

Week 06 : Design for additive manufacturing, single point and multipoint tools

Week 07 : Design for Assembly: Boothroyd Dewhurst method, theoretical minimum number of parts, Xerox producibility index (XPI) method

Week 08 : Do's and don't's in manual assembly, assembly time estimation, design for robotic assembly considerations. Design for sustainability



DESIGN OF FIXED WING UNMANNED AERIAL VEHICLES

PROF. SADERLA SUBRAHMANYAM

Department of Aerospace Engineering
IIT Kanpur

PRE-REQUISITES : Introduction to Aerodynamics

INTENDED AUDIENCE : Undergraduate and postgraduate students

INDUSTRIES APPLICABLE TO : DRDO, HAL, Boeing, Airbus, Bell, McDonnell Douglas, UAV Factory, Lockheed Martin

COURSE OUTLINE :

This course introduces the initial designing and sizing process for rapidly growing fixed – wing UAV technology, integrated with its performance and stability analysis and prototype testing.

ABOUT INSTRUCTOR :

Prof. Subrahmanyam Saderla obtained his B.Tech (Aeronautical Engineering) from JNTU, Hyderabad in 2008, M.Tech and Ph.D (Aerospace Engineering) from IIT Kanpur during 2010 and 2015 respectively. Later he joined as a postdoctoral fellow in the department of aerospace and software engineering at Gyeongsang National University (GNU), South Korea. At present he is working as an Assistant Professor in the Department of Aerospace Engineering at Indian Institute of Technology Kanpur. His current area of interest lies in real time system identification of unmanned aerial vehicles. His research interests also include design, flight tests and parameter estimation, high angle of attack aerodynamic modelling and dynamic wind tunnel testing as well as experimental flight dynamics, chaotic modelling (of cancer cell growth, seismic data & material properties etc.) using Artificial Neural Networks.

COURSE PLAN :

Week 01 : Introduction to fixed-wing UAVs, Introduction to Design, Basic Design Parameters.

Week 02 : Basic Design Parameters contd., Design Algorithm: Case Study, Design Algorithm: Mission Requirements.

Week 03 : Design Algorithm: Feasible Design Parameters, Configuration Layout: Airfoil Selection Configuration Layout: Planform Geometry selection

Week 04 : Weight and CG Estimation Analytical Parameter Estimation Analytical Parameter Estimation contd.

Week 05 : Performance and Stability Analysis Performance and Stability Analysis contd. Performance and Stability Analysis contd.

Week 06 : Simulation, Simulation contd..., Detailed Sizing

Week 07 : Estimation of inertial properties using 3D modelling, Prototype Fabrication

Week 08 : Wind Tunnel Testing, Aerodynamic Characterization through Wind Tunnel Testing



DESIGN OF REINFORCED CONCRETE STRUCTURES

PROF. NIRJHAR DHANG

Department of Civil Engineering
IIT Kharagpur

INTENDED AUDIENCE : Students of Civil Engineering and Architecture

INDUSTRIES APPLICABLE TO : This course will be recognized by design consultancy firms and construction industries.

COURSE OUTLINE :

Design of reinforced concrete structures is an introductory design course in civil engineering. In this course, basic elements governed by bending, shear, axial forces or combination of them are identified and are considered as building blocks of the whole structure. Different methods of design will be briefly described before introducing the limit states of collapse and serviceability. The design will be done as per IS 456:2000

ABOUT INSTRUCTOR :

Prof. Nirjhar Dhang (born 1962) is currently Professor of the Department of Civil Engineering, Indian Institute of Technology, Kharagpur, where he teaches Bridge Engineering, Structural Health Monitoring & Control, Design of Reinforced Concrete Structures. He works in the field of structural engineering particularly in the area of concrete, structural health monitoring & control and railway bridges applicable for high speed rail. He has done many consultancy and research project work.

COURSE PLAN :

Week 01 : Introduction, Different methods of design of reinforced concrete structures

Week 02 : Working stress method

Week 03 : Limit state of collapse - flexure

Week 04 : Design of singly reinforced beam

Week 05 : Design of doubly reinforced beam

Week 06 : Limit state of collapse - shear

Week 07 : Design for shear

Week 08 : Design of slab

Week 09 : Design of compression members

Week 10 : Design of footing

Week 11 : Design of staircase

Week 12 : Limit state of serviceability



DEVELOPING SOFT SKILLS AND PERSONALITY

PROF. T. RAVICHANDRAN

Department of Humanities and Social Sciences
IIT Kanpur

INTENDED AUDIENCE : Students, Teachers, Professionals, Trainers, Leaders, Employers

INDUSTRIES APPLICABLE TO : All industries/companies/organisations will recognize and value this course and recommend this for their employees and trainee programs.

COURSE OUTLINE :

The course aims to cause a basic awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality. Hard or technical skills help securing a basic position in one's life and career. But only soft skills can ensure a person retain it, climb further, reach a pinnacle, achieve excellence, and derive fulfillment and supreme joy. Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills.

ABOUT INSTRUCTOR :

Prof. T. RAVICHANDRAN is presently a Professor of English in the Department of Humanities and Social Sciences at the Indian Institute of Technology Kanpur, Uttar Pradesh, India. He has written about fifty research articles/book chapters, supervised six doctoral theses, edited a special issue on Cyberpunk Literature for the Creative Forum Journal, and published a book on Postmodern Identity. He is a recipient of the Fulbright-Nehru Academic and Professional Excellence Fellowship (2014-15) for his research/teaching at Duke University, North Carolina, USA. He is honored with Champa Devi Gangwal Chair Professorship at IIT Kanpur. In his distinguished twenty-five years of teaching career, he has taught various courses in English Language and Literature. His NPTEL Video and Web courses on Communication Skills are well-acclaimed nationally and internationally. His NPTEL MOOC on Developing Soft Skills and Personality became hugely popular and well-received by about fifteen thousand participants from India and abroad

COURSE PLAN:

Week 1: Lecture 1: Introduction: A New Approach To Learning

Lecture 2: Planning And Goal-Setting

Lecture 3: Human Perceptions: Understanding People

Lecture 4: Types Of Soft Skills: Self-Management Skills

Lecture 5: Aiming For Excellence: Developing Potential And Self-Actualisation

Lecture 6: Need Achievement And Spiritual Intelligence

Week 2: Lecture 7: Conflict Resolution Skills: Seeking Win-Win Solution

Lecture 8: Inter-Personal Conflicts: Two Examples

Lecture 9: Inter-Personal Conflicts: Two Solutions

Lecture 10: Types Of Conflicts: Becoming A Conflict Resolution Expert

Lecture 11: Types Of Stress: Self-Awareness About Stress

Lecture 12: Regulating Stress: Making The Best Out Of Stress

- Week 3:** **Lecture 13:** Habits: Guiding Principles
Lecture 14: Habits: Identifying Good And Bad Habits
Lecture 15: Habits: Habit Cycle
Lecture 16: Breaking Bad Habits
Lecture 17: Using The Zeigarnik Effect For Productivity And Personal Growth
Lecture 18: Forming Habits Of Success
- Week 4:** **Lecture 19:** Communication: Significance Of Listening
Lecture 20: Communication: Active Listening
Lecture 21: Communication: Barriers To Active Listening
Lecture 22: Telephone Communication: Basic Telephone Skills
Lecture 23: Telephone Communication: Advanced Telephone Skills
Lecture 24: Telephone Communication: Essential Telephone Skills
- Week 5:** **Lecture 25:** Technology And Communication: Technological Personality
Lecture 26: Technology And Communication: Mobile Personality?
Lecture 27: Topic: Technology And Communication: E-Mail Principles
Lecture 28: Technology And Communication: How Not To Send E-Mails!
Lecture 29: Technology And Communication: Netiquette
Lecture 30: Technology And Communication: E-Mail Etiquette
- Week 6:** **Lecture 31:** Communication Skills: Effective Communication
Lecture 32: Barriers To Communication: Arising Out Of Sender/Receiver's Personality
Lecture 33: Barriers To Communication: Interpersonal Transactions
Lecture 34: Barriers To Communication: Miscommunication
Lecture 35: Non-Verbal Communication: Pre-Thinking Assessment-1
Lecture 36: Non-Verbal Communication: Pre-Thinking Assessment-2
- Week 7:** **Lecture 37:** Nonverbal Communication: Introduction And Importance
Lecture 38: Non-Verbal Communication: Issues And Types
Lecture 39: Non-Verbal Communication: Basics And Universals
Lecture 40: Non-Verbal Communication: Interpreting Non-Verbal Cues
Lecture 41: Body Language: For Interviews
Lecture 42: Body Language: For Group Discussions
- Week 8:** **Lecture 43:** Presentation Skills: Overcoming Fear
Lecture 44: Presentation Skills: Becoming A Professional
Lecture 45: Presentation Skills: The Role Of Body Language
Lecture 46: Presentation Skills: Using Visuals
Lecture 47: Reading Skills: Effective Reading
Lecture 48: Human Relations: Developing Trust And Integrity



ECOLOGY AND ENVIRONMENT

Prof. Abhijit P Deshpande

Department of Multidisciplinary
IIT Madras

Prof. Ravi Krishna R

Department of Multidisciplinary
IIT Madras

INTENDED AUDIENCE : Any interested Learners

COURSE OUTLINE :

The objectives of the course is to introduce and sensitize all BTech students to the issue of ecology, environment and sustainability. The lectures are aimed at posing various questions that are relevant for all students of engineering and management to incorporate sustainability and a sensitivity to ecology and environment in their design of products, processes and systems.

ABOUT INSTRUCTOR :

Prof. Abhijit P. Deshpande is a Professor of Chemical Engineering at IIT Madras. His research focus is on polymeric systems, more specifically their aggregation and gelation behaviour. In his group, polymeric materials such as hydrogels and membranes are being investigated for applications in electrical, electromechanical and electrochemical devices. His teaching interests include specialized courses in polymers, fluid mechanics, rheology and continuum mechanics; and core chemical engineering courses such as mass transfer and thermodynamics

Prof. R. Ravikrishna Professor(2018 Current) Indian Institute of Technology Madras Associate Professor (2013-2018) Indian Institute of Technology Madras Assistant Professor (2006-2013) Indian Institute of Technology Madras Research Associate (2000-2006) Louisiana State University, Baton Rouge, USA

COURSE PLAN :

- Week 01** : Dr. B.S. Murty: Introduction (1), Sustainability Definition / Goals, Climate Change (2), Case Studies (3)
(Eg: Dams, Chemicals, e-waste, IOT, Landfill siting etc)
- Week 02** : Dr. Sudhir Chella Rajan: Sustainability and Economics (3), Sustainability and Ethics (3)
- Week 03** : Dr. Ligy Philip (Water Quality/ Waste Management): Water Quality and Treatment (3), Waste Management and Treatment (3)
- Week 04** : Dr. B. S. Murty (Water Management/ Resources): Urban Drainage, Water Resource Management, Impact of Climate Change
- Week 05** : Dr. Srinivas Jayanti (Energy):Energy Demand / Resources (1), Pollution from Energy generation (1), Energy and Climate Change (Global Warming) (1), Energy and Sustainability (1), Long Range and Short Range Solutions (1), (Global vs. India)
- Week 06** : Dr. R. Ravi Krishna: Risk Assessment Definition (1), Pollutant Pathways / Safety/ Exposure (1), Liability /Examples (1), Life Cycle Assessment (2), Environmental Management and LCA (1).
- Week 07** : Dr. Sudhir Chella Rajan: Urban Planning / Sprawl (1), Challenges in Urban Planning,Transport (1), Energy (Smart Grid) (1), Water (1), Waste (1), Governance (1).
- Week 08** : Dr. Susy Varughese / Dr. Parag Ravindran: Ecology – definitions / Systems (1), Biodiversity (1), Examples of Historical Impact of economy on Ecology, Restoration / Ecological Engineering.
- Week 09** : Dr. Ligy Philip / Dr. Ravi Krishna: Solid Waste Management, Hazardous Waste Management



ENERGY CONSERVATION AND WASTE HEAT RECOVERY

PROF. PRASANTA KUMAR DAS

Department of Mechanical Engineering
IIT Kharagpur

PROF. ANANDAROOP BHATTACHARYA

Department of Mechanical Engineering
IIT Kharagpur

INTENDED AUDIENCE : Energy Science and Engineering, Mechanical Engineering, Electrical Engineering students

PRE-REQUISITES : Basic Thermodynamics

INDUSTRIES APPLICABLE TO : BHEL, NTPC, CESC, WBSEB, DVC and other power companies, GE, Siemens, Alstom

COURSE OUTLINE :

Estimates from analyses and audits from various industries suggest that 20 to 50% of industrial energy input is lost as waste heat. This waste heat can be in the form of hot exhaust gases, water/fluid streams (from condensers in power plants) or heat lost from hot equipment and surfaces. As the world strives for higher energy efficiencies, it is imperative that along with better equipment we focus on recovering the energy stored in this “waste heat” and utilize it for useful purposes. The proposed course introduces us to various methods of Waste Heat Recovery that has been employed by the industry to harness the energy stored in waste heat and use it for generation of additional electric power.

ABOUT INSTRUCTOR :

Prof. Prasanta Kumar Das is a Professor of Mechanical Engineering and presently the Dean Post Graduate Studies and Research at IIT Kharagpur. He possesses a vast experience in teaching and research. His research interests lie in the broad area of thermal engineering with a special emphasis on two phase flow. Apart from teaching many fundamental subjects he offered applied courses like Power Plant Engineering, Thermal System Design, Waste Heat Recovery etc. He has also conducted tailor-made courses for industries. He contributed actively in sponsored research and offered consultancy to different Government and private industries. He contributed more than 190 publications in international journals, a vast number of publications in national and international conferences and 10 patents. He has supervised more than 20 scholars for their doctoral degree. He is fellows of Indian National Academy of Engineering and National Academy of Sciences India.

Prof. Anandaroop Bhattacharya is an Associate Professor of Mechanical Engineering at IIT Kharagpur. His research interests lie in the areas of electronics cooling, transport in porous media and gas turbine heat transfer. Prior to joining IIT, Anandaroop spent 12 years in the industry in USA and India working at Intel, General Motors and General Electric Research Centers.

COURSE PLAN :

Week 1 : Introduction to Waste Heat, Importance of Waste Heat Recovery, Review of Thermodynamics – Introduction to First and Second Laws

Week 2 : Review of Thermodynamics – Entropy, Entropy Generation, First and Second Law efficiency

Week 3 : Power Plant Cycles - Energy Cascading, Rankine Cycle, modification of Rankine cycle, examples

Week 4 : Gas Turbine Cycle, Combined Cycle, Combined Gas Turbine-Steam Turbine Power Plant, Heat Recovery Steam Generators

Week 5 : Thermodynamic cycles for low temperature application, Cogenerations, Introduction to Heat Exchangers, Analysis – LMTD and ϵ -NTU method

Week 6 : Analysis of Heat Exchanger – continued, Problem solving, Special Heat Exchangers for Waste Heat Recovery, Synthesis of Heat Exchanger Network

Week 7 : Heat pipes & Vapor Chambers, Direct conversion technologies –Thermoelectric Generators.

Week 8 : Direct conversion technologies – Thermoelectric Generators (contd.), Thermoionic conversion, Thermo-PV, MHD

Week 9 : Heat Pump; Heat Recovery from Incinerators, Energy Storage – Introduction.

Week 10 : Energy Storage Techniques – Pumped hydro, Compressed Air, Flywheel, Superconducting Magnetic storage

Week 11 : Energy Storage Techniques – Thermal storage (Sensible & Latent), Battery, Chemical Energy Storage, Fuel cells.

Week 12 : Energy Economics



ETHICAL HACKING

PROF. INDRANIL SENGUPTA

Dept. of Computer Science and Engineering
IIT Kharagpur

INTENDED AUDIENCE : Computer Science and Engineering / Information Technology / Electronics and Communication Engineering / Electrical Engineering

PREREQUISITES : Basic concepts in programming and networking

INDUSTRIES APPLICABLE TO : TCS, Wipro, CTS, Google, Microsoft, Qualcomm

COURSE OUTLINE

Ethical hacking is a subject that has become very important in present-day context, and can help individuals and organizations to adopt safe practices and usage of their IT infrastructure. Starting from the basic topics like networking, network security and cryptography, the course will cover various attacks and vulnerabilities and ways to secure them. There will be hands-on demonstrations that will be helpful to the participants. The participants are encouraged to try and replicate the demonstration experiments that will be discussed as part of the course.

ABOUT INSTRUCTOR

Prof. Indranil Sengupta has obtained his B.Tech., M.Tech. and Ph.D. degrees in Computer Science and Engineering from the University of Calcutta. He joined the Indian Institute of Technology, Kharagpur, as a faculty member in 1988, in the Department of Computer Science and Engineering, where he is presently a full Professor. He had been the former Heads of the Department of Computer Science and Engineering and also the School of Information Technology of the Institute. He has over 28 years of teaching and research experience. He has guided 22 PhD students, and has more than 200 publications to his credit in international journals and conferences. His research interests include cryptography and network security, VLSI design and testing, and mobile computing.

He is a Senior Member of IEEE. He had been the General Chairs of Asian Test Symposium (ATS-2005), International Conference on Cryptology in India (INDOCRYPT-2008), International Symposium on VLSI Design and Test (VDAT-2012), International Symposium on Electronic System Design (ISED-2012), and the upcoming Conference on reversible Computation (RC-2017). He had delivered invited and tutorial talks in several conferences in the areas of VLSI design and testing, and network security.

COURSE PLAN

Week 1: Introduction to ethical hacking. Fundamentals of computer networking. TCP/IP protocol stack.

Week 2: IP addressing and routing. TCP and UDP. IP subnets.

Week 3: Routing protocols. IP version 6.

Week 4: Installation of attacker and victim system. Information gathering using advanced google search, archive.org, netcraft, whois, host, dig, dnsenum and NMAP tool.

Week 5: Vulnerability scanning using NMAP and Nessus. Creating a secure hacking environment. System Hacking: password cracking, privilege escalation, application execution. Malware and Virus. ARP spoofing and MAC attack.

Week 6: Introduction to cryptography, private-key encryption, public-key encryption.

Week 7: Cryptographic hash functions, digital signature and certificate, applications.

Week 8: Steganography, biometric authentication, network-based attacks, DNS and Email security.

Week 9: Packet sniffing using Wireshark and Burpsuite, password attack using Burp Suite. Social engineering attacks and Denial of service attacks.

Week 10: Elements of hardware security: side-channel attacks, physical ineliminable functions, hardware trojans.

Week 11: Different types of attacks using Metasploit framework: password cracking, privilege escalation, remote code execution, etc. Attack on web servers: password attack, SQL injection, cross site scripting.

Week 12: Case studies: various attack scenarios and their remedies.

Fluid Mechanics - Video course

COURSE OUTLINE

Properties of fluids and fundamental concepts, Fluid statics and its applications, Kinematics of fluids, Conservation equations in fluid flow and its applications, Incompressible viscous flow with applications to pipe flow in practice, Principles of similarity, Flow of ideal fluids, Flow with free surface, Few unsteady flow phenomena in practice, Introduction to laminar boundary layer, Introduction to turbulent flow,

The course coverage is balanced with analytical treatments, physical concepts and practical applications.

COURSE DETAIL

Modules	Lecture Topics
Module: 1	Lecture 1: Introduction and Fundamental Concepts Part-I Lecture 2: Introduction and Fundamental Concepts Part-II Lecture 3: Introduction and Fundamental Concepts Part-III
Module: 2	Lecture 4: Fluid Statics Part-I Lecture 5: Fluid Statics Part-II Lecture 6: Fluid Statics Part-III Lecture 7: Fluid Statics Part-IV Lecture 8: Fluid Statics Part-V Lecture 9: Fluid Statics Part-VI
Module: 3	Lecture 10: Kinematics of Fluid Part-I Lecture 11: Kinematics of Fluid Part-II Lecture 12: Kinematics of Fluid Part-III
Module: 4	Lecture 13: Conservation Equations in Fluid Flow Part-I Lecture 14: Conservation Equations in Fluid Flow Part-II
Module: 5	Lecture 15: Conservation Equations in Fluid Flow Part-III Lecture 16: Conservation Equations in Fluid Flow Part-IV Lecture 17: Conservation Equations in Fluid Flow Part-V Lecture 18: Conservation Equations in Fluid Flow Part-VI Lecture 19: Conservation Equations in Fluid Flow Part-VII Lecture 20: Conservation Equations in Fluid Flow Part-VIII Lecture 21: Conservation Equations in Fluid Flow Part-IX
Module: 6	Lecture 22: Fluid Flow Applications Part-I Lecture 23: Fluid Flow Applications Part-II Lecture 24: Fluid Flow Applications Part-III Lecture 25: Fluid Flow Applications Part-IV Lecture 26: Fluid Flow Applications Part-V



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Mechanical Engineering

Coordinators:

Prof. S.K. Som

Department of
Mechanical
Engineering IIT Kharagpur

	Lecture 27: Fluid Flow Applications Part-VI Lecture 28: Fluid Flow Applications Part-VII
Module: 7	Lecture 29: Incompressible Viscous Flows Part-I Lecture 30: Incompressible Viscous Flows Part-II Lecture 31: Incompressible Viscous Flows Part-III Lecture 32: Incompressible Viscous Flows Part-IV
Module: 8	Lecture 33: Application of Viscous Flow through Pipes Part-I Lecture 34: Application of Viscous Flow through Pipes Part-II Lecture 35: Application of Viscous Flow through Pipes Part-III
Module: 9	Lecture 36: Principles of Similarity Part-I Lecture 37: Principles of Similarity Part-I Lecture 38: Principles of Similarity Part-I
Module: 10	Lecture 39: Flow of Ideal Fluids Part-I Lecture 40: Flow of Ideal Fluids Part-II
Module: 11	Lecture 41: Flows with a Free Surface Part-I Lecture 42: Flows with a Free Surface Part-II Lecture 43: Flows with a Free Surface Part-III
Module: 12	Lecture 44: A Few unsteady Flow Phenomena Part-I Lecture 45: A Few unsteady Flow Phenomena Part-II
Module: 13	Lecture 46: Introduction to Laminar Boundary Layer Part-I Lecture 47: Introduction to Laminar Boundary Layer Part-II
Module: 14	Lecture 48: Introduction to Turbulent Flow Part-I Lecture 49: Introduction to Turbulent Flow Part-II

References:

1. S K Som, G Biswas, Suman Chakraborty, Introduction to Fluid Mechanics and Fluid machines, Tata McGraw Hill Education.
2. R. W. Fox, P. J. Pritchard, A. T McDonald, Introduction to Fluid Mechanics, John Wiley
3. F. M White, Fluid Mechanics, Tata McGraw Hill Education.



FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

PROF. SHYAMANTA M. HAZARIKA

Department of Mechanical Engineering
IIT Guwahati

PRE-REQUISITES : Basic Course in Probability and Linear Algebra

INTENDED AUDIENCE : Final Year B.Tech/M.Tech and PhD students

COURSE OUTLINE :

What does automatic scheduling or autonomous driving have in common with web search, speech recognition, and machine translation? These are complex real-world problems that span across various practices of engineering! Aim of artificial intelligence (AI) is to tackle these problems with rigorous mathematical tools. The objective of this course is to present an overview of the principles and practices of AI to address such complex real-world problems. The course is designed to develop a basic understanding of problem solving, knowledge representation, reasoning and learning methods of AI.

ABOUT INSTRUCTOR :

Prof. Shyamanta M Hazarika is a Professor of Mechanical Engineering at IIT Guwahati and leads the Biomimetic Robotics and Artificial Intelligence Lab. His research interest is in Rehabilitation Robotics. This translates into interest in Artificial Intelligence, Biomimetic Robotics and Robotic Neurorehabilitation. Prior to joining IIT Guwahati, he was with the Department of Computer Science and Engineering, Tezpur University. He has been a Vertretungsprofessur of Cognitive Systems and Neuroinformatics, University of Bremen, Germany. Prof. Hazarika holds a B.E. in Mechanical Engineering from Assam Engineering College, Guwahati, India; M.Tech. in Robotics from Center for Robotics, IIT Kanpur, India. He completed his PhD in Artificial Intelligence (Knowledge Representation and Reasoning) from School of Computing, University of Leeds, England.

COURSE PLAN :

Week 1: AI and Problem Solving by Search

Week 2: Problem Solving by search

Week 3: Problem Solving by search (contd)

Week 4: Knowledge Representation and Reasoning

Week 5: Knowledge Representation and Reasoning (Contd)

Week 6: Knowledge Representation and Reasoning (contd)

Week 7: Reasoning under uncertainty

Week 8: Planning

Week 9: Planning and Decision Making

Week 10: Machine Learning

Week 11: Machine Learning (contd)

Week 12: Machine Learning (contd)



FUNDAMENTALS OF MANUFACTURING PROCESSES

PROF. D.K. DWIVEDI

Department of Mechanical and Industrial Engineering
IIT Roorkee

INTENDED AUDIENCE : Any interested learners

COURSE OUTLINE :

It is proposed to include fundamental of following aspects of manufacturing technology

A) Understanding Manufacturing: concept of manufacturing, need, scope, advantages, limitation, application, materials and manufacturing, classification of manufacturing, process capabilities, selection, break even analysis of manufacturing processes

B) Casting: approach, steps, pattern, molding, gate and riser, melt treatment, solidification, casting processes: sand mould, shell mould, permanent mould casting, casting defect and their remedy

C) Forming: approach, hot and cold forming, rolling, forging, extrusion, drawing, sheet metal forming, press, dies, types of dies and die set sheet metal operations punching, blanking, notching, nibbling

D) Joining: approach, need, principle of fusion welding, gas welding, thermit welding, arc welding common arc welding processes, resistance welding, weldability of metals, solidification of weld, weld discontinuities and their remedy

E) Machining: approach, mechanism, classification, cutting tool, tool material, heat generation, cutting fluid, grinding, internal and external surface grinding, centerless grinding designation and selection of grinding wheel, trueing and balancing, honing, reaming, lapping, polishing etc.

F) Improving properties: heat treatment of steel and aluminum alloys, Fe-C diagram, TTT diagram, and CCT diagram, heat treatment processes annealing, normalizing, quenching tempering, surface modification methods namely without change chemistry, changing chemical composition and development of coating and cladding.

ABOUT INSTRUCTOR :

Prof. D K Dwivedi obtained BE (mechanical engineering), in 1993 from GEC Rewa, ME (welding engineering) from Univ. of Roorkee in 1997 and PhD in Met. Engineering from MNIT, Jaipur in 2003. He has about 9 years teaching experience at NIT Hamirpur and 14 years at IIT Roorkee in subjects related with manufacturing at UG level and welding engineering related subjects at PG level. He has published more than 120 research papers in SCI/SCIE indexed journals and undertaken 20 sponsored research and 50 industrial consultancy projects. He has authored two books entitled Production and Properties of Cast Al-Si Alloys with New Age International, New Delhi (2013) and Surface Engineering with Springer, New Delhi (2018).

COURSE PLAN :

- Week 1 :** Understanding Manufacturing
Fundamental approaches of manufacturing
Manufacturing process specific advantages and limitation
Materials and manufacturing processes
Classification of manufacturing processes
- Week 2 :** Selection of manufacturing processes
Application of manufacturing processes
Effect of manufacturing processes on properties of metals
Break-even point analysis in manufacturing processes
Metal Casting: Introduction & Suitability
- Week 3 :** Metal Casting: Steps of casting processes
Metal Casting: Terminology
Metal Casting: Pattern allowances I
Metal Casting: Pattern allowances II
Metal Casting: Sand Moulding I

- Week 4 :** Metal Casting: Sand Moulding II
Metal Casting: Core & Core Prints
Metal Casting: Gating System
Metal Casting: Yield
Metal Casting: Riser Design
- Week 5 :** Metal Casting: Cleaning of casting
Metal Casting: Casting defects & their prevention
Metal Casting: Shell molding
Metal Casting: Investment and permanent mould casting
Metal working processes: Hot and cold working
- Week 6 :** Metal working processes: Rolling
Metal working processes: Forging
Metal working processes: Extrusion
Metal working processes: Wire Drawing
Metal working processes: Press
- Week 7 :** Metal working processing: Sheet metal operations (Shearing)
Metal working processing: Sheet metal operations II
Metal working processing: Sheet metal operations III
Metal working processing: Dies and die set
Material removal processes: Machining
- Week 8 :** Material removal processes: Mechanism of the metal cutting
Material removal processes: Chip Formation
Material removal processes: Types of chips and power consumption
Material removal processes: Heat generation
Material removal processes: Tool failure and tool life
- Week 9 :** Material removal processes: Tool materials
Material removal processes: Cutting fluids
Material removal processes: Grinding I
Material removal processes: Grinding II
Material removal processes: Grinding III
- Week 10 :** Material removal processes: Grinding operations
Joining of metals: Fundamentals I
Joining of metals: Fundamentals II
Joining of metals: Welding processes I
Joining of metals: Brazing, soldering and weldability
- Week 11 :** Joining of metals: Weldability and welding defects
Heat treatment: Fundamentals
Heat treatment: Fundamentals II
Heat treatment: Fundamentals III
Heat treatment: Normalizing and hardening
- Week 12 :** Heat treatment: Tempering
Improving surface properties: Introduction
Improving surface properties: Surface modification processes I
Improving surface properties: Changing chemical composition
Improving surface properties: Coating



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Heat Exchangers: Fundamentals and Design Analysis

By Prof. Prasanta Kumar Das & Prof. Indranil Ghosh | IIT Kharagpur

Learners enrolled: 1445

Heat Exchangers Fundamentals and Design Analysis by Pr...



Heat exchangers are extensively used in diverse industries covering power generation, refrigeration and air conditioning, cryogenics, oil refineries and chemical processes, automobiles and other transport devices. The performance of a heat exchanger is very important for the conservation of energy, assurance of product quality, process viability and environmental protection. The present course aims at developing a familiarity with various types of heat exchangers, their construction and applications. Conventional methods of heat exchanger analysis; brief design methodology of typical heat exchangers and synthesis of heat exchanger network. It is planned to develop an

Summary

Course Status :	Completed
Course Type :	Core
Duration :	12 weeks
Category :	◦ Mechanical Engineering
Credit Points :	3
Level :	Postgraduate
Start Date :	29 Jul 2019
End Date :	18 Oct 2019
Exam Date :	16 Nov 2019 IST

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

This is an AICTE approved FDP course

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basic expertise in heat exchanger through description, mathematical
 rical examples.

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INTENDED AUDIENCE : Mechanical Engineering, Chemical Engineering, Energy
 Engineering, Biotechnology Engineering, Aerospace Engineering etc.

PREREQUISITES : Thermodynamics, Fluid Mechanics and Heat Transfer (at a
 very basic level).

INDUSTRY SUPPORT : All the companies generating coal based and nuclear based
 power (NTPC, different state electricity boards, CPRI, BARC, and
 NPCL etc.). Companies dealing with the design and
 fabrication of heat exchangers, auto mobile industries, process industries,
 oil refineries. Companies dealing with waste heat recovery and
 renewable. Some specific companies could be BHEL, ALSTOM,
 HP, HPCL, IOCL, THERMAX, BPCL, GAIL, Reliance, TATA
 Chemicals etc.

(https://www.addtoany.com/share?url=https%3A%2F%2Fonlinecourses.nptel.ac.in%2Fnoc19_me62%2Fpreview&title=%20Course)

Course layout

- Week 1 :** Background, Application, Classification, Common terminologies.
- Week 2 :** Introduction to Thermal and hydraulic aspects, pressure drop and heat transfer, sizing and rating. F-LMTD and -NTU method.
- Week 3 :** Tubular Heat Exchangers: different designs, brief description of Shell and Tube Heat Exchangers, Special types.
- Week 4 :** Compact heat exchangers, enhancement of heat transfer, extended surface or Fin, fundamental of extended surface heat transfer, Fin tube heat exchanger.
- Week 5 :** Plate Fin Heat Exchangers (PFHE), types, construction, fabrication, design, application. Multistream PFHE.
- Week 6 :** Multistream PFHE continued. Direct contact heat exchangers, types, application, simple analysis.
- Week 7 :** Regenerators, types of regenerators, construction, application. Theory of Regenerator, -NTU and -method..
- Week 8 :** Heat pipes, construction, working principle, application, analysis. Special heat pipes.
- Week 9 :** Microscale Heat Exchangers and heat sinks; heat transfer and fluid flow through narrow conduits, special design considerations
- Week 10 :** Phase change HEX; phase change heat transfer, introduction to evaporators and condensers.
- Week 11 :** Phase change HEX; phase change heat transfer, introduction to evaporators



Exchanger testing, steady state and dynamic About Swayam (<https://swayam.gov.in/about>) | All Courses |

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(<https://swayam.gov.in/>)



Books and references

(https://swayam.gov.in/nc_details/NPTEL)

- 1) Fundamentals of Heat Exchanger Design by R. K. Shah, Dusan P. Sekulic, John Wiley & Sons, 11-Aug-2003.
- (2) Heat Exchanger Design Handbook by Kuppan Thulukkanam, Taylor & Francis, 23-Feb-2000.
- (3) Heat Exchangers: Selection, Rating, and Thermal Design, Third Edition by Sadik Kakac, Hongtan Liu, CRC-Press, 01-Feb-1998.
- (4) Cryogenic Heat Transfer, Second Edition by Randall F. Barron, Gregory F. Nellis, CRC Press, May 23, 2016.

Instructor bio



Prof. Prasanta Kumar Das is a Professor of Mechanical Engineering and presently the Dean Post Graduate Studies and Research at IIT Kharagpur. He possesses a vast experience in teaching and research. His research interests lie in the broad area of thermal engineering with a special emphasis on two phase flow. Apart from teaching many fundamental subjects he offered applied courses like Power Plant Engineering, Thermal System Design, Waste Heat Recovery etc. He has also conducted tailor-made courses for industries. He contributed actively in sponsored research and offered consultancy to different Government and private industries. He contributed more than 190 publications in international journals, a vast number of publications in national and international conferences and 10 patents. He has supervised more than 20 scholars for their doctoral degree. He is fellows of Indian National Academy of Engineering and National Academy of Sciences India.



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Prof. Indranil Ghosh received his B. Sc. and M. Sc. in Physics from Jadavpur University in 1990 and 1992 respectively, M.Tech and Ph.D. from the Cryogenic Engineering Centre, Indian Institute of Technology, Kharagpur in 1995 and 2005 respectively. With the experience of being an engineer, R&D of Bharat Heavy Plates and Vessel Ltd., Visakhapatnam and Post-Doctoral researcher in Hydrogen Research Institute, University of Quebec at Trois Rivieres, he joined Indian Institute of Technology, Kharagpur as an Assistant Professor in 2006. His research interests include heat transfer in cryogenic systems, heat transfer in metal foam, compact heat exchangers, sorption cooling techniques etc. He has carried out some sponsored projects (on-going) with MHRD and CSIR. He has published 22 research papers in peer reviewed international journals, 15 papers in national and international conferences.

Course certificate

- The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.
- The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).
- **Date and Time of Exams: 16 November 2019**, Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.
- Registration url: Announcements will be made when the registration form is open for registrations.
- The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.
- Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE

- Average assignment score = 25% of average of best 8 assignments out of the total 12 assignments given in the course.
- Exam score = 75% of the proctored certification exam score out of 100
- Final score = Average assignment score + Exam score



ELIGIBLE FOR A CERTIFICATE ONLY IF AVERAGE ASSIGNMENT SCORE $\geq 30/75$ | swayam.gov.in/about | All Courses |

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FINAL EXAM SCORE $\geq 30/75$.

If one of the 2 criteria is not met, you will not get the certificate even if the Final Score $\geq 40/100$.

The certificate will have your name, photograph and the score in the final exam with the logos of NPTEL and IIT Kharagpur. It will be e-verifiable at nptel.ac.in/noc (<http://nptel.ac.in/noc>).

- Only the e-certificate will be made available. Hard copies are being discontinued from July 2019 semester and will not be dispatched



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Initiative by : Ministry of Education (Govt of India)

Human-Computer Interaction - Web course

COURSE SYLLABUS

HCI foundation and history; Usability life cycle and methods; Design rules and guidelines; Empirical research methods; Models in HCI - GOMS, Fitts' law and Hick-Hyman's law; Task analysis; Dialogue design; Cognitive architecture and HCI ; Graphic User Interfaces & aesthetics; Usability Testing; UML, OOP, OOM; Design Case Studies.

COURSE DETAILS

Module		Lecture Details			
SL.No	Topic	No	Topic	No of Lectures	Remarks Author
M1	Introduction	L1	Course objective and overview	1	SB
		L2	Historical evolution of the field	1	SB
M2	Interactive system design (theory and practice)	L1	Concept of usability - definition and elaboration	1	PY
		L2	HCI and software engineering	1	SB
		L3	GUI design and aesthetics	1	PY
		L4	Prototyping techniques	1	SB
M3	Model-based Design and evaluation	L1-L4	Basic idea, introduction to different types of models, GOMS family of models (KLM and CMN-GOMS)	4	SB
		L5, L6	Fitts' law and Hick-Hyman's law	2	SB



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Computer Science and Engineering

Additional Reading:

- Yvonne Rogers, Helen Sharp, Jennifer Preece; Interaction Design 3rd Edition Wiley 2011
- Frank Bentley, Edward Barrett Building Mobile Experiences MIP Press Cambridge 2012
- Selected research papers (details will be provided at the end of relevant materials).
- Jacob Nielsen; *Useability Engineering*; Morgan Kaufmann, Academic Press, London, 1993.

Coordinators:

Dr.Samit Bhattacharya
Department of Computer Science and Engineering IIT Guwahati

Pradeep P Yammiyavar
Department of Computer Science and Engineering IIT Guwahati

		L7, L8	Model-based design case studies	2	SB
M4	Guidelines in HCI	L1	Shneiderman's eight golden rules	1	PY
		L2	Norman's seven principles	2	PY
		L3	Norman's model of interaction		
		L4	Nielsen's ten heuristics with example of its use	2	PY
		L5	Heuristic evaluation		
		L6	Contextual inquiry	1	PY
		L7	Cognitive walkthrough	1	PY
M5	Empirical research methods in HCI	L1, L2	Introduction (motivation, issues, research question formulation techniques)	2	SB
		L3, L4	Experiment design and data analysis (with explanation of one-way ANOVA)	2	SB
M6	Task modeling and analysis	L1	Hierarchical task analysis (HTA)	1	PY
		L2, L3	Engineering task models and Concur Task Tree (CTT)	2	SB
M7	Dialog Design	L1	Introduction to formalism in dialog design, design using FSM (finite state machines)	1	SB
		L2 – L4	State charts and (classical) Petri Nets in dialog design	3	SB
M8	Cognitive architecture	L1	Introduction to CA, CA types, relevance of CA in IS design	1	SB

		L2, L3	Model Human Processor (MHP)	2	SB
M9	Object Oriented Programming	L1	OOP- Introduction	1	PY
		L2	OOM- Object Oriented Modeling of User Interface Design	1	PY
M10	Design -Case Studies	L1	Case Study 1- Multi-Key press Hindi Text Input Method on a Mobile Phone	3	PY
		L2	Case Study 2 - GUI design for a mobile phone based Matrimonial application.		
		L3	Case Study 3 - Employment Information System for unorganised construction workers on a Mobile Phone.		
Total Modules	10	Total Lectures		40	SB = 25 PY = 15

References:

- Dix A., Finlay J., Abowd G. D. and Beale R. *Human Computer Interaction*, 3rd edition, Pearson Education, 2005.
- Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. *Human Computer Interaction*, Addison-Wesley, 1994.
- B. Shneiderman; *Designing the User Interface*, Addison Wesley 2000 (Indian Reprint).



INTERPERSONAL SKILLS

PROF. SMITA JHA

Department of Humanities and Social Sciences
IIT Roorkee

TYPE OF COURSE : New | Core_Elective | PG/UG

COURSE DURATION : 8 weeks (29 Jul'19 - 23 Aug'19)

EXAM DATE : 29 Sep 2019

INTENDED AUDIENCE : Under graduate and post graduate engineering students and post graduate science students

INDUSTRIES APPLICABLE TO : Almost all corporate sector employee will value this course including sales professionals, business leaders and educators. This course is useful for students as well as for housewives.

COURSE OUTLINE :

The proposed course is a program to enhance personality to deal with the various problems of a professional world. Soft skills are becoming increasingly vital to employers as it has become very competitive to survive in a business world. Be it team spirit, communication skills or being a quick-thinker, expressing and demonstrating the right soft skills can make hopeful applicants stand out from the crowd. This course will also focus on pronunciation so as to make one's speech impressive. To excel in a job one surely needs a repertoire of technical skills. This course has been designed to meet all the requirements.

ABOUT INSTRUCTOR :

Prof. Smita Jha is currently working as faculty of English language and literature in the Department of Humanities & Social Sciences, Indian Institute of Technology, Roorkee. She has done M.A. in English (Gold Medalist) from Bihar University, Bihar. She has done Post graduate diploma in teaching English from CIEFL, Hyderabad. Prof. Smita Jha has more than 23 years of teaching experience both at UG and PG level. She has developed course on Neurolinguistics for the first year B.Tech students, She is running Linguistics as elective for the 3rd and the 4th year B.Tech students. She has published more than 50 papers in refereed journals. She has also written books on divers topics like nativization of English prose, partition literature etc. Her research areas are Linguistics, Indian writing in English, World Literature, Contemporary Literary Theory, ELT. She has supervised seven research scholars on various aspects of literature.

COURSE PLAN :

Week 1 : Introduction to Interpersonal skills with pronunciation and communicative skills

Week 2 : Introduction to Body language as part of communicative skills

Week 3 : Introduction to group dynamics and group effectiveness and leadership

Week 4 : Various steps to give a successful oral presentation

Week 5 : Time Management with Negotiation

Week 6 : Creativity and Problem Solving Skills

Week 7 : Stage Freight & Death by PowerPoint

Week 8 : Making Decision & Emotional Intelligence with Group Discussion



INTRODUCTION TO ABSTRACT AND LINEAR ALGEBRA

PROF. SOURAV MUKHOPADHYAY

Department of Mathematics
IIT Kharagpur

INTENDED AUDIENCE : Mathematics

COURSE OUTLINE :

Abstract and Linear Algebra are applicable to every discipline, be it engineering and technology, economics or social sciences. It is essential for the students to get acquainted with the subject of Abstract and Linear Algebra at an early stage. The present course has been designed to introduce the subject to undergraduate/postgraduate students in science and engineering. The course contains a good introduction to each topic and an advance treatment of theory at a fairly understandable level to the students at this stage.

ABOUT INSTRUCTOR :

Prof. Sourav Mukhopadhyay is an Associate Professor at Indian Institute of Technology Kharagpur. He has completed his B.Sc (Honours in Mathematics) in 1997 from University of Calcutta, India. He has done M.Stat (in statistics) and M.Tech (in computer science) from Indian Statistical Institute, India, in 1999 and 2001 respectively. He worked with Cryptology Research Group at Indian Statistical Institute as a PhD student and received his Ph.D. degree in Computer Science from there in 2007. He was a Research Assistant at the Computer Science department of School of Computing, National University of Singapore (NUS). He visited InriaRocquencourt, project CODES, France and worked as a post-doctoral research fellows at the School of Computer Engineering, Nanyang Technological University (NTU), Singapore. He was a post-doctoral research fellow and a part time Lecturer with School of Electronic Engineering, Dublin City University (DCU), Ireland.

COURSE PLAN :

Week 1 : Basic set theory

Week 2 : Group Theory

Week 3 : Rings and Polynomial rings

Week 4 : Field and finite fields

Week 5 : Matrices and determinants

Week 6 : Vector spaces over fields

Week 7 : Linear transformations and their matrices

Week 8 : Linear equations



INTRODUCTION TO INTERNET OF THINGS

PROF. SUDIP MISRA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Basic programming knowledge

INTENDED AUDIENCE : CSE, IT, ECE, EE, Instrumentation Engineering, Industrial Engineering

COURSE OUTLINE :

Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

ABOUT INSTRUCTOR :

Prof. Sudip Misra is a Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Kharagpur. Prior to this he was associated with Cornell University (USA), Yale University (USA), Nortel Networks (Canada) and the Government of Ontario (Canada). He received his Ph.D. degree in Computer Science from Carleton University, in Ottawa, Canada. He has several years of experience working in the academia, government, and the private sectors in research, teaching, consulting, project management, architecture, software design and product engineering roles. His current research interests include Wireless Ad Hoc and Sensor Networks, Internet of Things (IoT), Computer Networks, Learning Systems, and algorithm design for emerging communication networks. Dr. Misra is the author of over 260 scholarly research papers, including 140+ reputed journal papers. He has won seven research paper awards in different conferences. Recently, he and his students won Samsung Innovation Award and the IEEE ComSoc Student Competition. He was awarded the fellow of NASI. He was also awarded the IEEE ComSoc Asia Pacific Outstanding Young Researcher Award at IEEE GLOBECOM 2012, Anaheim, California, USA. He was also the recipient of several academic awards and fellowships such as the Young Scientist Award (National Academy of Sciences, India), Young Systems Scientist Award (Systems Society of India), Young Engineers Award (Institution of Engineers, India), (Canadian) Governor General's Academic Gold Medal at Carleton University, the University Outstanding Graduate Student Award in the Doctoral level at Carleton University and the National Academy of Sciences, India - Swarna Jayanti Puraskar (Golden Jubilee Award). Dr. Misra was also awarded the Canadian Government's prestigious NSERC Post-Doctoral Fellowship and the Humboldt Research Fellowship in Germany. Dr. Misra has been serving the editorial boards of distinguished journals such as the Transactions on Vehicular Technology, Transactions on Mobile Computing, International Journal of Communication Systems (Wiley) and the IET Wireless Sensor Systems (UK). In the past, he served as the Associate Editor/Editorial Board Member of the Telecommunication Systems Journal (Springer), Security and Communication Networks Journal (Wiley), and the EURASIP Journal of Wireless Communications and Networking, IET Communications Journal, and the Computers and Electrical Engineering Journal (Elsevier). Dr. Misra has published 10 books in the areas of wireless ad hoc networks, wireless sensor networks, wireless mesh networks, communication networks and distributed systems, network reliability and fault tolerance, and information and coding theory, published by reputed publishers such as Cambridge University Press, Springer, Wiley, and World Scientific.

COURSE PLAN :

Week 1: Introduction to IoT: Part I, Part II, Sensing, Actuation, Basics of Networking: Part-I

Week 2: Basics of Networking: Part-II, Part III, Part IV, Communication Protocols: Part I, Part II

Week 3: Communication Protocols: Part III, Part IV, Part V, Sensor Networks: Part I, Part II

Week 4: Sensor Networks: Part III, Part IV, Part V, Part VI, Machine-to-Machine Communications

Week 5: Interoperability in IoT, Introduction to Arduino Programming: Part I, Part II, Integration of Sensors and Actuators with Arduino: Part I, Part II

Week 6: Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi

Week 7: Implementation of IoT with Raspberry Pi (contd), Introduction to SDN, SDN for IoT

Week 8: SDN for IoT (contd), Data Handling and Analytics, Cloud Computing

Week 9: Cloud Computing(contd), Sensor-Cloud

Week 10: Fog Computing, Smart Cities and Smart Homes

Week 11: Connected Vehicles, Smart Grid, Industrial IoT

Week 12: Industrial IoT (contd), Case Study: Agriculture, Healthcare, Activity Monitoring



INTRODUCTION TO MACHINE LEARNING (TAMIL)

PROF. ARUN RAJKUMAR

Department of Computer Science
IIT Madras

INTENDED AUDIENCE: Native Tamil speaking audience (Teachers/ Undergraduate Students)

PREREQUISITES: A basic course in linear algebra/probability/programming/algorithms would be a big plus. These are not strong pre-requisites.

INDUSTRY SUPPORT: All Data centric companies including those that have core business in search/e-commerce/social-media

COURSE OUTLINE:

A short course introducing the main ideas and algorithms of Machine Learning. The goal of the course is to cover the topics at a high level so that it would act as a first course for a full fledged Machine Learning course. The course will be delivered in spoken Tamil while the technical terms discussed/exams/assignments will be in English.

ABOUT INSTRUCTOR:

Prof.Arun Rajkumar is currently an assistant professor in the department of CSE at IIT Madras. His PhD thesis was in the area of Machine Learning and his broad research interests are in the areas of Machine Learning, sequential decision making.

COURSE PLAN:

Week 1: Basics of Linear Algebra, Probability, Optimization

Week 2: Introduction to Supervised Learning - Regression; Topics - Linear Regression; Ridge Regression; LASSO

Week 3: Supervised Learning - Classification; Topics: K-NN, Decision Tree.

Week 4: Supervised Learning - Classification; Topics: Naive Bayes.

Week 5: Supervised Learning - Logistic Regression ,Perceptron.

Week 6: Supervised Learning - Support Vector Machines

Week 7: Supervised Learning - Ensemble Methods

Week 8: Unsupervised Learning - K-means Clustering, PCA



INTRODUCTION TO R SOFTWARE

PROF. SHALABH

Department of Mathematics
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG

COURSE DURATION : 8 weeks (26 Jul'21 - 17 Sep'21)

EXAM DATE : 26 Sep 2021

PREREQUISITES : Mathematics background up to class 12 is needed.

Having some preliminary knowledge will be helpful but not necessarily mandatory.

INTENDED AUDIENCE : UG students of Science and Engineering. Students of humanities with basic mathematical background can also do it. Working professionals in analytics and anyone involved in programming, mathematical and statistical computations, simulations and data analysis can also do it.

INDUSTRIES APPLICABLE TO : All industries involved in mathematical and statistical computations, programming and simulations and having R & D set up will use this course.

COURSE OUTLINE

Any scientific task without the knowledge of software is difficult to imagine and complete in the current scenario. R is a free software that is capable of handling mathematical and statistical manipulations. It has its own programming language as well as built in functions to perform any specialized task. We intend to learn the basics of R software in this course.

ABOUT INSTRUCTOR

Prof. Shalabh is a Professor of Statistics at IIT Kanpur. His research areas of interest are linear models, regression analysis and econometrics. He has more than 22 years of experience in teaching and research. He has developed several web based NPTEL courses including on regression analysis and has conducted several workshops on statistics for teachers, researchers and practitioners. He has received several national and international award and fellowships. He has authored more than 70 research papers in national and international journals. He has written four books and one of the book on linear models is coauthored with Prof. C.R. Rao.

COURSE PLAN

Week 1: Basic fundamentals, installation and use of software, data editing, use of R as a calculator, functions and assignments.

Week 2: Use of R as a calculator, functions and matrix operations, missing data and logical operators.

Week 3: conditional executions and loops, data management with sequences.

Week 4: Data management with repeats, sorting, ordering, and lists.

Week 5: Vector indexing, factors, Data management with strings, display and formatting.

Week 6: Data management with display paste, split, find and replacement, manipulations with alphabets, evaluation of strings, data frames.

Week 7: Data frames, import of external data in various file formats, statistical functions, compilation of data.

Week 8: Graphics and plots, statistical functions for central tendency, variation, skewness and kurtosis, handling of bivariate data through graphics, correlations, programming and illustration with examples.



INTRODUCTION TO ROCKET PROPULSION

PROF. D. P. MISHRA

Department of Aerospace Engineering
IIT Kanpur

TYPE OF COURSE : New | Core&Elective | UG/PG

COURSE DURATION : 12 weeks (29 Jul'19 - 18th Oct'19)

EXAM DATE : 16 Nov 2019

PRE-REQUISITES : +2 Science

COURSE OUTLINE :

This is an introductory course on rocket propulsion. The objective of this course is to impart knowledge about rocket propulsion to both UG and PG students. In this course, fundamentals aspects of rocket propulsion namely Solid, Liquid and Hydride rocket engines are to be covered extensively. Besides this, performance of rocket engine and heat transfer aspects of various components are to be covered briefly.

ABOUT INSTRUCTOR :

Prof. Debi Prasad Mishra is a Professor in the Department of Aerospace Engineering at Indian Institute of Technology (IIT) Kanpur, India. His areas of research interest include combustion, computational fluid dynamics, atomization, etc. He was conferred with the Indian Oil Golden Jubilee Professional Chair in IIT Kanpur. He has authored five textbooks and has delivered several lectures on ancient Indian Science and Technology and culture and tradition to more than 45, 000 students across India.

COURSE PLAN :

Week 1: Introduction, Types of Rocket Engines, Applications of Rocket Engines

Week 2: Aerothermodynamics of Rocket Engines, Fundamentals of Aerodynamics, Elements of thermodynamics

Week 3: Combustion, Ideal Rocket Engine

Week 4: Thrust Equation, Rocket Engine parameters, Rocket Engine Nozzles

Week 5: Space Flight Performance, Rocket Propellant

Week 6: Introduction to Solid Propellant Rocket Engine, Components of SPRE, Regression rate relation

Week 7: Liquid Propellant Rocket Engine, Injector, Feed system

Week 8: Hybrid rocket Engine, Rocket Heat transfer

Week 9: Liquid Propellant Rocket Engine, Types of liquid rocket engines, Combustion of liquid propellant

Week 10: Combustion Chamber Geometry, Types of liquid rocket engines, Injectors, Feed system

Week 11: Combustion Instability, Ignition System, Hybrid rocket Engine

Week 12: Rocket Heat transfer, Types of Cooling System



MANUFACTURING AUTOMATION

PROF. SOUNAK KUMAR CHOUDHURY

Department of Mechanical Engineering
IIT Kanpur

PRE-REQUISITES : Basic Engineering Courses

INTENDED AUDIENCE : Mechanical Engineering, Metallurgy, Aerospace Engineering, Production Engineering

INDUSTRIES APPLICABLE TO : All Manufacturing industries, Machine tool manufacturing industries, Automobile Industries and aeronautical assembly industries

COURSE OUTLINE :

The course will basically deal with the following topics: Introduction: Definition; Types of automation; Reasons for automating; Automation strategies. Detroit type automation : Automated flow lines: types and their selection; Methods of workpart transport; Transfer mechanisms; Controlling of automated flow lines. Analysis of automated flow lines: System aspects of designing and running the line; Average production time and production rate; Line efficiency; Analysis of transfer lines without storage – upper bound and lower bound approach; Partial automation. Automated assembly systems: Historical developments of the assembly process; Choice of assembly methods; Design for automated assembly; Transfer systems; Vibratory bowl feeders – its analysis; Non-vibratory feeders and their analysis; Analysis and design of part orienting devices, feed tracks and part placing mechanisms. Orientation of parts in automatic assembly: In-Bowl and Out-of-Bowl Toolings; Typical Orienting Systems: Wiper Blade, Pressure Break, slot in the track; Analysis of Part Orienting Systems; Examples of Out-of-Bowl Toolings; Feed Tracks: Analysis of Horizontal Delivery Feed Track; “ON-OFF” Sensors; Reliability of Feeding.

ABOUT INSTRUCTOR :

Prof. Sounak Kumar Choudhury have completed my Ph.D. in Mechanical Engineering from Moscow, Russia in 1985 followed by post-doctoral at the same university till 1986. From 1986 I am involved in teaching and research in the Mechanical Engineering Department of Indian Institute of Technology Kanpur. My areas of specialization are conventional and non-conventional machining, automatic control, hydraulic control, machine tools and manufacturing automation.

COURSE PLAN :

Week 1 : Definition; Discussion on Pros and Cons of Automation; Benefits of Automation; Types of automation: Fixed automation, programmable automation, and Flexible automation- Typical Features and examples; Reasons for automating; Automation strategies; Automated flow lines: the objectives of the use of flow line automation; General forms of Work Flow – criteria for selection; Methods of work part transport: Continuous, intermittent and asynchronous: types and their selection; Transfer Mechanisms; Examples of transfer mechanisms for linear travel and rotary transfer mechanisms; Buffer Storage;

Week 2 : Flow line Performance Analysis: Average production time and production rate; Mean time per cycle when machine breakdown occurs; Flow line Performance Analysis: Line efficiency; Cost per item produced; Partial automation: Reasons for using, Advantages and drawbacks; Production and Throughput: Examples; Effect of machine Jamming; Component Quality Control; Choice of assembly methods: Cost, Production Rate, Availability of Labour, and Market Life of the Product; Advantages of Automatic Assembly; Design for automated assembly; Components of automatic Assembly Machines;

Week 3 : Transfer systems; Assembly Machines: In-Line, Rotary; Continuous and Intermittent Transfer; Indexing Machines: Factors affecting the choice; Various Indexing Mechanisms; Vibratory bowl feeders: Mechanics of Vibratory Conveying - its analysis; Effect of Frequency, Track Acceleration and Vibration Angle; Effect of Track Angle and Coefficient of Friction; Summary of Bowl Feeder Design; Spiral Elevators; General Requirements of Part Feeders; Non-vibratory feeders : Reciprocating Tube Hopper Feeder – its analysis; General Features. Centerboard Hopper Feeder: Analysis: Maximum Track Inclination, Total Cycle Time, Mean Feed Rate;

Week 4 : Reciprocating Tube Hopper Feeder: Principle of Operation; External Gate Hopper Feeder: Its Analysis: Maximum Peripheral Velocity, Mean Feed rate; Rotary Disk Feeder: Indexing and Rotary Disk Feeder with continuous drive and their analysis: Load sensitivity, Efficiency and Mean Feed Rate; Orientation of Parts in Automatic Assembly: In-Bowl and Out-of-Bowl Tooling's; Typical Orienting Systems: Wiper Blade, Pressure Break, slot in the track; Analysis of Part Orienting Systems; Examples of Out-of-Bowl Toolings; Feed Tracks: Analysis of Horizontal Delivery Feed Track; “ON-OFF” Sensors; Reliability of Feeding.



MANUFACTURING OF COMPOSITES

PROF. J RAMKUMAR

Department of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Core/Elective | UG/PG

COURSE DURATION : 8 weeks (26 Aug'19 - 18 Oct'19)

EXAM DATE : 17 Nov 2019

INTENDED AUDIENCE : Students of all Engineering and Science disciplines.

PRE-REQUISITES : The student should have completed two semesters of UG Engineering or Science program.

INDUSTRIES APPLICABLE TO : HAL, NAL, SAIL, ISRO

COURSE OUTLINE

Selecting manufacturing technique has emerged as one the paramount challenge in the field of composites. Composites are now being used in almost every field of industry, and students working in the area of the composites need to learn the basics, and progressive techniques of composites manufacturing. This course covers the important aspects of composites manufacturing: process selection guidelines, thermoset and thermoplastic Composites manufacturing processes, process parameters and characterizations. Applications and use of each manufacturing process is focused and this is represented separately.

ABOUT INSTRUCTOR

Prof. Janakranjan .Ramkumar is currently a Professor of Mechanical Engineering Department, and Design Program, Indian Institute of Technology, Kanpur. He teaches manufacturing science, micro/nano technology, new product development. He has a bachelors in Production Engineering with his doctorate in Defect quantification in drilling of composites from IIT Madras, India with a best thesis award. Over the years his contribution in teaching and research is remarkable. He has worked for BOSCH group and improved the productivity of the company. His research and teaching focus is on nano technology and inclusive design. He has several international and national patents in his credit and has published more than 100 journal papers.

COURSE PLAN

Week 1: Introduction to Composites; Introduction to Composites; Function of the Matrix and Reinforcement in Composites
Matrices: Thermosets and Thermoplastic; Fiber Reinforcement

Week 2: Properties and testing composites; Properties of Composites; Composites testing; Composites design: Laminate theory, Rule of mixtures, symmetry and balance

Week 3: Thermoset Composites manufacturing processes; Material selection process cont.; Material selection process cont. Design for manufacturing.

Week 4: Thermoset composite manufacturing processes; Thermoset Composite manufacturing:Lay-up processes,Spray up process;Thermoset Composite manufacturing:Fiber placement process;Thermoset Composite manufacturing:Resin transfer moulding

Week 5: Thermoplastic composite manufacturing processes; Thermoset Composite manufacturing:Vaccum assisted resin transfer moulding; Thermoset Composite manufacturing:Compression molding process; Thermoset composites manufacturing:Filament winding

Week 6: Thermoplastic composite manufacturing processes; Thermoplastic Composite manufacturing:Sheet moulding Thermoplastic Composite manufacturing: Injection moulding, sheet moulding, Calendaring; Thermoplastic Composite manufacturing:Extrusion, Blow molding, rotational molding, Thermoforming

Week 7: Metal and ceramic matrix composites; Metal Matrix Composites: Metal matrix and reinforcement; Manufacturing processes for Metal Matrix Composites:Dispersion hardened and particle composite; Manufacturing processes for Metal matrix composites:Layer composites and infiltration method

Week 8: Prevention of Damage, repair of Composites and selection of processes; Ceramic matrix composites: Hot isostatic processing ; Non – destructive testing of Composites; Manufacturing process selection: Cost, performance, size shape, rate of production. Steps for process selection



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Mathematical Modeling Of Manufacturing Processes

By Prof. Swarup Bag | IIT Guwahati

Learners enrolled: 658 | Exam registration: 73

Mathematical Modeling of Manufacturing Processes [Intr...



ABOUT THE COURSE:

The understanding of the basic mechanism such as heat and mass transport with associated fluid flow including metallurgical transformation, distortion and residual stress generation in different manufacturing processes is the focus of this course. Understanding the complex interaction not only helps to develop mathematical model, it makes the foundation for analysis, numerical simulation at different scale and experimentation for different types of manufacturing processes. The development of computational models for a manufacturing process relies on mathematical expression of

Summary

Course Status :	Completed
Course Type :	Elective
Duration :	12 weeks
Category :	<ul style="list-style-type: none">Mechanical EngineeringManufacturing Processes and Technology
Credit Points :	3
Level :	Undergraduate/Postgraduate
Start Date :	24 Jul 2023
End Date :	13 Oct 2023
Enrollment Ends :	07 Aug 2023



mechanism. It helps to design relevant experiments and drives to find the mechanism. Mutual understanding between About Swayam (<https://swayam.gov.in/about>) leads to better insight of the basic manufacturing processes that impact on the improvement of existing process and directs for the development of new process. However, this course is completely different from statistical or data driven modeling approach. This course emphasized on the understanding of the most general to advanced manufacturing processes based on scientific principle. The complex mechanism is presented in a simplified way to understand the subject at elementary level. The broad impact is that the students will be able to develop physics based computational model of manufacturing process using standard commercial package (However, this course does not intend to cover the learning of the commercial software).

INTENDED AUDIENCE: Bachelor/Master/PhD students having background in Mechanical/Material Science/Metallurgical engineering/Production Engineering/Manufacturing Technology.

Exam
Registration | All Courses | 18 Aug 2023 (0)

Ends :

Exam Date : 28 Oct 2023 IST

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

This is an AICTE approved FDP course

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Course layout

- Week 1:** Introduction to Manufacturing processes
- Week 2:** Physics of manufacturing processes
- Week 3:** Conventional machining
- Week 4:** Non-conventional machining
- Week 5:** Metal forming
- Week 6:** Welding
- Week 7:** Welding
- Week 8:** Casting and powder metallurgy
- Week 9:** Coating and additive manufacturing
- Week 10:** Heat treatment
- Week 11:** Micro/nano scale manufacturing
- Week 12:** Processing of non-metallic materials





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- (<https://swayam.gov.in/>) Manufacturing Science, East-West Press Pvt Ltd, 2nd Ed., 2010.
1. A Brandt, J C Warner: Metallurgy Fundamentals, Goodheart- Willcox, 2009.
 2. O Lakshmana Rao and Anil P Deshpande: Modelling of Engineering Materials, Ane Books Pvt. Ltd., New Delhi, India, 2010.
 3. J. Chakrabarty: Theory of plasticity, 3rd Eds, Elsevier India, 2009.
 4. Norman Y Zhou: Microjoining and Nanojoining, Woodhead publishing, 2008
 5. R W Messler: Principles of Welding John Wiley and Sons, 1999.
 6. J T Black and Ronald A Kohser: DeGarmo's Materials & processes in Manufacturing Wiley-India, 2010.
 7. V K Jain: Advanced Machining Processes, Allied Publishers, Mumbai, 2002.
 8. Yi Qin: Micromanufacturing Engineering and Technology, Elsevier, 2015.
 9. J Zhang and Yeon-Gil Jung: Additive Manufacturing: Materials, Processes, Quantifications and Applications, Elsevier, 2018.
 10. J A Dantzig and M Rappaz: Solidification, CRS press, 2009.

Instructor bio



Prof. Swarup Bag

IIT Guwahati

The broad area of instructor is teaching and research interest of materials and manufacturing processes through computational models using finite element method and experiments. The instructor completed his Ph.D on "Development of bi-directional heat transfer and fluid flow model for reliable design of GTA and laser welding processes" from Indian Institute of Technology Bombay. Later he has worked at the Center for Material Forming (CEMEF), MINES Paris Tech, France in Metallurgy, Structure and Rheology (MSR) group. Soon after post-doctoral research experience, he joined in the Department of Mechanical Engineering, Indian Institute of Technology Guwahati as a faculty member. His primary area of research is fundamental process modeling of welding and joining technologies, optimization of manufacturing processes and recrystallization in metal forming processes. Dr. Bag has published about 56 journal papers, 45 Conference papers, and 18 book chapters related to welding and joining processes. He is the author of the book 'Computational models for GTA and laser welding processes' and recipient of 'Royal Arc Award 2009' from Indian Institute of Welding for the best PhD thesis in welding. The instructor is involved in teaching the subjects like 'Physics of Manufacturing Processes',





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PROBLEM SOLVING THROUGH PROGRAMMING IN C

PROF. ANUPAM BASU

Department of Computer Science and Engineering
IIT Kharagpur

INTENDED AUDIENCE : BE/BTech in all disciplines BCA/MCA/M. Sc

INDUSTRIES APPLICABLE TO : All IT Industries

COURSE OUTLINE : This course is aimed at enabling the students to

- Formulate simple algorithms for arithmetic and logical problems
- Translate the algorithms to programs (in C language)
- Test and execute the programs and correct syntax and logical errors
- Implement conditional branching, iteration and recursion
- Decompose a problem into functions and synthesize a complete program using divide and conquer approach
- Use arrays, pointers and structures to formulate algorithms and programs
- Apply programming to solve matrix addition and multiplication problems and searching and sorting problems
- Apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration

ABOUT INSTRUCTOR :

Prof. Anupam Basu is Professor in the Dept. of Computer Science Engineering, IIT Kharagpur, and has been an active researcher in the areas of Cognitive and Intelligent Systems, Embedded Systems and Language Processing, Presently he is acting as the Chairman and Head of the Center for Educational Technology, IIT Kharagpur. He has developed several embedded system based tools empowering the physically challenged and has led several national projects in the area. He has taught at the University of California, Irvine at the Center for Embedded Systems. He is an Alexander von Humboldt Fellow and a Fellow of the Indian National Academy of Engineering. The awards won by him include the State Award for the Best Contribution to the Cause of Empowerment of the Disabled (2014), Universal Design Award 2011, for contributions in design for the disabled, by National Council for Promotion of Employment of Disabled Persons, India, the National Award for the Best Technology Innovation for the Physically Disabled (2007) and the Da-Vinci Award 2004 from the Engineering Society of Detroit.

COURSE PLAN :

Week 1: Introduction to Problem Solving through programs, Flowcharts/Pseudo codes, the compilation process, Syntax and Semantic errors, Variables and Data Types

Week 2: Arithmetic expressions, Relational Operations, Logical expressions; Introduction to Conditional Branching

Week 3: Conditional Branching and Iterative Loops

Week 4: Arranging things : Arrays

Week 5: 2-D arrays, Character Arrays and Strings

Week 6: Basic Algorithms including Numerical Algorithms

Week 7: Functions and Parameter Passing by Value

Week 8: Passing Arrays to Functions, Call by Reference

Week 9: Recursion

Week 10: Structures and Pointers

Week 11: Self-Referential Structures and Introduction to Lists

Week 12: Advanced Topics



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Product Design Using Value Engineering

By Prof. Inderdeep Singh | IIT Roorkee

Learners enrolled: 3750

Product Design using Value Engineering



It has been established worldwide that the most successful economies are based on innovation and creativity led entrepreneurship. The government is focusing on putting concerted efforts to produce job creators.

The current MOOC on Product Design using Value Engineering is conceptualized and planned in such a way that it helps both job creators as well as job seekers. The main objective of the course is to acquaint the learners/students with the practical knowledge regarding conceptualization, design and development of a new product with a focused

Summary

Course Status : Completed

Course Type : Elective

Duration : 4 weeks

Category :

- Mechanical Engineering

Credit Points : 1

Level : Undergraduate

Start Date : 29 Jul 2019

End Date : 23 Aug 2019

Exam Date : 29 Sep 2019 IST

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

This is an AICTE approved FDP course

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Approach. The need of a new product, the product design process, the Engineering principles in product design process have been discussed in the course. The difference between the concept of Value Engineering and Cost Cutting has been elaborated with examples. The Value Engineering Job Plan (VEJP) has also been discussed, especially in context of the product design process. Different types of product functions, their identification, definition, analysis has been explained with examples. Various concepts, such as function-cost relationship have been explained with relevant and specific examples/ case studies.

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INTENDED AUDIENCE: Engineers, Product Designers, Product Management Professionals, UG/PG students.

PREREQUISITES: No-prerequisite, any student enrolled for a UG/PG degree in any discipline of humanities, management, science and engineering can complete the course.

INDUSTRY SUPPORT: All industries where products are being conceptualized, designed and developed in order to satisfy the human needs and requirements.

Course layout

Week 1: Introduction to Product Design and Development, Product Design Steps and Product Analysis, Profit Consideration, Value Engineering (History, Concept and Definitions), Value Engineering vs. Cost Cutting.

Week 2: Creative Thinking, Problem Identification and VEJP, Types of Product Functions, Functional Analysis, Functional Analysis System Technique.

Week 3: Function-Cost Relationship – I, Function-Cost Relationship - II, VE Applications in Product Design, Value Engineering:Case Study -I, Value Engineering: Case Study –II.

Week 4: VE Tools and Techniques – I, VE Tools and Techniques – II, , VE Success Stories –I, VE Success Stories -II .Behavioral Roadblocks

Books and references

1. Lawrence D. Miles; "Techniques of Value Analysis and Engineering", 2nd Edition, McGraw-Hill Book Company, Inc. New York.
2. Larry W. Zimmerman, Glen D. Hart; "Value Engineering", Reprint 1999, CBS Publishers and Distributors, New Delhi
3. A. K. Chitale and R. C. Gupta, "Product Design and Manufacturing", 3rd Edition, Prentice-Hall of India.



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Dr. Inderdeep Singh is currently working as Associate Professor in Department of Mechanical and Industrial Engineering at Indian Institute of Technology Roorkee. He has taught among others, the industrial engineering courses such as Production Planning and Control, Product Design and Development, Work System Design, Industrial Management and Quality Management. He has been actively involved in the National Mission Project on Education Through ICT (NME-ICT) of Government of India. He has completed eight video and one web course under the National Programme on Technology Enhanced Learning (NPTEL, MOOCs). He has developed suitable pedagogical methods for two under-graduate courses of Mechanical Engineering.

Course certificate

- The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.
- The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).
- **Date and Time of Exams: 29 September 2019**, Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.
- Registration url: Announcements will be made when the registration form is open for registrations.
- The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.
- Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE

- Average assignment score = 25% of average of best 3 assignments out of the total 4 assignments given in the course.
- Exam score = 75% of the proctored certification exam score out of 100.
- Final score = Average assignment score + Exam score.



ELIGIBLE FOR A CERTIFICATE ONLY IF AVERAGE ASSIGNMENT SCORE >= 30/75

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Score >= 40/100.

The certificate will have your name, photograph and the score in the final exam with the logos of NPTEL and IIT Roorkee. It will be e-

verifiable at nptel.ac.in/noc (<http://nptel.ac.in/noc>).

- Only the e-certificate will be made available. Hard copies are being discontinued from July 2019 semester and will not be dispatched.



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PROGRAMMING IN JAVA

PROF. DEBASIS SAMANTA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : This course requires that the students are familiar with programming language such as C/C++ and data structures, algorithms.

INTENDED AUDIENCE : The undergraduate students from the engineering disciplines namely CSE, IT, EE, ECE, etc. might be interested for this course.

INDUSTRIES APPLICABLE TO : All IT companies.

COURSE OUTLINE :

With the growth of Information and Communication Technology, there is a need to develop large and complex software. Further, those software should be platform independent, Internet enabled, easy to modify, secure, and robust. To meet this requirement object-oriented paradigm has been developed and based on this paradigm the Java programming language emerges as the best programming environment. Now, Java programming language is being used for mobile programming, Internet programming, and many other applications compatible to distributed systems. This course aims to cover the essential topics of Java programming so that the participants can improve their skills to cope with the current demand of IT industries and solve many problems in their own field of studies.

ABOUT INSTRUCTOR :

Prof. Debasis Samanta holds a Ph.D. in Computer Science and Engineering from Indian Institute of Technology Kharagpur. His research interests and work experience spans the areas of Computational Intelligence, Data Analytics, Human Computer Interaction, Brain Computing and Biometric Systems. Prof. Samanta currently works as a faculty member at the Department of Computer Science Engineering at IIT Kharagpur.

COURSE PLAN :

Week 1: Overview of Object-Oriented Programming and Java

Week 2: Java Programming Elements

Week 3: Input-Output Handling in Java

Week 4: Encapsulation

Week 5: Inheritance

Week 6: Exception Handling

Week 7: Multithreaded Programming

Week 8: Java Applets and Servlets

Week 9: Java Swing and Abstract Windowing Toolkit (AWT)

Week 10: Networking with Java

Week 11: Java Object Database Connectivity (ODBC)

Week 12: Interface and Packages for Software Development



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Programming, Data Structures And Algorithms Using Python

By Prof. Madhavan Mukund | Chennai Mathematical Institute

Learners enrolled: 41331



This course is an introduction to programming and problem solving in Python. It does not assume any prior knowledge of programming. Using some motivating examples, the course quickly builds up basic concepts such as conditionals, loops, functions, lists, strings and tuples. It goes on to cover searching and sorting algorithms, dynamic programming and backtracking, as well as topics such as exception handling and using files. As far as data structures are concerned, the course covers Python dictionaries as well as classes and objects for defining user defined datatypes such as linked lists and binary search trees.

Summary

Course Status :	Completed
Course Type :	Elective
Duration :	8 weeks
Category :	<ul style="list-style-type: none">◦ Computer Science and Engineering◦ Programming◦ Data Science◦ Artificial Intelligence◦ Foundations of Computing
Credit Points :	2
Level :	Undergraduate
Start Date :	24 Jan 2022
End Date :	18 Mar 2022





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Enrollment Ends | All Courses | 07 Feb 2022 ()

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INTENDED AUDIENCE: Students in any branch of mathematics/science/engineering, 1st

Exam Date : 27 Mar 2022 IST



PREREQUISITES: School level mathematics.

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

INDUSTRY SUPPORT: This course should be of value to any company requiring programming skills.

This is an AICTE approved FDP course

ABOUT CMI: [Click here \(https://www.youtube.com/watch?v=J_cz9JvbTg4\)](https://www.youtube.com/watch?v=J_cz9JvbTg4)

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Course layout

Week 1

Informal introduction to programmin, algorithms and data structures viagcd
 Downloading and installing Python
 gcd in Python: variables, operations, control flow - assignments, condition-als, loops, functions

Week 2

Python: types, expressions, strings, lists, tuples
 Python memory model: names, mutable and immutable values
 List operations: slices etc
 Binary search
 Inductive function denitions: numerical and structural induction
 Elementary inductive sorting: selection and insertion sort
 In-place sorting





analysis: input size, asymptotic complexity, About Swayam (<https://swayam.gov.in/about>) | All Courses |

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Merge sort

Quick sort

Stable sorting

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Week 4

Dictionaries

More on Python functions: optional arguments, default values

Passing functions as arguments

Higher order functions on lists: map, lter, list comprehension

Week 5

Exception handling

Basic input/output

Handling files

String processing

Week 6

Backtracking: N Queens, recording all solutions

Scope in Python: local, global, nonlocal names

Nested functions

Data structures: stack, queue

Heaps

Week 7

Abstract datatypes

Classes and objects in Python

"Linked" lists: find, insert, delete

Binary search trees: find, insert, delete

Height-balanced binary search trees

Week 8

Efficient evaluation of recursive definitions: memoization

Dynamic programming: examples

Other programming languages: C and manual memory management

Other programming paradigms: functional programming

Books and references

NIL





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**Prof. Madhavan
Mukund**

Chennai
Mathematical
Institute

Prof. Madhavan Mukund studied at IIT Bombay (BTech) and Aarhus University (PhD). He has been a faculty member at Chennai Mathematical Institute since 1992, where he is presently Professor and Director. His main research area is formal verification. He has active research collaborations within and outside India and serves on international conference programme committees and editorial boards of journals.

He has served as President of both the Indian Association for Research in Computing Science (IARCS) (2011-2017) and the ACM India Council (2016-2018). He has been the National Coordinator of the Indian Computing Olympiad since 2002. He served as the Executive Director of the International Olympiad in Informatics from 2011-2014.

In addition to the NPTEL MOOC programme, he has been involved in organizing IARCS Instructional Courses for college teachers. He is a member of ACM India's Education Committee. He has contributed lectures on algorithms to the Massively Empowered Classroom (MEC) project of Microsoft Research and the QEEE programme of MHRD.

Course certificate

The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.

The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).

Date and Time of Exams: **27 March 2022** Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.

Registration url: Announcements will be made when the registration form is open for registrations.

The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.

Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE




 We have an unproctored programming exam also apart from the Proctored
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 Final score = Assignment score + Unproctored programming exam score + Proctored
 Exam score
https://swayam.gov.in/noc_details/NPTEL

Assignment score = 25% of average of best 6 assignments out of the total 8
 assignments given in the course.

- (All assignments in a particular week will be counted towards final scoring -
 quizzes and programming assignments).
- Unproctored programming exam score = 25% of the average scores obtained as
 part of Unproctored programming exam - out of 100
- Proctored Exam score =50% of the proctored certification exam score out of 100

**YOU WILL BE ELIGIBLE FOR A CERTIFICATE ONLY IF ASSIGNMENT SCORE >=10/25 AND
 UNPROCTORED PROGRAMMING EXAM SCORE >=10/25 AND PROCTORED EXAM SCORE
 >= 20/50.**

If any one of the 3 criteria is not met, you will not be eligible for the certificate even if the
 Final score >= 40/100.

Certificate will have your name, photograph and the score in the final exam with the
 breakup.It will have the logos of NPTEL and IIT Madras .It will be e-verifiable
 at npTEL.ac.in/noc (<http://npTEL.ac.in/noc>).

Only the e-certificate will be made available. Hard copies will not be dispatched.

Once again, thanks for your interest in our online courses and certification. Happy
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Week 1:

BASICS OF PYTHON SPYDER (TOOL)

- Introduction Spyder
- Setting working Directory
- Creating and saving a script file
- File execution, clearing console, removing variables from environment, clearing environment
- Commenting script files
- Variable creation
- Arithmetic and logical operators
- Data types and associated operations

Week 2:

Sequence data types and associated operations

- Strings
- Lists
- Arrays
- Tuples
- Dictionary
- Sets
- Range

NumPy

- ndarray

Week 3:

Pandas dataframe and dataframe related operations on Toyota Corolla dataset

1. Reading files
2. Exploratory data analysis
3. Data preparation and preprocessing

Data visualization on Toyoto Corolla dataset using matplotlib and seaborn libraries

1. Scatter plot
2. Line plot
3. Bar plot
4. Histogram
5. Box plot
6. Pair plot

Control structures using Toyota Corolla dataset

1. if-else family
2. for loop
3. for loop with if break
4. while loop

Week 4: CASE STUDY

Regression

1. Predicting price of pre-owned cars

Classification

1. Classifying personal income



SELECTION OF NANOMATERIALS FOR ENERGY HARVESTING AND STORAGE APPLICATIONS

PROF. KAUSHIK PAL

Department of Mechanical and Industrial Engineering
IIT Roorkee

INTENDED AUDIENCE : UG & PG students of Metallurgy, Nano Science & Nanotechnology, Chemical Engg, Chemistry, Electronics, Electrical, Physics, and Material Science etc. R&D personnels from industries

COURSE OUTLINE :

Selection of nanomaterials for energy harvesting and storage applications is an interdisciplinary course which deals with selection of nanomaterials and key challenges to improve performance of the energy harvesting and storage devices/techniques. In this course we will be covering different energy harvesting and storage techniques and the parameters that are to be considered in selecting the nanomaterials for the same.

ABOUT INSTRUCTOR :

Prof. Kaushik Pal is an Associate Professor in Department of Mechanical and Industrial Engineering, IIT Roorkee since 2012. He has obtained his Ph.D Degree (2009) from IIT, Kharagpur and then joined to Gyeongsang National University, South Korea for pursuing Post-Doc research. His fields of interests are surface modification of nano-materials and use of such materials in different electronic, mechanical and bio-medical applications. Currently, he is acting as reviewer of several internationally known journals and an active member of National Academy of Sciences, American Chemical Society (ACS) and Royal Society of Chemistry (RSC). Also, he is the recipient of Brain Korea (BK-21) fellowship award and DAAD fellowship award.

COURSE PLAN :

Week 1:

Introduction, Criteria for choosing the nanomaterials for energy harvesting and storage applications, Brief discussion about all types of energy harvesting and storage systems, Solar energy, Nanomaterials used for solar energy, Types of solar energy, Solar thermal and heat transfer fluids with example.

Week 2:

Hydrogen energy: Introduction, Nanomaterials used for hydrogen energy generation, Methods to produce hydrogen energy, Hydrogen production from fossil fuels and biomass, thermo-chemical process, electrolysis, solar and biological, Key Challenges for hydrogen energy generation.

Week 3:

Nanogenerators: Introduction, Types of Nanogenerators: Piezoelectric, Thermoelectric, Pyro-electric, Electromagnetic, and Triboelectric, Key challenges for choosing nanomaterials for nanogenerators, Other conventional energy generation techniques: Wind energy, Tidal, Thermal, hydro power generation, Nuclear and geothermal energy production.

Week 4:

Energy storage, Nanomaterials used for energy storage, key challenges for energy storage, Solution of key challenges, Type of energy storages: Electrochemical (Batteries), Supercapacitor, Hydrogen storage, Thermal energy storage.



SMART MATERIALS AND INTELLIGENT SYSTEM DESIGN

PROF. BISHAKH BHATTACHARYA

Department of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 4 weeks (21 Feb'22 - 18 Mar'22)

EXAM DATE : 24 Apr 2021

INTENDED AUDIENCE : People aiming to explore advance areas.

PRE-REQUISITES : Basics of Nature and Properties of Materials, Linear algebra

INDUSTRIES APPLICABLE TO : Aerospace, Automobile, Manufacturing industries

COURSE OUTLINE :

Smart Structures and Intelligent System are becoming an integral part of new aerospace and automobile systems due to high performance and fast response potential. Knowledge in this field is multi-disciplinary in nature involving materials, composites, basic electronics, control system and informatics. In this short course, I intend to convey the core flavor of the field by introducing the basic concepts behind such system along with some industrial applications developed in the SMSS laboratory of IIT Kanpur.

ABOUT INSTRUCTOR :

Prof. Bishakh Bhattacharya is currently Dr. Gurumukh D. Mehta and Veena M. Mehta Chair Professor at the Department of Mechanical Engineering and joint faculty at Cognitive Science and Technology, IIT Kanpur. His research interest primarily lies in vibration control, structural health monitoring, energy harvesting system, intelligent system design and Child-Reconfigurable Robot Interaction. He is the coordinator of Space Technology Cell, IIT Kanpur and head of the SMSS (Smart Materials, Structures and Systems) Laboratory.

<http://home.iitk.ac.in/~bishakh/>

COURSE PLAN :

Week 01 : Introduction to Smart Materials

Week 02 : Mechanics of Composite Materials

Week 03 : Induced Strain Actuation Mechanisms

Week 04 : Intelligent System Design

- Motivation for Computing
- Welcome to Programming!!
- Variables and Expressions : Design your own calculator
- Loops and Conditionals : Hopscotch once again
- Lists, Tuples and Conditionals : Lets go on a trip
- Abstraction Everywhere : Apps in your phone
- Counting Candies : Crowd to the rescue
- Birthday Paradox : Find your twin
- Google Translate : Speak in any Language
- Currency Converter : Count your foreign trip expenses
- Monte Hall : 3 doors and a twist
- Sorting : Arrange the books
- Searching : Find in seconds
- Substitution Cipher : What's the secret !!
- Sentiment Analysis : Analyse your Facebook data
- 20 questions game : I can read your mind

- Permutations : Jumbled Words
- Spot the similarities : Dobble game
- Count the words : Hundreds, Thousands or Millions.
- Rock, Paper and Scissor : Cheating not allowed !!
- Lie detector : No lies, only TRUTH
- Calculation of the Area : Don't measure.
- Six degrees of separation : Meet your favourites
- Image Processing : Fun with images
- Tic tac toe : Let's play
- Snakes and Ladders : Down the memory lane.
- Recursion : Tower of Hanoi
- Page Rank : How Google Works !!



WASTEWATER TREATMENT AND RECYCLING

PROF. MANOJ KUMAR TIWARI

Department of Civil Engineering
IIT Kharagpur

INTENDED AUDIENCE : The course will be beneficial for B.Tech/M.Tech/B.Sc/M.Sc/Research Scholars/Faculty members from different institutions. In addition, we will strongly encourage engineers/professionals working in any area related to waste management should consider taking advantage from this unique application orientated course. Regulators (SPCB, CPCB and MOEF professionals) and policy makers will also benefit from this course.

PRE-REQUISITES : Environmental Sciences, Introduction to Environmental Engineering

INDUSTRIES APPLICABLE TO : Larsen and Turbo, Tata Group of Industries, Ramky Group of Industries, IF&LS Environment

COURSE OUTLINE :

This course has emphasises on Integrated Solid Waste Management aspects within the broad subject area of Integrated Waste Management for a Smart City. The issues of Municipal Solid Waste (MSW) management, Construction and Demolition (C&D) Waste and Electronic Waste Management will be covered in this course. The topics will include: generation rates and waste composition; Integrated waste management issues, collection, recovery, reuse, recycling, energy-from-waste, and landfilling; Biological treatment of the organic waste fraction - direct land application, composting, and anaerobic digestion. The environmental impact of waste management and its relationship on the big picture sustainable development and smart city development will be discussed. A major focus of this course will be the role of MSW management within the various initiatives of the Govt. of India including: Swachh Bharat Mission, Smart Cities as well as Make in India. The challenges of waste management for smart cities will also be discussed taking case studies from the first list of 20 smart cities identified in the first phase for this program. This will be followed by overview of the Construction and Demolition (C&D) Waste and Electronic Waste (E-Waste) management issues in India in general and for the smart cities in particular. The new rules with respect of C&D Waste and E-Waste Management will be covered. The challenges of managing these waste streams effectively will be discussed.

ABOUT INSTRUCTOR :

Prof. Manoj Kumar Tiwari [Ph.D. (IIT Kanpur)] is a civil engg. graduate with specialization in environmental engg. and holds expertise in water and wastewater treatment, water distribution systems, water pricing, and contaminant fate and transport. He is a recipient of prestigious Fulbright Fellowship. Prof. Tiwari has co-authored several papers in apex international journals, and has presented his research in various top ranked conferences across the globe. Prof. Tiwari has over 8 years of teaching experience with both UG as well as PG level course. He has designed several new courses at IIT Kharagpur for Masters programme in Water Engineering and Management. He has delivered several invited lectures at various organizations, and has also conducted short-term course under Technical Education Quality Improvement Programme (TEQIP) with participants ranging from Faculties and Ph.D. students from NITs to field professionals working in government organizations as well as private companies.

COURSE PLAN :

Week 1 : Introduction: General outline; Introduction to wastewater; Various sources and types of wastewater; Need of wastewater management; Concept of wastewater treatment and recycling

Week 2 : Wastewater Generation and Characteristics: Wastewater generation and quantity estimation; Water quality parameters and standards (COD, BOD, DO, Solids, Nutrients, metals and emerging contaminants); Sources specific wastewater physical and chemical characteristics

Week 3 : Natural Attenuation of Pollutants in Wastewater: Concept of natural attenuation; Wastewater discharge in rivers; Attenuation of pollutants on land application.

Week 4 : Treatment Philosophy: Objectives of wastewater treatment; Concept of mass balance; kinetics and equilibrium processes; Reactors tanks; Continuously mixed tank

reactors; Plug-flow reactors Introduction to primary, secondary and tertiary treatment;

Week 5 : Preliminary and Primary Treatment Processes: Screening; Grit removal; Equalization tank; Sedimentation theory; Rectangular and circular sedimentation tanks

Week 6 : Secondary Treatment Processes: Biological treatment of wastewater; Microbial ecology and growth kinetics; Types of microorganisms; Aerobic and anaerobic processes; Suspended and attached growth systems; Activated sludge process; Tricking filters and Rotating biological contactors

Week 7 : Secondary Treatment Processes - Anaerobic: Anaerobic treatment; Anaerobic decomposition of organic matter; Fluidized bed systems; Upflow anaerobic sludge blanket systems; Biogas production and collection; other reactor configurations

Week 8 : Sludge Management: The quantity and characteristics of sewage sludge; Sludge dewatering, drying, and thickening; Sludge digestion; Aerobic and anaerobic sludge stabilization; Composting

Week 9 : Tertiary (Advanced) Treatment Processes: Need and Objectives of advanced treatment; Nutrient (N and P) removal; Chemical treatment processes; Advanced oxidation processes; Adsorption and Ion-exchange; Membrane processes

Week 10 : Current Treatment Approaches: Conventional systems; Integrated treatment systems; Advanced reactor configurations; SBR, MBR and MBBR; Application and case studies

Week 11 : Wastewater Recycling: Scope and demands; Types and stages of recycling; Recycling requirements; Designated reuse criteria; centralized vs decentralized recycling systems.

Week 12 : Technology Selection and Decision Making: Research trends in wastewater treatment and recycling; Choice modelling and decision making; Risks and challenges; Socio-economic perspectives; Case studies



WELDING METALLURGY

PROF. PRADEEP K. JHA

Department of Metallurgy and Material Science
IIT Roorkee

TYPE OF COURSE : Rerun | Core | PG/UG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 24 Apr 2022

PRE-REQUISITES : Introduction to courses such as Welding processes, Materials science etc.

INDUSTRIES APPLICABLE TO : Manufacturing Industries like SAIL, BHEL etc.

COURSE OUTLINE :

The course focuses on understanding the metallurgy and solidification of weldments. The course will make the students aware with the metallurgical aspects of welding. For getting a sound weld, the students are required to be aware of the science behind the welding phenomena, especially in the domain of weld metal solidification, heat transfer, heat treatment processes, strengthening mechanisms etc. The course will be useful for engineering graduates as well as professionals working in the area of welding.

ABOUT INSTRUCTOR :

Prof. Pradeep K. Jha is presently working as Associate Professor in the Department of Mechanical & Industrial Engineering at IIT Roorkee. He has been teaching the courses related to manufacturing technology and theory of production processes to undergraduate and postgraduate students for more than 12 years. He is actively involved in research work related to production processes, especially casting and welding processes.

COURSE PLAN :

Week 1: Introduction to welding metallurgy, phase diagrams

Week 2: Phase transformation, TTT and CCT diagrams

Week 3: Metal strengthening approaches

Week 4: Heat treatment processes for weldments

Week 5: Analysis of heat flow and temperature distribution in welding

Week 6: Concept of solidification in welding, constitutional supercooling

Week 7: Introduction to heat affected zones, Properties of HAZ

Week 8: Residual stresses in welding, Preheat and postweld heat treatment

Week 9: Types of welding distortion and its control

Week 10: Cracks in welds

Week 11: Weldability issues in materials

Week 12: Welding defects, Design considerations in welding



WELDING OF ADVANCED HIGH STRENGTH STEELS FOR AUTOMOTIVE APPLICATIONS

PROF. MURUGAIYAN AMIRTHALINGAM

Department of Metallurgical and Materials Engineering
IIT Madras

INTENDED AUDIENCE : Final year bachelors and masters students in Metallurgy, Mechanical, Automobile and Production Engineering. Industrial personnel working in automotive and steel making industries.

PRE-REQUISITES : Final year B.E/B.Tech students or Graduates of Metallurgical/Mechanical/Automobile/Production Engineering, Basic knowledge of steel physical metallurgy and welding processes.

INDUSTRIES APPLICABLE TO : All automotive manufacturers and their OEMs and Steel plants.

COURSE OUTLINE :

The use of advanced high strength steels (AHSS) is increasingly preferred in automotive applications due to improved crash energy management and enhanced strength-ductility combinations, resulting in greener and safer vehicles. The weldability of AHSS is generally poorer than conventional steels due to the high alloying contents required to obtain multi-phase microstructure. This course is aimed to discuss the (i) role of alloying elements in stabilizing multi-phase microstructures of AHSS, (ii) effect of weld thermal cycles on the evolution of microstructures and (iii) weldability of AHSS.

ABOUT INSTRUCTOR :

Prof. Murugaiyan Amirthalingam is currently working as an Assistant Professor in IIT-Madras. His research interests include welding metallurgy, welding processes development, steel product development and additive manufacturing

COURSE PLAN :

Week 01 : Introduction to physical metallurgy of advanced high strength steels

Week 02 : Introduction to welding processes in automotive industries (Advanced Gas Metal Arc, Resistance Spot and Laser Welding Processes).

Week 03 : Welding metallurgy of advanced high strength steels – Effect of weld thermal cycles on the stability of phases, solidification behaviour, segregation and hot cracking susceptibility.

Week 04 : Mechanical properties of advanced high strength steel weldments – Tensile shear testing, HAZ softening characteristics, role of modified weld thermal cycles (post pulsing and post weld heat treatments) to improve the mechanical properties.



ADVANCED CONCRETE TECHNOLOGY

PROF. MANU SANTHANAM

Department of Civil Engineering
IIT Madras

INTENDED AUDIENCE : Post-graduate students, and final year undergraduate students

PRE-REQUISITES : Basic course on Construction Materials in UG level. Additional course on Concrete Technology (UG level) is optional.

INDUSTRIES APPLICABLE TO : Civil contracting firms, Ready mixed concrete companies, Cement companies, Construction chemicals companies, Materials research laboratories etc

COURSE OUTLINE :

This course explores the materials science of concrete, and attempts to bring about the understanding of concrete behavior from a fundamental perspective. The first part of the course discusses the structure and properties of concrete making materials. This is followed by mixture proportioning of high performance concrete, and a study of selected topics regarding fresh and hardened concrete behavior. The final part of the course deals with long term performance issues, related to creep, shrinkage and durability of concrete.

ABOUT INSTRUCTOR :

Prof. Manu Santhanam is a Professor in the Department of Civil Engineering at IIT Madras, where he has worked since October 2001. His primary research interests are in Cement Chemistry, Durability of Concrete and Non-Destructive Evaluation. He has published more than 75 refereed journal papers, and has guided 10 PhD theses, in addition to being lead investigator on several sponsored projects.

COURSE PLAN :

Week 01 : Cement production and composition

Week 02 : Cement chemistry

Week 03 : Aggregates for concrete

Week 04 : Chemical admixtures

Week 05 : Chemical and Mineral admixtures

Week 06 : Mineral admixtures

Week 07 : High performance concrete mixture proportioning

Week 08 : Topics in fresh concrete

Week 09 : Topics in hardened concrete

Week 10 : Creep and shrinkage

Week 11 : Durability of concrete

Week 12 : Durability of concrete



APPLIED NATURAL LANGUAGE PROCESSING

PROF. RAMASESHAN R

Department of Computer Science and Engineering
Chennai Mathematical Institute

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (20 Jul'20 - 9 Oct'20)

EXAM DATE : 17 Oct 2020

PRE-REQUISITES : Essential – Algorithms, Python Proficiency, Elementary probability and statistics, Linear Algebra, basic understanding of machine learning

COURSE OUTLINE :

A major portion of communication now is through text and any organization has more than 90% of its content in the unstructured form. Natural Language Processing (NLP), an important part in Artificial Intelligence, is one of the important technologies that would help in activities such as classification, retrieving and extraction of information, identifying important documents, etc. Students will gather knowledge in the fundamentals of NLP, methods and techniques and gain skills to use them in practical situations.

ABOUT INSTRUCTOR :

Prof. Rameseshan R is currently working as a Visiting faculty at Chennai Mathematical Institute and teaches this course to the students there. He has more than 30 years of experience in Research and Development, Teaching, Product Development, Information Technology, Innovation and Convergence.

COURSE PLAN :

Week 1: Introduction to language processing – tokens, sentences, paragraphs

Week 2: Regular expressions - extraction of information using Regex

Week 3: Document Similarity measures - Cosine and cluster measures

Week 4: Spelling correction - Edit distance

Week 5: Information retrieval, extraction

Week 6: Document Classification, Clustering, topic modeling techniques

Week 7: Vector Space Model - word vectors, GloVe/Word2Vec model, word embedding

Week 8: Text Classification, Clustering, and Summarization

Week 9: Machine Learning, Perceptron

Week 10: Back Propagation, Recurrent Neural network relevant to NLP

Week 11: Machine Translation, Language Generation

Week 12: Applications – Sentiment Analysis, Spam Detection, Resume Mining, Alnstein



BASIC PRINCIPLES AND CALCULATIONS IN CHEMICAL ENGINEERING

PROF. SUBRATA KUMAR MAJUMDAR

Department of Chemical Engineering

IIT Guwahati

PRE-REQUISITES : 10+2 Examination in science

INTENDED AUDIENCE : Chemical, BioChemical, chemical science and Technology / Chemical Engineering Petroleum science and technology

INDUSTRIES APPLICABLE TO : Industrial Research and development section of chemical and Biochemical Engineering

COURSE OUTLINE :

The objective of the course is to introduce chemical engineering students to the basic principles and calculation techniques used in the chemical industries and to acquaint them with the fundamentals of the material and energy balances as applied to chemical engineering processes. The course is mainly intended for graduate chemical engineering student. It will expose them to solve the problems in material and energy balances that arise in relation to the problems involving in different chemical process units. It also will introduce them to numerical methods used to solve the problems. The course will introduce in simple language and ample of examples so that it will encourage learners to get used to the course.

ABOUT INSTRUCTOR :

Prof. Subrata Kumar Majumder is a Professor in the Chemical Engineering Department, IIT Guwahati, India. His research interests include multiphase flow and reactor development, hydrodynamics in multiphase flow, mineral processing, process intensifications and micro-nano bubble science and technology and its applications. He is a Fellow of the International Society for Research and Development, 8A Kapteinsvigein, London, UK. He is also a recipient of various honours and awards like: Editor, Journal of Chemical Engineering Research Studies, Guest editor, American Journal of Fluid Dynamics, published by Scientific & Academic Publishing Co., CA, 91731, USA, Editorial board member of Scientific Journal of Materials Science, IIME Award on beneficitation from Indian Institute of Mineral Engineers (IIME), Editorial board Member of the Journal of Science and Technology, Scientific and Academic Publishing, USA, Advisory board member of Excelling Tech Publishers (ETP), London, UK. He is a life member of Indian Institute of Chemical Engineers, Indian Institute of Mineral Engineers, member of Institute of Engineers (India), Member of Asia-Pacific Chemical, Biological & Environmental Engineering Society (PCBEE), senior member of International Association of Engineers (IAE), Japan. He authored four books, five book chapters, and has more than 80 publications in several reputed international journals. Presently he is working in the field of Microbubble science and technology and its applications in mineral beneficiation, food processing and arsenic, ammonia and dye removal and process intensifications by developing ejector-induced gas aided extraction process.

COURSE PLAN :

Week 1: Introduction

Contents:

Definition, history and role of chemical engineers: Definition of chemical engineering, role of chemical engineers in society

Basic features of chemical process: Classifications and modes of chemical processes; basic features of chemical process and unit operation

Unit systems and dimensions: Dimensional homogeneity and its analysis, Analysis of problem with solution

Week 2: Process Variables and Rate

Contents:

Variables and properties of material in systems: Physical and transport properties of materials and mixtures, Analysis of problem with solution

Pressure and temperature of flow process: Pressure and temperature and their measurements in flow process, problem solving

Rate of chemical processes: Flow rate and its measurements, Flow rate and its measurements, Rate of momentum transfer, Rate of heat transfer, Rate of mass transfer, Analysis of problem with solution Solving problems³

Week 3: Fundamentals of Material Balance

Contents:

Principles of material balance and its calculation: basis of engineering calculations, the general material balance equation, Balances on single and multiple unit processes without reaction, Solving problems

Material balances on non-reactive processes: Material balances on non-reactive processes with recycle and bypass, Solving problems

Material balances on reactive processes: Material balances on reactive processes, Solving problems

Material balances on combustion processes: Material balances based on combustion reactions, Solving problems

Week 4: Basic Principles of Compressible System

Contents:

State equation of ideal gas and calculation: Basic equations of state for ideal gas and their calculations;

State equation of non-ideal gas and calculation: Basic equations of state for non-ideal gas and their calculations

Week 5: Basic Principles of Multiphase System

Contents:

Phase equilibrium and Vapour Pressure: Phase equilibrium, Gibb's phase law, Clausius-Clapeyron Equation, Antoine's Equation, Cox Chart

Equilibrium laws: Raoul's Law, Henry's law, volatility, their calculations with examples

Saturation and Humidity: Principles of saturation, humidity, Psychrometric chart and its use, problem solving

Process of phase change: Condensation, vaporization, Examples

Week 6: Energy and Its Forms

Contents:

Principles of Energy: concepts and units, Different forms of energy and their calculations, The general energy balance equation

Laws and Properties of thermodynamics: Laws of thermodynamics, definitions of thermodynamic properties like Heat capacity, enthalpy, entropy; Calculation of enthalpy changes (without change of phase), enthalpy changes for phase transitions

Heat of formation, reaction and solution: Definition and calculations

Week 7: Energy Balances on Non-reactive Processes

Contents:

The mechanical energy balance: basic understanding with example

Enthalpy balances without reaction: basic understanding with example

Energy balances on non-reactive processes of multiple inlet and outlet streams: basic understanding with example

Enthalpy balances for heat of solution: Analysis with example

Week 8: Energy Balances on Reactive Systems

Contents:

Energy balance with standard heat of reaction: basic understanding with example

Energy balance with heat of reaction: basic understanding with example

Energy balances on heat of combustion: basic understanding with example

Week 9: Balances on Unsteady State Processes

Contents:

Material balances of unsteady state process: basic understanding with example

Unsteady state energy balance: basic understanding with example; Example of simultaneous material and energy balance

Week 10: Computational Techniques

Contents:

The methods of least squares: Linear equation fitting with experimental data with example

Non-linear algebraic equation system: basic understanding with example

Numerical Integration: basic understanding with example

Week 11: Computer-aided Balance Calculations

Contents:

Degree of freedom analysis: basic understanding with example

Process flow sheeting and codes: basic understanding

Week 12: Case Studies on Chemical Process

Contents:

Case study-I on chemical process: Analysis with example

Case study-II on chemical process: Analysis with example 3



BASICS IN INORGANIC CHEMISTRY

PROF. D. MAITI

Department of Chemistry

IIT Bombay

PRE-REQUISITES : Basic Chemistry courses, Basic Mathematics from school, 10+2 standard

INTENDED AUDIENCE : Undergraduate students belonging to Science and Engineering

COURSE OUTLINE :

This course will mainly deal with basics of Inorganic Chemistry. This includes periodic properties of the elements, source and extraction of metals. The study of transition metals comprises major portion of Inorganic Chemistry. Therefore, we will discuss some common properties like crystal field stabilization energy, magnetic properties, spectroscopic properties and uses of these properties in various fields including biological systems.

ABOUT INSTRUCTOR :

I am Prof. Debabrata Maiti, Associate Professor at IIT Bombay. I have completed PhD from Johns Hopkins University with Prof. Kenneth D. Karlin in bioinorganic chemistry. Then I moved to MIT where I did my Post-doctoral research with Prof. Steven Buchwald. I have started independent carrier at IIT Bombay in 2011 and since then involved actively in teaching bio-inorganic chemistry and organometallic chemistry. Our group is also active in research areas of bio-inorganic chemistry and C-H activation.

COURSE PLAN :

Week 1: Basics in Inorganic Chemistry

Week 2: Purification of elements; Coordination Chemistry; 18 electron rule; Valence bond theory; Crystal field theory

Week 3: Term symbols; Spectroscopy of complexes; Jahn-Teller distortion; Spinels; Magnetism

Week 4: Bio-inorganic Chemistry, Enzymes; Hemoglobin and Myoglobin; Toxicity; Medicinal inorganic compounds



BIG DATA COMPUTING

PROF. RAJIV MISRA

Department of Computer science and engineering
IIT Patna

PRE-REQUISITES : Data Structure & Algorithms, Computer Architecture, OperatingSystem, Database Management Systems

INDUSTRY SUPPORT : Companies like Amazon, Microsoft, Google, IBM, Facebook

COURSE OUTLINE :

In today's fast-paced digital world , the incredible amount of data being generated every minute has grown tremendously from sensors used to gather climate information, posts to social media sites, digital pictures and videos, purchase transaction records, and GPS signals from cell phone to name a few. This amount of large data with different velocities and varieties is termed as big data and its analytics enables professionals to convert extensive data through statistical and quantitative analysis into powerful insights that can drive efficient decisions. This course provides an in-depth understanding of terminologies and the core concepts behind big data problems, applications, systems and the techniques, that underlie today's big data computing technologies. It provides an introduction to some of the most common frameworks such as Apache Spark, Hadoop, MapReduce, Large scale data storage technologies such as in-memory key/value storage systems, NoSQL distributed databases, Apache Cassandra, HBase and Big Data Streaming Platforms such as Apache Spark Streaming, Apache Kafka Streams that has made big data analysis easier and more accessible. And while discussing the concepts and techniques, we will also look at various applications of Big Data Analytics using Machine Learning, Deep Learning, Graph Processing and many others. The course is suitable for all UG/ PG students and practicing engineers/ scientists from the diverse fields and interested in learning about the novel cutting edge techniques and applications of Big Data Computing.

ABOUT INSTRUCTOR :

Prof. Rajiv Misra is working in Department of Computer Science and Engineering at Indian Institute of Technology Patna, India. He obtained his Ph.D degree from IIT Kharagpur, M.Tech degree in Computer Science and Engineering from the Indian Institute of Technology (IIT) Bombay, and Bachelor's of engineering degree in Computer Science from MNIT Allahabad. His research interests spanned a design of distributed algorithms for Mobile, Adhoc and Sensor Networks, Cloud Computing and Wireless Networks. He has contributed significantly to these areas and published more than 70 papers in high quality journals and conferences, and 2 book chapters. His h-index is 10 with more than 590 citations. He has authored papers in IEEE Transactions on Mobile Computing, IEEE Transaction on Parallel and Distributed Systems, IEEE Systems Journal, Adhoc Networks, Computer Network, Journal of Parallel and Distributed Computing. He has edited a book titled as "Smart Techniques for a Smarter Planet: Towards Smarter Algorithms" for the "Studies in Fuzziness and Soft Computing" book series, Springer (2018). He has supervised four Phd students and currently four Phd students working under his supervision in the area of big data, cloud computing, distributed computing, and sensor networks. He is a senior member of the IEEE and fellow of IETE. He has completed as the Principal Investigator of R&D Project Sponsored by DeITY entitled as "Vehicular Sensor and Mesh Networks based Future ITS". He has mentored the online courses on Cloud Computing, Advanced Graph Theory and Distributed Systems in the platform of NPTEL

COURSE PLAN :

Week 1: Introduction to Big Data

Week 2: Introduction to Enabling Technologies for Big Data

Week 3: Introduction to Big Data Platforms

Week 4: Introduction to Big Data Storage Platforms for Large Scale Data Storage

Week 5: Introduction to Big Data Streaming Platforms for Fast Data

Week 6: Introduction to Big Data Applications (Machine Learning)

Week 7: Introduction of Big data Machine learning with Spark

Week 8: Introduction to Big Data Applications (Graph Processing)



CHARACTERIZATION OF CONSTRUCTION MATERIALS

PROF. MANU SANTHANAM

Department of Civil Engineering
IIT Madras

TYPE OF COURSE : New | Elective | PG
COURSE DURATION : 12 weeks (27 Jan' 20 - 17 Apr' 20)
EXAM DATE : 26 Apr 2020

PROF. PIYUSH CHAUNSALI

Department of Civil Engineering
IIT Madras

PRE-REQUISITES : Basic Civil Engineering degree

INTENDED AUDIENCE : Interested Learners

INDUSTRIES APPLICABLE TO : Cement companies, Concrete Producers, Construction chemical manufacturers, Construction companies

COURSE OUTLINE :

The objective of the course is to introduce students to the characterization of construction materials and their behaviour, with a view of developing their understanding of the mechanisms that govern the performance of these materials. The course will be focused primarily on cement and concrete, and include a few techniques; the physics of the techniques and their application to cement science. Lab demonstrations and experiments will be covered.

ABOUT INSTRUCTOR :

Dr. Manu Santhanam is a Professor at the Department of Civil Engineering at IIT Madras. His research interests are in multi-scale characterization of concrete, supplementary cementing materials, durability and non-destructive evaluation

Dr. Piyush Chaunsali is an Assistant Professor at the Department of Civil Engineering at IIT Madras. His research focuses on the use of principles of materials science, life-cycle assessment and structural engineering to design sustainable building materials

COURSE PLAN :

Week 1: Introduction to course; Structure of Construction Materials – An Overview

Week 2: Calorimetry

Week 3: X-ray diffraction

Week 4: X-ray diffraction, cont'd

Week 5: Thermal analysis

Week 6: Surface area measurement

Week 7: Optical microscopy

Week 8: Scanning electron microscopy

Week 9: Image analysis

Week 10: Spectroscopic techniques

Week 11: Mercury intrusion porosimetry

Week 12: Impedance analysis and ultrasonic methods



GOOGLE CLOUD COMPUTING FOUNDATIONS

Prof. Soumya Kanti Ghosh

Department of Computer Science and Engineering
IIT Guwahati

COURSE OUTLINE :

The Google Cloud Computing Foundations course aims to provide a detailed overview of concepts covering cloud basics, big data, and machine learning and where and how the Google Cloud Platform fits in. The course involves understanding concepts and perform hands-on training (via Qwiklabs platform) to practice the learning. There are 26 labs on Qwiklabs that are part of the course.

Those enrolling for the course should ideally:

- Have basic IT knowledge and be interested in learning more about Cloud and ML.
- Have competency in at least one language (such as Python, Java).
- Be familiar with the basics of shell scripting, SQL.

Disclaimer:

Google may contact you by email to provision benefits and send surveys and other communication related to the Google Cloud Computing Foundations Course.

By joining, you agree to Google Cloud Training tracking your grades and other activity in it's learning program.

ABOUT INSTRUCTOR :

Prof. Soumya K. Ghosh received the Ph.D. and M.Tech. degrees from Department of Computer Science and Engineering, Indian Institute of Technology (IIT), Kharagpur, India. Presently, he is a Professor with Department of Computer Science and Engineering, IIT Kharagpur. Before joining IIT Kharagpur, he worked for the Indian Space Research Organization in the area of satellite remote sensing and geographic information systems. He has more than 200 research papers in reputed journals and conference proceedings. His research interests include spatial data science, spatial web services and cloud computing.

COURSE PLAN :

Week 0: Introduction to the course

Week 1: So, What's the Cloud anyway? Start with a Solid Platform

Week 2: Use GCP to build your Apps

Week 3: Where do I store this stuff?

Week 4: There's an API for that! You can't secure the Cloud right?

Week 5: It helps to network!

Week 6: It helps to network (continued)

Week 7: Let Google keep an eye on things. You have the data, but what are you doing with it?

Week 8: Let machines do the work



CLOUD COMPUTING AND DISTRIBUTED SYSTEMS

PROF. RAJIV MISRA

Department of Computer Science and Engineering
IIT Patna

PRE-REQUISITES : Minimum: Data Structures and Algorithms; Ideal: Computer Architecture, Basic OS and Networking concepts

INDUSTRIES SUPPORT : Companies like Amazon, Microsoft, Google, IBM, Facebook and start-ups working on this field.

COURSE OUTLINE :

Cloud computing is the on-demand delivery of computations, storage, applications, and other IT resources through a cloud services platform over the internet with pay-as-you-go business model. Today's Cloud computing systems are built using fundamental principles and models of distributed systems. This course provides an in-depth understanding of distributed computing "concepts", distributed algorithms, and the techniques, that underlie today's cloud computing technologies. The cloud computing and distributed systems concepts and models covered in course includes: virtualization, cloud storage: key-value/NoSQL stores, cloud networking, fault-tolerance cloud using PAXOS, peer-to-peer systems, classical distributed algorithms such as leader election, time, ordering in distributed systems, distributed mutual exclusion, distributed algorithms for failures and recovery approaches, emerging areas of big data and many more. And while discussing the concepts and techniques, we will also look at aspects of industry systems such as Apache Spark, Google's Chubby, Apache Zookeeper, HBase, MapReduce, Apache Cassandra, Google's B4, Microsoft's Swan and many others. Upon completing this course, students will have intimate knowledge about the internals of cloud computing and how the distributed systems concepts work inside clouds.

ABOUT INSTRUCTOR :

Prof. Rajiv Misra is an Associate Professor in Department of Computer Science and Engineering at Indian Institute of Technology Patna, India. He obtained his Ph.D degree from IIT Kharagpur, M.Tech degree in Computer Science and Engineering from the Indian Institute of Technology (IIT) Bombay, and Bachelors of engineering degree in Computer Science from MNIT Allahabad. His research interests spanned a design of distributed algorithms for Mobile, Adhoc and Sensor Networks, Cloud Computing and Wireless Networks. He has contributed significantly to these areas and published more than 70 papers in high quality journals and conferences, and 2 book chapters. His h-index is 10 with more than 590 citations. He has authored papers in IEEE Transactions on Mobile Computing, IEEE Transaction on Parallel and Distributed Systems, Adhoc Networks, Journal of Parallel and Distributed Computing.

COURSE PLAN :

Week 1: Introduction to Clouds, Virtualization and Virtual Machine

1. Introduction to Cloud Computing: Why Clouds, What is a Cloud, Whats new in todays Clouds, Cloud computing vs. Distributed computing, Utility computing, Features of today's Clouds: Massive scale, AAS Classification: HaaS, IaaS, PaaS, SaaS, Data-intensive Computing, New Cloud Paradigms, Categories of Clouds: Private clouds, Public clouds

2. Virtualization: What's virtualization, Benefits of Virtualization, Virtualization Models: Bare metal, Hosted hypervisor

3. Types of Virtualization: Processor virtualization, Memory virtualization, Full virtualization, Para virtualization, Device virtualization

4. Hotspot Mitigation for Virtual Machine Migration: Enterprise Data Centers, Data Center Workloads, Provisioning methods, Sandipiper Architecture, Resource provisioning, Black-box approach, Gray-box approach, Live VM Migration Stages, Hotspot Mitigation

Week 2: Network Virtualization and Geo-distributed Clouds

1. Server Virtualization: Methods of virtualization: Using Docker, Using Linux containers, Approaches for Networking of VMs: Hardware approach: Single-root I/O virtualization (SR-IOV), Software approach: Open vSwitch, Mininet and its applications
2. Software Defined Network: Key ideas of SDN, Evolution of SDN, SDN challenges, Multi-tenant Data Centers: The challenges, Network virtualization, Case Study: VL2, NVP
3. Geo-distributed Cloud Data Centers: Inter-Data Center Networking, Data center interconnection techniques: MPLS, Google's B4 and Microsoft's Swan

Week 3: Leader Election in Cloud, Distributed Systems and Industry Systems

1. Leader Election in Rings (Classical Distributed Algorithms): LeLann-Chang-Roberts (LCR) algorithm, The Hirschberg and Sinclair (HS) algorithm
2. Leader Election (Ring LE & Bully LE Algorithm): Leader Election Problem, Ring based leader election, Bully based leader election, Leader Election in Industry Systems: Google's Chubby and Apache Zookeeper
3. Design of Zookeeper: Race condition, Deadlock, Coordination, Zookeeper design goals, Data model, Zookeeper architecture, Sessions, States, Usecases, Operations, Access Control List (ACL), Zookeeper applications: Katta, Yahoo! Message Broker

Week 4: Classical Distributed Algorithms and the Industry Systems

1. Time and Clock Synchronization in Cloud Data Centers: Synchronization in the cloud, Key challenges, Clock Skew, Clock Drift, External and Internal clock synchronization, Christians algorithm, Error bounds, Network time protocol (NTP), Berkeley's algorithm, Datacenter time protocol (DTP), Logical (or Lamport) ordering, Lamport timestamps, Vector timestamps
2. Global State and Snapshot Recording Algorithms: Global state, Issues in Recording a Global State, Model of Communication, Snapshot algorithm: Chandy-Lamport Algorithm
3. Distributed Mutual Exclusion: Mutual Exclusion in Cloud, Central algorithm, Ring-based Mutual Exclusion, Lamport's algorithm, Ricart-Agrawala's algorithm, Quorum-based Mutual Exclusion, Maekawa's algorithm, Problem of Deadlocks, Handling Deadlocks, Industry Mutual Exclusion : Chubby

Week 5: Consensus, Paxos and Recovery in Clouds

1. Consensus in Cloud Computing and Paxos: Issues in consensus, Consensus in synchronous and asynchronous system, Paxos Algorithm
2. Byzantine Agreement: Agreement, Faults, Tolerance, Measuring Reliability and Performance, SLIs, SLOs, SLAs, TLAs, Byzantine failure, Byzantine Generals Problem, Lamport-Shostak-Pease Algorithm, Fischer-Lynch-Paterson (FLP) Impossibility
3. Failures & Recovery Approaches in Distributed Systems: Local checkpoint, Consistent states, Interaction with outside world, Messages, Domino effect, Problem of Livelock, Rollback recovery schemes, Checkpointing and Recovery Algorithms: Koo-Toueg Coordinated Checkpointing Algorithm

Week 6: Cloud Storage: Key-value stores/NoSQL

1. Design of Key-Value Stores: Key-value Abstraction, Key-value/NoSQL Data Model, Design of Apache Cassandra, Data Placement Strategies, Snitches, Writes, Bloom Filter, Compaction, Deletes, Read, Membership, CAP Theorem, Eventual Consistency, Consistency levels in Cassandra, Consistency Solutions
2. Design of HBase: What is HBase, HBase Architecture, Components, Data model, Storage Hierarchy, Cross-Datacenter Replication, Auto Sharding and Distribution, Bloom Filter, Fold, Store, and Shift

Week 7: P2P Systems and their use in Industry Systems

1. Peer to Peer Systems in Cloud Computing: Napster, Gnutella, FastTrack, BitTorrent, DHT, Chord, Pastry and Kelips.

Week 8: Cloud Applications: MapReduce, Spark and Apache Kafka

1. MapReduce: Paradigm, Programming Model, Applications, Scheduling, Fault-Tolerance, Implementation Overview, Examples
2. Introduction to Spark: Resilient Distributed Datasets (RDDs), RDD Operations, Spark applications: Page Rank Algorithm, GraphX, GraphX API, GraphX working
3. Introduction to Kafka: What is Kafka, Use cases for Kafka, Data model, Architecture, Types of messaging systems, Importance of brokers



COMPILER DESIGN

PROF. RUPESH NASRE

Department of Computer Science and Engineering
IIT Madras

TYPE OF COURSE : Core | UG

PRE-REQUISITES : Programming and Data Structures, C programming language, along with tools such as lex-yacc/bison

COURSE OUTLINE : The objectives are to teach students a understanding of some of the standard passes in a general purpose compiler and to provide hands-on experience in implementing a compiler for a subset of a high-level language such as C.

ABOUT INSTRUCTOR : Rupesh is an associate professor in the CSE Department at IIT Madras. He completed PhD from IISc Bangalore and Post-Doctoral Fellowship from the University of Texas at Austin. His research focus is in Compilers and Parallelization. He is a recipient of the Young Faculty Recognition Award at IIT Madras, Cray HPC Award, NVIDIA Special Prize for CodeForScience, a winner of the Yahoo! University Hack Day, and holds five US patents. He is the head of the National Supercomputing Mission's Nodal Centre at IITM for Training in HPC and AI.

COURSE PLAN :

Week 1: **Introduction** | **Concepts covered** - Programming languages and compilers, Language Translators

Keywords - Phases of a compiler, Static vs Dynamic contexts, Parameter passing

Week 2: **Lexical Analysis** | **Concepts covered** - Regular Expressions, flex tool, Finite Automata

Keywords - Terminology, Regex, flex tool, Lexical errors, Input buffering, Lookahead, KMP string matching, Regex to DFA conversion

Week 3: **Lexical Analysis, Parsing** | **Concepts covered** - Parse tree, Ambiguity

Keywords - CFG, Parse tree, Precedence, Ambiguity, Sentential forms, Error recovery, if-else ambiguity, Left recursion, Recursive descent parsing

Week 4: **Parsing** | **Concepts covered** - Predictive Parsing, LL(1) Grammars

Keywords - First and Follow, Predictive parsing table, Predictive parsing table, LL(1) grammars, Discussions and doubts clarification

Week 5: **Parsing** | **Concepts covered** - Bottom-up Parsing, Shift-Reduce Parsing

Keywords - SLR parsing, LR(0) automaton, SLR parsing using automaton

Week 6: **Parsing** | **Concepts covered** - SLR(1) Parsing

Keywords - SLR(1) parsing table, SLR(1) parsing algorithm

Week 7: **Parsing** | **Concepts covered** - LR(1) Parsing, LALR Parsing

Keywords - Viable prefixes, LR(1) automaton

Week 8: **Syntax Directed Translation** | **Concepts covered** - SDT, SDD

Keywords - Attributes, S- and L-attributed SDD, Applications, Actions within productions

Week 9: **Intermediate Code Generation** | **Concepts covered** - Syntax Trees and DAGs

Keywords - Code generation for while loop

Week 10: **Intermediate Code Generation** | **Concepts covered** - IR, Three Address Code

Keywords - Discussions and Doubt Clarifications, Static Single Assignment

Week 11: **Intermediate Code Generation** | **Concepts covered** - IR for various language constructs

Keywords - Type expressions, array expressions, boolean expressions, break, continue, switch

Week 12: **Code Generation** | **Concepts covered** - IR and Target Code

Keywords - Instruction Selection, Ordering, Basic Blocks, CFG, x86 Assembly Code

Week 13: **Code Optimization** | **Concepts covered** - Local, Peephole Optimizations, Data Flow Analysis

Keywords - Array References, Register Allocation, Liveness Analysis, Reaching Definitions



COMPUTER INTEGRATED MANUFACTURING

PROF. JANAKARAJAN RAMKUMAR

Department of Mechanical Engineering
IIT Kanpur

PROF. AMANDEEP SINGH

Department of Mechanical Engineering
IIT Kanpur

PRE-REQUISITES : The student should have completed two semesters of UG Engineering or Science program.

INTENDED AUDIENCE : Students of all Engineering and Science disciplines.

INDUSTRIES APPLICABLE TO : HAL, NAL, SAIL, ISRO

COURSE OUTLINE :

Use of computers in manufacturing in order to design and develop the products has found unprecedented applications. Computer integrated way of manufacturing provides a myriad of benefits such as speed, flexibility, and better control. In this course, Computer Integrated Manufacturing (CIM) approaches are discussed. CAD/CAM tools and their within and between the production systems are presented along with appropriate case studies. Data storage and handling is also the need of contemporary manufacturing systems. This is also catered using software tools. The course is reinforced with the laboratory demonstrations to add a practitioners' touch. Students would develop a process to largely plan, design and develop a product and a production system after completing this course

ABOUT INSTRUCTOR :

Prof. Janakarajan Ramkumar is Professor of Mechanical Engineering Department, and Design Program, at Indian Institute of Technology, Kanpur. He teaches manufacturing science, micro/nano technology, new product development. He has a bachelor's in Production Engineering with his doctorate in Defect quantification in drilling of composites from IIT Madras, India with a best thesis award. Over the years his contribution in teaching and research is remarkable. He has worked for BOSCH group and improved the productivity of the company. His research and teaching focus is on nano technology and inclusive design. He has several international and national patents in his credit and has published more than 100 journal papers

Prof. Amandeep Singh is working as Research Scientist in the Mechanical Engineering Department, and Design Program, Indian Institute of Technology, Kanpur, India. He holds PhD degree from Indian Institute of Technology Kanpur, India, and a bachelor's degree in Production Engineering. Dr. Singh has ten years of industrial and academic experience. His research interests are Sustainable Manufacturing Processes and Systems, Simulation of Manufacturing Systems, Product Design and Manufacturing, Applied Ergonomics and Engineering Metrology. He has traveled in countries like US, Canada, and Australia to present his research in various international conferences organized by reputed bodies like CIRP and IEOM. His research is also published in various international reputed journals.

COURSE PLAN :

Week 1: Introduction to Computer Integrated Manufacturing (CIM)

Week 2: Computer Aided Design

Week 3: Computer Aided Manufacturing

Week 4: Computer Numerical Control

Week 5: Computer Aided Process Planning (CAPP)

Week 6: CIM interfaces: CAD vs CAM

Week 7: Data and information in CIM

Week 8: Manufacturing Systems and their design

Week 9: Simulation of Manufacturing Systems

Week 10: Computer Aided Maintenance

Week 11: Computer Integrated Additive Manufacturing

Week 12: Advanced CIM techniques



CONSTRUCTION METHODS AND EQUIPMENT MANAGEMENT

PROF. INDU SIVA RANJANI GANDHI

Department of Civil Engineering
IIT Guwahati

INTENDED AUDIENCE : Post graduate students of Construction Technology and Management

Specialization, Undergraduate students of Civil Engineering , People working in Construction Industry

INDUSTRIES APPLICABLE TO : Larsen and Toubro, Caterpillar, Liebherr, Hyundai Construction Equipment India and other Construction Equipment Companies.

PREREQUISITES : Engineering would be minimum qualification to understand the basics related to this course.

COURSE OUTLINE :

The key element for successful execution of any project is planning, which also includes planning of equipment. Due to recent advancement in mechanization, different models of machines are available in the market for a particular job. Hence the task of selection of right machine for the right job is quite challenging for project planner. Therefore, understanding of machine capabilities is very important for optimal selection and utilization of equipment. This course provides comprehensive information on guidelines for selection of equipment, estimation of cost and productivity of various equipment and determination of optimum replacement time of equipment. Knowledge on estimation of cost of equipment is very important, as accurate information on equipment cost is needed for preparation of bids. Further, a deep insight into excavation, pile driving methods, cranes and concreting equipment is provided, the information on which is very much essential for people working in construction industry

ABOUT INSTRUCTOR :

Prof. G. Indu Siva Ranjani holds a PhD degree in Civil Engineering (Building Technology and Construction Management) from Indian Institute of Technology Madras, India. She is recipient of Gold medal and Shree Gayathri Devi Award for securing highest CGPA in the Ph.D. Civil Engineering programme in July 2011 at IIT Madras. Presently she is working as Assistant Professor at Indian Institute of technology Guwahati, India. She has handled courses at IIT Guwahati related to both Construction Management and Construction materials. Some of the management related courses handled by her, to be mentioned are Construction methods and Equipment management, Quality and Safety management and Construction Technology and Management. Similarly, in materials domain, she has handled courses on Construction materials and Advanced Concrete Technology. Her major research interests are Lightweight concrete, sustainable construction materials and energy efficient structures. She has also proposed new materials for the production of foamed concrete. Her work has been published in peer reviewed journals and cited more than 500 times in leading scientific journals throughout the world. She has so far guided 21 MTechs, & 2 Ph.D. projects.

COURSE PLAN :

Week 1: Module 1: Introduction to course and Planning Process of Equipment

Lecture 1: Planning process of equipment

– Factors affecting equipment selection, Planning equipment utilization, Equipment utilization chart.

Module 2: Cost of Owning and Operating Construction Equipment

Lecture 2: Estimation of Ownership cost (Average Annual Investment method)

– Elements of ownership cost, Depreciation accounting methods, Cost Estimation using Average Annual Investment method.

Week 2: Module 2: Cost of Owning and Operating Construction Equipment

Lecture 3: Estimation of Ownership cost (Time value method)

– Use of compounding factors in Equipment cost estimation based on time value method.

Lecture 4: Operating cost of Equipment

– Operating cost components, Illustrations on estimation of operating cost.

Lecture 5: Equipment cost estimation

– Caterpillar & Peurifoy method – Illustrations on use of Caterpillar method and Peurifoy method for estimation of total equipment cost.

Week 3: Module 3: Equipment Life and Replacement Analysis

Lecture 6: Equipment Life and Replacement Analysis (Part 1)

- Physical life, Profit life, Economic life, Illustrations on determination of economic life of equipment.

Lecture 7: Equipment Life and Replacement Analysis (Part 2)

- Equipment Replacement analysis- Intuitive method, Minimum cost method, Maximum profit method.

Lecture 8: Equipment Life and Replacement Analysis (Part 3)

- Determination of economic life based on equivalent annual cost (using time value concept).

Week 4: Module 4: Engineering Fundamentals of Moving Earth

Lecture 9: Engineering Fundamentals of Moving Earth

- Machine Performance-Required power, Available power, Usable power, Rolling resistance, tractive force, co-efficient of traction, Effect of grade on tractive effort, Effect of altitude on performance of IC engines, Performance chart, ways to define payload of equipment.

Module 5: Earthmoving and Excavating equipment

Lecture 10: Bull Dozers

- Bull Dozers-Types of dozer blades, blade adjustments, Blade performance, production estimation.

Lecture 11: Scrapers (Part 1)

- Scrapers, Scraper operation, types of scraper, Components of production cycle of scraper and pusher.

Lecture 12: Scrapers (Part 2)

- Illustrations on production estimation of scraper and balancing interdependent machines.

Week 5: Module 5: Earthmoving and Excavating equipment

Lecture 13: Front End loaders

- Front-End loaders –loader attachments, productivity estimation.

Lecture 14: Excavators

- Excavators-Front shovels and backhoes, operation, factors affecting selection, production estimation.

Lecture 15: Trucks

- Production cycle, cycle time estimation, Productivity of trucks, balancing interdependent machines.

Week 6: Module 6: Piles and Pile driving equipment

Lecture 16: Piles and Pile driving equipment (Part 1)

- Pile types: Precast and cast in situ piles, pile hammers, principle of pile hammer, factors affecting pile hammer selection.

Lecture 17: Piles and Pile driving equipment (Part 2)

- Types of pile hammer: Drop hammer, Single acting and double acting steam hammers, Diesel hammers, Vibratory pile drivers.

Week 7: Module 7: Lifting equipment

Lecture 18: Cranes (Part 1)

- Cranes, Crane motions, Principles of lifting mechanism of crane, types of cranes-lattice boom crawler crane, lattice boom truck mounted cranes, telescopic boom crane.

Lecture 19: Cranes (Part 2)

- Types of cranes-Tower cranes, Factors affecting lifting capacity of crane, Range diagram.

Week 8: Module 8: Concreting equipment

Lecture 20: Concreting equipment (Part 1)

- Steps in concrete making process, types of concrete mixer machines.

Lecture 21: Concreting equipment (Part 2) & Conclusion

- Methods of handling and transporting concrete, Consolidation of concrete, Methods of finishing and curing of concrete.



DAIRY AND FOOD PROCESS AND PRODUCTS TECHNOLOGY

PROF. TRIDIB KUMAR GOSWAMI

Department of Agricultural and Food Engineering
IIT Kharagpur

INTENDED AUDIENCE : Agricultural Engineering, Food Technology, Food Engineering, Chemical Engineering, Biotechnological Engineering, Thermal Engineering, Biotechnology

INDUSTRIES APPLICABLE TO : Any Processing Industry such as Britannia, ITC, Hindustan Lever, Mother Dairy, Amul, etc.

COURSE OUTLINE :

This course will cover basics of dairy (liquid food) food processing and preservation technologies required in any dairy and food processing industries. The basic knowledge on dairy food processing is intermingled with most of the unit operations at some or other stage of processing. Since, this basic aspect of food processing and preservations not taught in most of the Agricultural engineering institutions elaborately, a comprehension of these aspects of processing and preservation will enrich the knowledge base of the students in general.

ABOUT INSTRUCTOR :

Prof. Tridib Kumar Goswami, a NAAS, ISAE, IE, AABS Fellow, did his B.Sc. in Chemistry (Hons) from University of Calcutta, B.Tech. in Food Technology and Biochemical Engineering from Jadavpur University, Ph.D. from IIT Kharagpur. After serving Kwality Ice Cream, Bombay for 1 years, he joined IIT Kharagpur in 1989 and is still continuing as a Professor. He has earned 5 Indian Patents, published 104 papers in peer reviewed reputed journals, 55 conference proceedings. He has written 4 books and 14 book chapters published by International publishers. He has travelled around the world for presenting papers and was specially invited by Jeonbuk National University, Korea with full sponsorship in 2009. He has guided 14 Ph.D., out of which 3 theses have been awarded the prestigious Jawaharlal Nehru Award offered by ICAR. One of his papers was awarded the prestigious N.N. Mohan Memorial Award for 2009 conferred by AIFPA, New Delhi for Best Paper of the year. He has also received several National and International awards. He has completed several sponsored research & consultancy projects as PI and co-PI. He is the first faculty from Agricultural Engineering discipline in India to contribute to the National program on technology enhanced learning.

COURSE PLAN :

Week 1 : Basic principles and methods of food processing and preservation. Emerging Technologies in food processing. Food additives and preservatives.

Week 2 : Food laws and standards. Effect of processing on acceptability and nutritive value of food.

Week 3 : Physico-chemical properties and structure of milk and milk constituents.

Week 4 : Chemical and microbial spoilage of milk and milk products; Fluid milk Processing, packaging and distribution.

Week 5 : Common dairy processes – cream separation (standardization), pasteurization, sterilization and Homogenization.

Week 6 : Process technology for manufacture of evaporated milk, condensed milk, dried milk, malted milk, infant and baby foods, ice-cream, cheese, butter, fermented milk and indigenous dairy products.

Week 7 : Methods and procedures for sampling and testing of milk and milk products. Laws and standards for milk and milk products.

Week 8 : Technological processes for industrially manufactured foods of commercial importance, from plant and animal origin.

Week 9 : Cereals, vegetables, fruits, meats, poultry and egg products; Bakery, pasta and confectionary products, ready to eat foods, fermented foods, alcoholic and non-alcoholic Beverages, tea, coffee and cocoa, fabricated foods.

Week 10 : Packaging materials; Characteristics, properties and their design. Packaging requirement for Different processed and unprocessed foods.

Week 11 : Working Principles of various type of fillers : form-fill- seal machine.

Week 12 : Gas packaging and modified atmosphere Package design. Shelf life prediction of foods in packages. Quality control in Food packaging. Product safety and packaging regulations.



DATA ANALYTICS WITH PYTHON

PROF. A RAMESH

Department of Management Studies
IIT Roorkee

INTENDED AUDIENCE : Management, Industrial Engineering and Computer Science Engineering Students

INDUSTRIES APPLICABLE TO : Any analytics company

COURSE OUTLINE :

We are looking forward to sharing many exciting stories and examples of analytics with all of you using python programming language. This course includes examples of analytics in a wide variety of industries, and we hope that students will learn how you can use analytics in their career and life. One of the most important aspects of this course is that you, the student, are getting hands-on experience creating analytics models; we, the course team, urge you to participate in the discussion forums and to use all the tools available to you while you are in the course!

ABOUT INSTRUCTOR :

Prof. Ramesh Anbanandam graduated in Production Engineering from Madras University, Chennai. He did his post-graduation from National Institute of Technology, Trichy. He later earned his Ph.D. in Supply Chain Management from Indian Institute of Technology Delhi. His professional interest includes Humanitarian Supply Chain Management, Operations Management, Operations Research, Healthcare Waste Management, Sustainable Multi-model and Freight Transportation, Transportation Asset Management and Advanced Data Analytics using Python and R-programming. He has published various research articles in reputed journals. He was also awarded Emerald Literati Award for Excellence under "Highly Commended Research Paper in the Year 2011 and 2016" in the field of Supply Chain Management.

COURSE PLAN :

Week 1: Introduction to data analytics and Python fundamentals

Week 2: Introduction to probability

Week 3: Sampling and sampling distributions

Week 4: Hypothesis testing

Week 5: Two sample testing and introduction to ANOVA

Week 6: Two way ANOVA and linear regression

Week 7: Linear regression and multiple regression

Week 8: Concepts of MLE and Logistic regression

Week 9: ROC and Regression Analysis Model Building

Week 10: χ^2 Test and introduction to cluster analysis

Week 11: Clustering analysis

Week 12: Classification and Regression Trees (CART)

Week 1: Course Overview. Introduction to RDBMS

Week 2: Structured Query Language (SQL)

Week 3: Relational Algebra. Entity-Relationship Model

Week 4: Relational Database Design

Week 5: Application Development. Case Studies. Storage and File Structure

Week 6: Indexing and Hashing. Query Processing

Week 7: Query Optimization. Transactions (Serializability and Recoverability)

Week 8: Concurrency Control. Recovery Systems. Course Summarization.

- Week 1: 1D array, list and vector, 2D matrices and tables of objects
- Week 2: Java implementation of 1D and 2D arrays and its operations
- Week 3: Linked lists and its various operations, stack and queue
- Week 4: Java implementation of linked lists, stack and queue
- Week 5: Binary trees: Representation and operations. Variations of binary tree: Binary search tree, Height balanced search tree, Heap tree
- Week 6: Java implementation of binary trees and its variations
- Week 7: Graph : Structure, representation and operations
- Week 8: Java implementations of graph data structures
- Week 9: Algorithms (Part-I): Searching and sorting algorithms
- Week 10: Java implementation of Part-I algorithms
- Week 11: Algorithms (Part-II): Greedy algorithms, shortest path algorithms
- Week 12: Java implementation of Part-II algorithms



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Demystifying networking

By Prof. Sridhar Iyer | IIT Bombay

Learners enrolled: 5342



This course will provide students with an overview of networking concepts and technologies. It is meant as a primer for non-majors, i.e., for students who don't have networking as a core course in their curriculum. After this primer, students may choose to take other networking courses for delving deeper into specific technologies.

INTENDED AUDIENCE: Computer networking

PREREQUISITES: Nil

INDUSTRY SUPPORT: Networking, Security, Troubleshooting

About Swayam (<https://swayam.gov.in/about>)

Summary

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Course Status : Completed

Course Type : Elective

Duration : 4 weeks

Category :

- o Computer Science and Engineering

Credit Points : 1

Level : Undergraduate

Start Date : 29 Jul 2019

End Date : 23 Aug 2019

Exam Date : 29 Sep 2019 IST

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

This is an AICTE approved FDP course

(/ #facebook) (/ #x)

(/ #microsoft_teams) (/ #linkedin)



(/#whatsapp)

(<https://swayam.gov.in/>)



(https://www.addtoany.com/share?url=https%3A%2F%2Fonlinecourses.nptel.ac.in%2Fnoc19_cs75%2Fpreview&title=Demystifying%20networking%20-%20Course)

(https://swayam.gov.in/nc_details/NPTEL)

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Course layout

Week 1: Layers of Computer Networks and Network Addressing

Week 2: Routing

Week 3: Transport and Application Layers

Week 4: Introduction to Security and Troubleshooting

Books and references

There are many textbooks on computer networking. Students may refer to any of them for the topics in this course.



(<https://swayam.gov.in/>)



(https://swayam.gov.in/nc_details/NPTEL)

Prof. Sridhar Iyer is a faculty member in the Inter-Disciplinary Program in Educational Technology, and Department of Computer Science and Engineering at IIT Bombay. His current research interests include: Technology enhanced learning environments for thinking skills, Pedagogies for effective use of educational technologies, and Computer science education research. Sridhar Iyer received his BTech, MTech and PhD from the Dept of Computer Science & Engg. at IIT Bombay

Course certificate

CERTIFICATION EXAM :

- The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centers.
- The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).
- **Date and Time of Exams: 29th September 2019** Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.

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url: Announcements will be made when the registration form is

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The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form



is published. If there are any changes, it will be mentioned then.

Please check the form for more details on the cities where the exams will be

(https://swayam.gov.in/noc_details/NPTEL)

Here, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE

- Average assignment score = 25% of average of best 3 assignments out of the total 4 assignments given in the course.
- Exam score = 75% of the proctored certification exam score out of 100
- Final score = Average assignment score + Exam score

YOU WILL BE ELIGIBLE FOR A CERTIFICATE ONLY IF AVERAGE ASSIGNMENT SCORE $\geq 10/25$ AND EXAM SCORE $\geq 30/75$.

- If one of the 2 criteria is not met, you will not get the certificate even if the Final score $\geq 40/100$.
- Certificate will have your name, photograph and the score in the final exam with the breakup. It will have the logos of NPTEL and IIT Bombay. It will be e-verifiable at nptel.ac.in/noc (<http://nptel.ac.in/noc>).
- Only the e-certificate will be made available. Hard copies are being discontinued from July 2019 semester and will not be dispatched.



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Initiative by : Ministry of Education (Govt of India)



DESIGN THINKING - A PRIMER

PROF. ASHWIN MAHALINGAM

Department of Civil Engineering
IIT Madras

PROF. BALA RAMADURAI

Department of Management Studies
IIT Madras

INTENDED AUDIENCE : General

INDUSTRIES APPLICABLE TO : Many industries and institute recognize the need for design thinking - e.g., ICT, manufacturing, sales, marketing

COURSE OUTLINE :

Design thinking is a systematic method of solving problems. This method is unique that it starts and ends with humans. The design thinkers start by observing, interviewing or just plain experiencing a situation. Then, they proceed to improve the situation of the humans by solving problems for them.

ABOUT INSTRUCTOR :

Prof. Ashwin Mahalingam joined the faculty in the Building Technology and Construction Management division of the Civil engineering department at IIT-Madras in 2006. Ashwin received his B.Tech in Civil engineering from IIT-Madras and then proceeded to Stanford University for a Masters in Construction Engineering and Management. He then helped start up an internet based company in the USA called All Star Fleet, aimed at providing asset management services for construction companies. Following this he returned to Stanford University to pursue a PhD in the area of Infrastructure Project Management. Ashwin's research interests are in the areas of Public Private Partnerships (PPP) in Infrastructure, the management and governance of large engineering projects and the use of digital technologies in construction. Ashwin's current research focuses on institutional strengthening and post-award governance of PPP projects in India. Ashwin is also a co-founder of Okapi Advisory Services Pvt. Ltd and serves as a Director on the Board.

Prof. Bala Ramadurai is an independent innovation consultant and professor. He has 3 patents to his credit and 10+ publications in international research journals. He co-founded TRIZ Innovation India (<http://trizindia.org>) and is an Adjunct Professor at Symbiosis Institute of Business Management, India. He has a PhD from Arizona State University, USA, and a B.Tech from IIT Madras, India.

COURSE PLAN :

Week 1 : Introduction to Design Thinking

Week 2 : Empathize Phase: Customer Journey Mapping

Week 3 : Analyze Phase: 5-Whys and How might we...

Week 4 : Solve Phase: Ideation: Free Brainstorming & Make/Test Phase: Prototype



DIGITAL CIRCUITS

PROF. SANTANU CHATTOPADHYAY

Department of Electronics and Electrical Communication Engineering,
IIT Kharagpur.

INTENDED AUDIENCE : All Engineering Student/Faculty

PRE-REQUISITES : Basic Electronics

INDUSTRIES APPLICABLE TO : Companies involved in development digital products

COURSE OUTLINE :

Digital circuits are part of any electronic design today. This also happens to be one of the core subjects for the undergraduate students in Electronics, Electrical and Computer Engineering. It forms the basis of many of the next level courses. The proposed course on digital circuits will cover all the fundamental concepts in digital design. It will primarily focus on the prescribed GATE syllabus for Electronics and Communication Engineering (ECE) specialization. The course will start with the representations of numbers – different number systems and conversion between them, representation of integer and real numbers etc. This will be followed by combinational and sequential circuit design techniques. Data converters and semiconductor memories will be covered. Microprocessor 8085 will be discussed as a complete digital system example. Designed primarily as a single course covering the digital circuits portion of GATE syllabus, the course will also be helpful for any other aspirant willing to learn digital electronics principles comprehensively in today's perspective.

ABOUT INSTRUCTOR :

Prof. Santanu Chattopadhyay received his BE degree in Computer Science and Technology from Calcutta University (B.E. College) in 1990. He received M.Tech in Computer and Information Technology and PhD in Computer Science and Engineering from Indian Institute of Technology Kharagpur in 1992 and 1996, respectively. He is currently a Professor in the Department of Electronics and Electrical Communication Engineering, IIT Kharagpur. Prior to this, he had been a faculty member in the IEST Sibpur and IIT Guwahati in the departments of Computer Science and Engineering. In both these places he has taught the subject of Compiler Design several times. His research interests include Digital Design, Embedded Systems, System-on-Chip (SoC) and Network-on-Chip (NoC) Design and Test, Power- and Thermal-aware Testing of VLSI Circuits and Systems. He has published more than 150 papers in reputed international journals and conferences. He has published several text and reference books on Compiler Design, Embedded Systems and other related areas. He is a senior member of the IEEE and an Associate Editor of IET Circuits Devices and Systems journal.

COURSE PLAN :

Week 01 : Introduction, Number System

Week 02 : Boolean Algebra

Week 03 : Combinational function minimization – K Map, Boolean identities

Week 04 : Logic Gates

Week 05 : Arithmetic circuits, Code converters

Week 06 : Multiplexers, Decoders, PLA

Week 07 : Sequential Circuits – Latches and Flip-flops

Week 08 : Counters, Shift Registers, Finite State Machines

Week 09 : Data Converters – Sample and hold circuits, ADCs, DACs

Week 10 : Semiconductor Memories – ROM, SRAM, DRAM

Week 11: Microprocessor 8085 – Part I

Week 12 : Microprocessor 8085 – Part II



ELECTROCHEMICAL TECHNOLOGY IN POLLUTION CONTROL

PROF. J. R. MUDAKAVI

Department of Chemical Engineering
IISc Bangalore

PRE-REQUISITES : 10 +2 + 3 years of BE / BSc Basic knowledge of differential calculus and integration

INTENDED AUDIENCE : Chemists and Chemical Engineers, Environmental Engineers, Environmental Scientists, Civil Engineers, Pollution Control Administrators, B.Sc, M.Sc and PhD students.

INDUSTRIES APPLICABLE TO : Chemical industries, Pollution Control

COURSE OUTLINE :

Electroanalytical techniques have assumed great importance in pollution monitoring of chemical species in the last 20 years. Electrochemical sensors including ion selective electrodes are employed to detect the pollution levels in all public spaces. They also find extensive applications in medical diagnosis, industrial process monitoring, communication industry etc. Fuel cells and battery technology are the energy sources of the future. Industrial wastes generated from electrochemical processes are one of the most hazardous wastes which need to be effectively managed. The course aims to introduce the fundamental principles of electrochemistry for routine and non-routine analysis, electrochemical processes used in the industry, battery and fuel cell technologies and recent advances in hazardous electrochemical waste management including concepts of zero liquid discharge.

ABOUT INSTRUCTOR :

Prof. J.R Mudakavi is a former faculty of Chemical Engineering Department in Indian Institute of Science, Bangalore. He has taught "Modern Instrumental Methods of analysis and Pollution Control" for 36 years. He is the author of 2 books on Air Pollution and Hazardous Waste management. He has published more than 100 papers in National and International Journals, conferences, Symposia etc. He is a member of several expert committees such as CSIR, DST, MOEF, KSPCB etc., He is a popular science writer and lecturer and environmentalist.

COURSE PLAN :

Week 1: Atomic and Molecular structure

Week 2: Properties of solutions

Week 3: Electrochemical methods-1

Week 4: Electrochemical methods-2

Week 5: Electrochemical methods-3

Week 6: Ion selective electrodes and Electrochemical sensors

Week 7: Process waste handling and Electroplating

Week 8: Batteries and fuel cells and ZLD



ELECTRONIC WASTE MANAGEMENT – ISSUES AND CHALLENGES

PROF. BRAJESH KUMAR DUBEY

Department of Civil Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | PG

COURSE DURATION : 4 weeks (24 Jan' 22-18 Feb' 22)

EXAM DATE : 27 March 2022

PRE-REQUISITES : Environmental Sciences, Introduction to Environmental Engineering

INTENDED AUDIENCE : Disciplines of Engineering, Science, Humanities and Management

INDUSTRIES APPLICABLE TO : E Parisaraa, Ecoreco Recycling, Earth Sense, Attero Recycling, EWRI, WEEE Recycle, J. S. Pigments Limited. In addition ULBs across the country will be interested in this course, so as professionals from SPCB and CPCB.

COURSE OUTLINE :

This course will discuss the overall scenario of E-Waste management in India in comparison with other countries around the globe. At first, the present scenario of E-Waste management in India will be discussed along the role of various stakeholders. Then, the effects of recycling and management of Electronic Waste on human health, environment and society will also be presented. This will be followed by the risk assessment owing to pollutants released from E-Waste recycling in soil, air and water. The possible option of extraction of Rare-Earth Minerals will also be discussed in this course. The E-Waste management Rules of India and around the World will be compared. Finally a Life-Cycle Analysis approach will be employed for a possible sustainable solution of E-Waste Management for cutting the ill-effects of informal recycling.

ABOUT INSTRUCTOR :

Prof. Brajesh Kr. Dubey has his Bachelors Degree in Civil Engineering (Hons) from Indian Institute of Technology (IIT) Kharagpur, India and PhD in Environmental Engineering Sciences, University of Florida, Gainesville, Florida, USA. He is presently Associate Professor (Integrated Waste Management and Sustainable Engineering) in the Division of Environmental Engineering and Management at Indian Institute of Technology (IIT), Kharagpur, India. Dr. Dubey has more than 17 years of research, teaching, training and industrial outreach experience in the areas of Integrated Solid and Hazardous Waste Management, and Sustainable Engineering and Application of Life Cycle Assessment techniques. He also works in the area of Life Cycle Analysis and Sustainable Engineering. He has been teaching courses in the area of Solid Waste Management, Hazardous Waste Management. Dr. Dubey has authored/co-authored more than 200 publications in his area of expertise and have presented at several national and international conferences. He has worked as Waste Management Expert for UN agencies and World Bank.

COURSE PLAN :

Week 1: Overview of the course

Week 2: Exposure pathway of pollutants emitted from Recycling of E-Waste

Week 3: E-Waste Management Rules of India (2011 and 2016 Rules)

Week 4: E-waste Management: Case Studies and Unique Initiatives from around the World



EMOTIONAL INTELLIGENCE

PROF. RABINDRA KUMAR PRADHAN

Department of Humanities and Social Sciences
IIT Kharagpur

INTENDED AUDIENCE : Engineering, Management, Social Sciences and Law students

INDUSTRIES APPLICABLE TO : Human resource management division, training & development division of both manufacturing and service industries, MBA and HRM students

COURSE OUTLINE :

“Intelligence quotient (IQ) gets you hired but emotional quotient (EQ) gets you promoted”. This popular quote by Times magazine during late nineties has made the concept of emotional intelligence more popular among people by highlighting its multiple implications and applications. The uses and utility of emotional intelligence at home, school and workplace have benefited thousands in many disciplines. This course is designed to sensitize the participants about the concept, theory and applications of emotional intelligence. The participants will get to know the added advantage of EQ the software of the brain over the hardware (IQ). This programme will also explore how our hearts rule over our heads for creative creation. It will also focus on how various principles of emotional intelligence guide us in different contexts of life. The awareness about the credo of emotional intelligence will develop insights into self-regulation and realization of one’s optimum potentials for better performance. The participants will come to know about many unknowns of life, which will further help them to enhance their awareness to be effective on their roles. The course will offer useful lessons with the help of practical exercises, games, audio-visual instruments, case studies, classroom interaction to show the road map how to foster emotional intelligence in organisation for achieving health, happiness and optimal performance at work.

ABOUT INSTRUCTOR :

Prof. Rabindra Kumar Pradhan is currently working as associate professor in the department of humanities and social sciences, Indian Institute of Technology Kharagpur. He is currently working in diverse areas of behavioral sciences and human resource management. He is actively involved in teaching, training & research in the fields of positive psychology, industrial and organizational psychology, human resource development and management, and organizational behavior. He has 18 years of experience in teaching, research and training. He has published 02 books on emotional intelligence, 01 book on human resource management and 01 book on human development through training. He has also published more than 70 journal articles and 22 book chapters. His research papers/ articles have been published in international journal Emerald Insights, Inderscience Publishers, Sage, Springer, Taylor & Francis, etc. Recently, Dr. Pradhan has been awarded with the “best trainer award-2012” by ISTD, Hyderabad and “best teacher award-2013” by ISTD, Kolkata for outstanding contribution in training & HRD. Some of his research papers have been awarded as “best paper” in ICOM-2015, Abu Dhabi and IBRC-2015, India.

COURSE PLAN :

Week 1: Introduction to emotion, intelligence & wisdom

Week 2: Concept, theory, measurement and applications of intelligence

Week 3: Emotional intelligence: concept, theory and measurements

Week 4: Correlates of emotional intelligence

Week 5: Emotional intelligence, culture, schooling and happiness

Week 6: For enhancing emotional intelligence EQ mapping

Week 7: Managing stress, suicide prevention, through emotional intelligence, spirituality and meditation

Week 8: Application of emotional intelligence at family, school and workplace



ENHANCING SOFT SKILLS AND PERSONALITY

PROF.T. RAVICHANDRAN

Department of Humanities and Social Sciences
IIT Kanpur

INTENDED AUDIENCE : Students, Teachers, Professionals, Trainers, Leaders, Employers

INDUSTRIES APPLICABLE TO : All industry/companies/organisations will recognize and value this course and recommend this for their employees and trainee programs.

COURSE OUTLINE :

The course aims to cause an enhanced awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality. Hard or technical skills help securing a basic position in one's life and career. But only soft skills can ensure a person retain it, climb further, reach a pinnacle, achieve excellence, and derive fulfilment and supreme joy. Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills. The focus of this course is on interpersonal and management skills. It has been approved for "Faculty Development Programme" by AICTE.

ABOUT INSTRUCTOR :

Prof. T. Ravichandran is presently a Professor of English in the Department of Humanities and Social Sciences at the Indian Institute of Technology Kanpur, Uttar Pradesh, India. He has written about fifty research articles/book chapters, supervised six doctoral theses, edited a special issue on Cyberpunk Literature for the Creative Forum Journal, and published a book on Postmodern Identity. He is a recipient of the Fulbright-Nehru Academic and Professional Excellence Fellowship (2014-15) for his research/teaching at Duke University, North Carolina, USA. He is honored with Champa Devi Gangwal Chair Professorship at IIT Kanpur. In his distinguished twenty-five years of teaching career, he has taught various courses in English Language and Literature. His NPTEL Video and Web courses on Communication Skills are well-acclaimed nationally and internationally. His NPTEL MOOC on Developing Soft Skills and Personality became hugely popular and well-received by about fifteen thousand participants from India and abroad.

COURSE PLAN :

Week 1 : Highlights of Developing Soft Skills and Personality Course-1-24 ; Highlights of Developing Soft Skills and Personality Course-25-48 ; Definitions and Types of Mindset ; Learning Mindsets ; Secrets of Developing Growth Mindsets

Week 2 : Importance of Time and Understanding Perceptions of Time ; Using Time Efficiently ; Understanding Procrastination ; Overcoming Procrastination ; Don't Say "Yes" to Make Others Happy!

Week 3 : Types of People ; How to Say "No" ; Controlling Anger ; Gaining Power from Positive Thinking-1 ; Gaining Power from Positive Thinking-2

Week 4 : What Makes Others Dislike You? ; What Makes Others Like You?-1 ; What Makes Others Like You?-2 ; Being Attractive-1 ; Being Attractive-2

Week 5 : Common Errors-1 ; Common Errors-2 ; Common Errors-3 ; Common Errors-4 ; Common Errors-5

Week 6 : Humour in Communication ; Humour in the Workplace ; Function of Humour in the Workplace ; Money and Personality ; Managing Money

Week 7 : Health and Personality ; Managing Health-1: Importance of Exercise ; Managing Health-2: Diet and Sleep ; Love and Personality ; Managing Love

Week 8 : Ethics and Etiquette ; Business Etiquette ; Managing Mind and Memory ; Improving Memory ; Care for Environment ; Highlights of the Course



ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY

PROF. ANJALI PAL

Department of Civil Engineering
IIT Kharagpur

PROF. SUDHA GOEL

Department of Civil Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 24 Apr' 2022

PRE-REQUISITES : Basic chemistry - Class XII

INTENDED AUDIENCE : Masters degree students of any of the Civil Engineering, Chemical Engineering Environmental Engineering, Mining Engineering, Geology and Geophysics, and Bioengineering/Biotechnology

INDUSTRIES APPLICABLE TO : Environmental consulting firms, Coal India, Thermal power plants

COURSE OUTLINE :

The objective of the course is to provide students with basic concepts from environmental chemistry and microbiology for understanding and solving environmental problems. Major topics that will be covered in environmental chemistry are: review of basic concepts in chemistry, concept of chemical equilibria, equilibrium constants and activity, reaction kinetics, acid and basis, polyprotic acids and bases, acidity, alkalinity, carbonate system, pH-Ct, buffers, and solubility reactions, nuclear chemistry, nitrogen chemistry and chlorination. Major topics that will be covered in environmental microbiology are: Introduction, the bacteria, the fungi, the algae, protozoa and other higher forms, viruses, pathogens and disease, microbial growth and enumeration, control of microorganisms, microbial diversity and metabolic pathways for remediating contaminated water, solid and hazardous waste, and soil.

ABOUT INSTRUCTOR :

Prof. Anjali Pal did her M.Sc & PhD from Calcutta University in Chemistry and at present teaching as a full professor in the Department of Civil Engineering, Indian Institute of Technology, Kharagpur. Prof. Pal is actively engaged in teaching and research in the field of Environmental Engineering and Science. She has published more than 215 research papers and received International Hall of Fame award (USA), R & D 100 award (USA) for her contribution in the field of pollution monitoring. Her Convention Award from the Indian Chemical Society is for her independent contribution to organic chemistry. Her research interest includes adsorbilization, adsorption, advanced oxidation processes (AOPs), catalysis and spectroscopy. She has developed a number of new methods for trace detection / determination of pollutants. She has visited many countries like USA, UK, Japan, France, Taiwan etc. as a visiting professor.

Prof. Sudha Goel did her B.E. (1990) in Environmental Engineering from L.D. College of Engineering, Gujarat University, Ahmedabad and M.S.E. (1992) and Ph.D. (1997) in Environmental Engineering from The Johns Hopkins University (JHU), Baltimore, US. She is currently Associate Professor, Department of Civil Engineering and School of Environmental Science and Engineering, IIT Kharagpur. She has been teaching Environmental Microbiology and some aspects of Environmental chemistry regularly since 2004. Her research interests include Water quality and treatment, and Solid and Hazardous Waste Management. She developed a web-based course 'Water and Wastewater Engineering' and wrote a textbook of the same name. She has several publications, taught several courses, and guided students at all levels in their research work.

COURSE PLAN :

Week 1: Concepts of acids, bases and salts, strengths of acids and bases, buffers, acid-base indicators, choice of indicators

Week 2: Concept of chemical equilibrium, solubility and solubility product, activity, Le Chatelier principle

Week 3: Reaction kinetics, rate and order of a reaction, determination of order

Week 4: Reaction mechanism, rate determining step, catalysts, activation energy

Week 5: Radioactivity and nuclear chemistry

Week 6: Nitrogen chemistry and chlorination

Week 7: Introduction and overview of environmental applications; major groups of microbes: bacteria, fungi, algae, protozoa and virus.

Week 8: Cell chemistry, biology and microscopy

Week 9: Microbial Metabolism

Week 10: Microbial Growth and Control

Week 11: Pathogens and diseases, metabolic diversity-1

Week 12: Metabolic Diversity-2 and Biogeochemical Cycles

Experimental Stress Analysis - Video course

COURSE OUTLINE

The course covers the basic aspects of experimental stress analysis that includes exhaustive treatment of the most versatile techniques like photoelasticity and strain gauges and also a brief introduction to the emerging techniques like digital image correlation. In addition it also provides the fundamental aspects of six different experimental techniques such as Moiré, Brittle Coatings, Holography, Speckle Methods, Thermoelastic Stress Analysis and Caustics.

COURSE ORGANISATION

Modules	Titles	Lectures	Hours
1	Overview of Experimental Stress Analysis	1-10	10
2	Transmission Photoelasticity	11-23	13
3	Introduction to Three Dimensional Photoelasticity and Digital Photoelasticity	24-25	2
4	Photoelastic Coatings and Brittle Coatings	26-30	5
5	Strain Gauges	31-40	10
6	Discussion Section	41	1

COURSE DETAIL

Lecture	Concepts Covered
1. Overview of Experimental Stress Analysis	Overview of experimental stress analysis, Stress analysis – Analytical, Numerical and Experimental approaches, Specific domain of these approaches, Advantages and disadvantages.



NP-TEL

NPTEL

<http://nptel.iitm.ac.in>

Mechanical Engineering

Pre-requisites:

- Strength of Materials.

Additional Reading:

Articles from the journals:

- Experimental Techniques
- Experimental Mechanics
- Strain
- Journal of Strain Analysis for Engineering Design and Optics and Lasers in Engineering etc.

Coordinators:

Prof. K. Ramesh
Department of Applied Mechanics IIT Madras

2. Optical Methods Work as Optical Computers	Optical methods work as optical computers, Direct information provided by various experimental methods – brief description, Visual appreciation of field information – Listing of various problems of different complexity.
3. Stress, Strain and Displacement Fields	Stress, Strain and Displacement fields for various problems, Beam under pure bending, Analytical solution, Fringe contours from various experimental methods, Disc under diametral compression – Analytical solution, Fringe contours from various experimental techniques, Clamped circular plate under a central load – Analytical solution, Fringe contours from various experimental techniques.
4. Physical Principle of Strain Gauges, Photoelasticity and Moiré	Spanner tightening a nut – completeness of a numerical solution, comparison with photoelastic fringes. Physical principle behind various experimental techniques, Strain Gauges, Photoelasticity, Grids for determining plastic strains, Geometric moiré, grating details – u and v displacements, Demonstration of fringes due to translation and rotation of gratings of various types
5. Introduction to Moiré, Brittle Coatings and Holography	Brief introduction to Moiré, Brittle coatings and Holography. Difference between normal photography and holography, Visualising the depth information, Formation of speckles due to illumination by a laser, Rainbow hologram.
6. Hologram Interferometry, Speckle Methods	Hologram interferometry, Steps in a double exposure hologram interferometry, Speckle methods, Objective speckles, Subjective speckles
7. Introduction to Shearography, TSA, DIC and Caustics	Brief introduction to Speckle interferometry, Shearography, Thermoelastic Stress Analysis (TSA), Digital Image Correlation (DIC) and Caustics. Caustics in a tea cup, dimple formation, Class demonstration of Caustic experiment.
8. Fringe Patterns – Richness of Qualitative Information	Coherent gradient sensor, Naming of experimental methods, Fringe patterns – Richness of qualitative information, Information provided by fringe thickness, density. Optical methods for quality inspection, Comparison of various designs – Streamline fillet, Key technologies that have influenced Experimental Mechanics.
9. Multi-Scale Analysis in Experimental Mechanics	Multi-scale analysis in experimental mechanics, Trends in experimental mechanics, Discussion on selection of an experimental technique,

10. Selection of an Experimental Technique	Discussion on selection of an experimental technique contd., References. Review of solid mechanics, definition of free surface, ambiguity in associating the correct value of principal stress direction to the magnitude of the principal stress, Eigen value approach or use of Mohr's circle, Shear distribution in a three point bend specimen
11. Introduction to Transmission Photoelasticity	Physical principle, Historical development, Various branches of photoelasticity, Birefringence, Nature of light, Polarisation, Methods to get polarized light, Understanding polarization, Class experiment on showing crossed polarizers, Passage of light through isotropic media.
12. Ordinary and Extraordinary Rays	Snell's laws, Passage of light through crystalline media, Demonstration of birefringence effect of Calcite prism, Influence on the role of optical axis of the crystal, Light ellipse.
13. Light Ellipse, Passage of Light Through a Crystal Plate	Light ellipse (contd.) Retardation plates and wave plates, Historical development on polarization optics, Dichroism, Sheet polarisers
14. Retardation Plates, Stress-optic Law	Sheet polarisers contd., Retardation plates and wave plates, Quarter wave, Half wave and Full wave plates, Stress-optic law, Maximum stress information obtainable by photoelasticity.
15. Plane Polariscopes	Plane polariscopes, Logical explanation of formation of fringes, Understanding isochromatics, isoclinics. Intensity of light transmitted in a plane polariscopes by trigonometric resolution.
16. Jones Calculus	Jones calculus, Rotation matrix, Retardation matrix, Representation of a retarder, Elements of the polariscopes, Analysis of plane polariscopes by Jones calculus, Circular polariscopes, Dark and bright fields.
17. Circular Polariscopes	Circular polariscopes (contd.), Intensity of light transmitted by Jones calculus, Various optical arrangements possible, Demonstration of a commercial polariscopes, Use of white light, Colour code, Tint of passage, Storage of photoelastic materials, Time-edge effect, Summary of photoelastic fringes.
18. Determination of Photoelastic Parameters at an Arbitrary Point	Review of colour code, Determination of photoelastic parameters at an arbitrary point, Compensation techniques, Babinet-Soleil compensator in

	detail, Steps in Tardy's Method of compensation.
19. Tardy's Method of Compensation	Tardy's method of compensation, Brief exposure to digital photoelasticity, Need for calibration of photoelastic materials, advantage of circular disk, Calibration of photoelastic model materials, Stress field in a circular disc under diametral compression.
20. Calibration of Photo elastic Materials	Conventional approach to calibration, Linear least squares analysis, Sampled least squares, Introduction to the use of Image processing techniques, Image sampling and quantization
21. Fringe Thinning Methodologies	Fringe thinning methodologies, Thresholding to find fringe areas, Binary based and intensity based algorithms, Chen & Taylor algorithm for one scanning direction, Fringe skeletonisation, Global fringe thinning algorithm, Experimental evaluation, Theoretical reconstruction of fringe pattern, Opening remarks on comments on fringe ordering.
22. Fringe Ordering in Photoelasticity	Importance of accurate evaluation of material stress fringe value, Global fringe thinning – summary, Comments on fringe ordering (contd.), Features of isochromatic and isoclinic fringe field, Positive and negative isotropic points, Role of principles of solid mechanics in fringe ordering, Identification of zeroth fringe order.
23. Miscellaneous Topics in Transmission Photoelasticity	Resolving the ambiguity on the principal stress direction, Determination of the sign of the boundary stress, Compatibility conditions, Role of elastic constants on stress field, Model to prototype relations, Properties of photoelastic model materials.
24. Three Dimensional Photoelasticity	Three dimensional photoelasticity, Stress freezing, Slicing, Application to a complex problem, Integrated photoelasticity, Principle of optical equivalence.
25. Overview of Digital Photoelasticity	Introduction to digital photoelasticity, Use of colour information for quantitative analysis, Three Fringe Photoelasticity (TFP), Refined TFP (RTFP) to solve slow time variant problems. Paradigm shift in data processing, Processing of intensity data for photoelastic data extraction, Overview of digital photoelasticity, Ten-step method, Understanding phasemaps.
26. Introduction to Photoelastic Coatings	Photoelastic coatings, Historical development, Optical arrangements, Photoelastic strain gauges, Strain-optic relation for coating, Evaluation of coating and specimen stresses.

27. Correction Factors for Photoelastic Coatings	Correction factors for photoelastic coatings, Correction factor for bending, Combined in-plane and bending loads, Correction factor for torsion, Correction factor for pressure vessel.
28. Coating Materials, Selection of Coating Thickness, Industrial Application of Photoelastic Coatings	Correction factors – Summary, Handling mismatch of Poisson's ratio, Coating materials, Properties of photoelastic coating materials, Selection of the coating thickness, Maximum fringe order obtainable, Use of photoelastic coatings to solve a range of problems of practical interest.
29. Calibration of Photoelastic Coatings, Introduction to Brittle Coatings	Demonstration of photoelastic coating test, Calibration of photoelastic coatings, Compact displacement controlled loading jig. Historical development of brittle coatings, Methodology of brittle coatings, Crack patterns produced by direct loading, Uniaxial, Biaxial and Isotropic stress fields, Steps in brittle coating tests, Coating selection, Surface preparation.
30. Analysis of Brittle Coatings	Undercoating, Application of the coating, Drying. Coating stresses, Uniaxial specimen stress, Nature of coating stress, Calibration of brittle coatings, Influence of Poisson's ratio mismatch, Crack patterns by refrigeration, Crack patterns by relaxation, Stresscoat.
31. Introduction to Strain Gauges	Analysis of Isoentatic data, Strain Gauges: Physical principle, Historical development, Development of SR-4 gauges, Strain sensitivity of a conductor, Gauge construction, Gauge length, Gauge length error in measurement, Thumb rule in selection of gauge length, Commonly used strain gauge materials.
32. Strain Sensitivity of a Strain Gauge, Bridge Sensitivity, Rosettes	Strain sensitivity of a strain gauge, Transverse sensitivity factor, Gauge factor, Experimental determination of gauge factor, Wheatstone bridge, Strain measurement options, Bridge sensitivity, Bridge factor, Accuracy achievable in Foil strain gauges, Linearity, Hysteresis and Zero shift, Determination of strain at a point, Three element rectangular rosette.
33. Strain Gauge Alloys, Carriers and Adhesives	Delta rosette, Metallic alloys commonly employed, Advance, Isoelastic alloy, Karma alloy, Thermally induced apparent strain, Nichrome-D, Strain gauge carriers, Types, Cements for bonding a strain gauge: Cynoacrylate, Epoxy cements and Polyester cements.
34. Performance of Strain Gauge System	Ceramic cements, High temperature strain gauge, Flame spraying Rokide process, Strain gauge linearity, Hysteresis, Drift, Stability, Heat dissipation,

	Allowable power density, Selection of bridge voltage, Sensitivity of gauge to temperature, Strain sensitivity of a conductor as a function of temperature.
35. Temperature Compensation, Two-wire and Three-wire Circuits	Temperature compensation, Temperature compensated gauges, Measurement techniques: Two-wire circuit, Gauge factor desensitization, Role of change in temperature, Three-wire circuit, Benefits of three-wire circuits.
36. Strain Gauge Selection	Selection compromises, Strain gauge designation systems, Various gauge patterns for different applications, Guidelines for strain gauge selection.
37. Bonding of a Strain Gauge	Temperature effects guiding the selection of certain parameters, Importance of following a bonding procedure, Surface preparation: Strain gauge installation kit, Solvent degreasing, Surface abrading, Layout lines, Surface conditioning, Neutralizing. Strain gauge bonding: Strain gauge handling, Strain gauge alignment, Catalyst application, Bonding with adhesive.
38. Soldering, Accounting for Transverse Sensitivity Effects	Masking, Tinning, Soldering, Application of protective coating, Testing the installation, Transverse sensitivity, Actual and apparent strains, Corrections for transverse strain effects for the case of known ratio of the transverse strain to the axial strain.
39. Correction Factors for Special Applications	Corrections for transverse strain effects for a general case, T-rosette, Rectangular rosette. Effect of hydrostatic pressure, Effect of nuclear radiation, Effect of high temperature, Effect of cryogenic temperature, Effect of strain cycling, Environmental effects.
40. Special Gauges	Environmental effects contd., Torque gauge, Stress gauge, Single element strain gauge as stress gauge, Evaluation of SIF by strain gauges, Strip gauge, Single element strain gauge to evaluate SIF. Summary of the course.
41. Questions & Answers	A few questions from the whole course were discussed.

References:

1. K. Ramesh, e-Book on Experimental Stress Analysis, IIT Madras, 2009. URL: http://apm.iitm.ac.in/smlab/kramesh/book_5.htm
2. K. Ramesh, Digital Photoelasticity – Advanced Techniques and Applications, Springer, 2000.
3. W.N. Sharpe (Ed.), Springer Handbook of Experimental Solid Mechanics,

Springer, 2008.

4. J.W. Dally and W.F. Riley, Experimental Stress Analysis, McGraw-Hill, 1991.
5. L.S. Srinath, M.R. Raghavan, K. Lingaiah, G. Gargesa, B. Pant, and K. Ramachandra, Experimental Stress Analysis, Tata Mc Graw Hill, 1984.



FOUNDATIONS OF COMPUTATIONAL MATERIALS MODELLING

PROF. NARASIMHAN SWAMINATHAN

Department of Mechanical Engineering
IIT Madras

TYPE OF COURSE : Rerun | Elective | PG

COURSE DURATION : 12 weeks (26 Jul' 21 - 15 Oct' 21)

EXAM DATE : 24 Oct 2021

PRE-REQUISITES : Basic Materials Science Course at the undergraduate level, MATLAB programming, familiarity with LINUX is preferred.

INTENDED AUDIENCE : All Engineering students

INDUSTRIES APPLICABLE TO :None. This course will be useful for students pursuing research requiring molecular simulations of solids.

COURSE OUTLINE :

This course provides the necessary foundations to (a) build computational samples of crystals (b) Introduce statistical mechanics and its connection to Molecular dynamics (c) Provide enough ground in Molecular dynamics using LAMMPS

ABOUT INSTRUCTOR :

The instructor Dr. Narasimhan Swaminathan is an Associate Professor in the Dept. of Mechanical Engineering at IIT Madras. Prior to this, he was a Post Doctoral Research Associate in the Materials Science and Engineering Department at University of Wisconsin, USA. Dr. Narasimhan obtained his Ph.d. from the Georgia Institute of Technology in 2009. His current research areas include molecular simulations to study radiation damage, polymer mechanics, etc. He also studies stress-diffusion interaction in Li-ion battery electrodes using continuum mechanics.

COURSE PLAN :

Week 1: Introduction to Computational Modeling

Week 2: Introduction to Crystals

Week 3: Symmetry in Crystals

Week 4: Plane Groups

Week 5: Space Groups

Week 6: Construction of 2D and 3D crystals in MATLAB

Week 7: Statistical Mechanics

Week 8: Statistical Mechanics, cont'd

Week 9: Introduction to Molecular Dynamics

Week 10: Molecular dynamics using LAMMPS – 1

Week 11: Molecular dynamics using LAMMPS -2

Week 12: Molecular dynamics using LAMMPS -3 and Closure



FUNDAMENTALS OF SEMICONDUCTOR DEVICES

PROF. DIGBIJOY N. NATH

Centre for Nano Science and Engineering (CeNSE)
IISc Bangalore

PRE-REQUISITES : High school physics & math, 10+2 physics

INTENDED AUDIENCE : Students pursuing B.E./B.Tech in ECE/EE, or M. Sc Physics

INDUSTRIES APPLICABLE TO : Semiconductor

COURSE OUTLINE :

This course seeks to cover the basics of semiconductor devices including the physics of energy bands, doping and carrier statistics and transport leading up to the understanding of common semiconductor devices including p-n junctions and their applications, BJTs and MOSFETs. The course will also give a flavour of the basics of compound semiconductors and their devices, and also touch base with opto-electronic devices such as solar cells, photodetectors and LEDs. The course will ensure that undergraduates, college teachers and other interested audience with no background in semiconductors are able to grasp the content. In parallel, the course will consistently seek to engage the audience by giving real-life examples pertaining to the content, and also seek to calibrate the content with respect to practical and commercial technologies which are all around us and which use semiconductor devices. There will be enough food for thought even for advanced learners such as PhD students and active researchers.

ABOUT INSTRUCTOR :

Prof. Digbijoy N. Nath completed his B.E. (Hons) in Electrical and Electronics Engineering from BITS, Pilani (Rajasthan) and PhD in Electrical Engineering from Ohio State University, Columbus specializing in gallium nitride based semiconductor devices. He has been as Assistant Professor at Centre for Nano Science and Engineering (CeNSE) at Indian Institute of Science (IISc), Bangalore since Aug 2014. His research interests lie in wide band gap semiconductor devices for high power & RF electronics/deep-UV opto-electronics. He has authored/co-authored 46 publications so far. He has been teaching a postgraduate level course Semiconductor Devices and IC Technology for PhD/Masters students at IISc for four years while he has also started a new advanced-level course titled Semiconductor Opto-electronics and Photovoltaics (jointly with another faculty member).

COURSE PLAN :

Week 1 : Importance of semiconductor devices and their diverse applications. Introduction to semiconductors, concept of energy bands and how bands form. Effective mass of electrons, E-k diagram. Concept of holes. Concept of Fermi level, Fermi-Dirac distribution. Doping (extrinsic & intrinsic semiconductor), density of states.

Week 2 : Equilibrium electron-hole concentration, temperature-dependence. Carrier scattering and mobility, velocity saturation, Drift-diffusion transport

Week 3 : Excess carrier decay & recombination, charge injection, continuity equation, quasi-Fermi level

Week 4 : p-n junction: static behaviour (depletion width, field profile), p-n junction under forward & reverse bias, current equations, generation-recombination current and reference to typical devices.

Week 5 : Zener and avalanche breakdown, Capacitance-voltage profiling, metal/semiconductor junction – Ohmic and Schottky contacts, reference to device applications.

Week 6 : MOS capacitor, charge/field/energy bands, accumulation, inversion, C-V (high and low frequencies), deep depletion, Real MOS cap: Flat-band & threshold voltage, Si/SiO₂ system.

Week 7 : MOSFET: structure and operating principle, derivation of I-V, gradual channel approximation, substrate bias effects, sub-threshold current and gate oxide breakdown. Control of threshold voltage, short channel effects. Moore's Law and CMOS scaling

Week 8 : Introduction to compound semiconductors & alloys, commonly used compound semiconductors, heterostructure band diagrams and basics of MODFET & HEMT, introduction to quantum well, applications of heterostructure device technologies

Week 9 : BJT: working principle, DC parameters and current components, base transport factor, Early Effect, charge control equation & current gain, need for HBT. Applications of BJTs/HBTs in real-life.

Week 10 : (Basics of) - transistors for high-speed logic, transistors for high frequency (RF), transistors for high power switching, transistors for memories, transistors for low noise, transistors for the future.

Week 11 : Solar cells: principle, efficiency, Fill factor, Shockley-Queisser limit, silicon solar cells, multi-junction solar cell, Photodetectors: operation, figures of merit (responsivity, QE, bandwidth, noise, Detectivity), examples from IR to UV detectors.

Week 12 : LEDs: working principle, radiative/non-radiative recombination, various types of efficiencies (EQE, WPE, IQE), light extraction and escape cone. Blue LED and the Nobel Prize, visible LEDs and chromaticity.



FUNDAMENTALS OF SURFACE ENGINEERING: MECHANISMS, PROCESSES AND CHARACTERIZATIONS

PROF. D.K. DWIVEDI

Department of Mechanical Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Elective | PG
COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)
EXAM DATE : 24 Apr 2022

INTENDED AUDIENCE : UG and PG Student, Research Scholar & Practicing Engineers

INDUSTRIES APPLICABLE TO : Mining, Hydropower, Cement and Manufacturing

COURSE OUTLINE :

The course content is designed to have systematic and comprehensive understanding on various aspects related with surface engineering of metallic components for enhanced tribological life. It is proposed to include fundamental mechanisms of wear such as adhesive, abrasive, erosive, cavitation, corrosion etc., governing laws, materials properties importance for improved wear resistance under different wear conditions, materials increased tribological life, processes for engineering surfaces of three broad categories a) regulating the micro-structure without changing chemical composition b) modification of chemical composition of near surface layers and c) developing of films, coating, and cladding on the. Methods of characterization needed for evaluating the metallurgical and mechanical and tribological properties and performance of engineered surfaces shall also be presented. Presentations will be supported with case studies for effective communication of concepts and procedures. Case studies will be taken up regarding surface engineering of various metal systems like ferrous and non-ferrous metals using different approaches discussed.

ABOUT INSTRUCTOR :

Prof. D.K. Dwivedi obtained BE (Mechanical Engineering) , in 1993 from GEC Rewa, ME (welding engineering) from Univ. of Roorkee in 1997 and PhD in Met. Engineering from MNIT, Jaipur in 2003. He has about 9 years teaching experience at NIT Hamirpur and 12 years at IIT Roorkee of subjects related with manufacturing at UG level and welding engineering related subjects at PG level including failure analysis of welded joints. He has undertaken work of failure investigation valves, penstocks, bridges for many private and public sector industries especially in hydropower sector.

COURSE PLAN :

Week 01 : Introduction

Week 02 : Introduction - contd.

Week 03 : Surface damage

Week 04 : Surface damage - contd.

Week 05 : Materials for wear resistant applications

Week 06 : Processes for Controlling Wear: Structural Modification

Week 07 : Processes for Controlling Wear: Composition Modification

Week 08 : Processes for Controlling Wear: Composition Modification - contd.

Week 09 : Processes for Controlling Wear: Composition Modification & Weld Surfacing

Week 10 : Processes for Controlling Wear: Coatings & Cladding

Week 11 : Processes for Controlling Wear: Coatings & Overlays

Week 12 : Processes for Controlling Wear: Coatings & Characterization



GEOGRAPHIC INFORMATION SYSTEMS

PROF. ARUN K. SARAF

Department of Civil Engineering
IIT Roorkee

PRE-REQUISITES : Current students of engineering, post graduate science students and PhD students should have basic knowledge of computers

INTENDED AUDIENCE : Under and post-graduate engineering, post graduate and doctoral students

INDUSTRIES APPLICABLE TO : Geoinformatics companies, e.g NIIT, ESRI India, Leica Geoinformatics, MapmyIndia, ISRO, etc.

COURSE OUTLINE :

The proposed course provides detailed understanding about Geographic Information Systems and their applications in Civil Engineering and Earth Sciences. All aspects starting from data input to modelling would be discussed in this course. Further, in the proposed course various datasets including DEMs, their source, generation techniques, derivatives, errors and limitations would be discussed extensively. Surface Hydrologic Modelling using DEMs, modelling derivatives and their applications would also be discussed.

ABOUT INSTRUCTOR :

Prof. Arun K. Saraf is Ph. D. (Remote Sensing) from University of Dundee, United Kingdom. Presently he is working as Professor in the Department of Earth Sciences, Indian Institute of Technology, Roorkee, and teaches courses on Geographic Information Systems (GIS), Advanced GIS, Remote Sensing, Geomorphology etc. to under- and post-graduate students of Geological Technology and Applied Geology. He was also Head of Department of Earth Sciences between Jan. 2012-Feb. 2015. He was first in the country to introduce GIS course to post-graduate students in the year 1990. In 1986, he was awarded National Fellowship to Study Abroad by Govt. of India for his doctoral degree.

COURSE PLAN :

Week 1: What is Geographic Information Systems?, Essential components of GIS, Different types of vector data, Concept of topology, Demonstration through GIS software

Week 2: Raster data model and comparisons with vector, TIN data model and comparisons with raster, Non-spatial data (attributes) and their types, Vector Data Compression Techniques, Demonstration through GIS software

Week 3: Raster Data Compression Techniques-01, Raster Data Compression Techniques-02, Georeferencing, Pre- processing of spatial datasets-01, Demonstration through GIS software

Week 4: Pre-processing of spatial datasets-02, Pre-processing of spatial datasets-03, Spatial Interpolation Techniques-01, Spatial Interpolation Techniques-02, GIS Analysis- 01

Week 5: GIS Analysis-02, GIS Analysis-03, GIS Analysis- 04, GIS Analysis-05, Demonstration through GIS software

Week 6: GIS Analysis-06, GIS Analysis-07, Attributes Classification Methods, Spatial Database systems and their types-01, Demonstration through GIS software

Week 7: Spatial Database systems and their types-02, Concept of NoData in Raster, Different map projections, Concept of digital elevation model (DEM) and how it is represented, Demonstration through GIS software

Week 8: Various techniques to generate digital elevation models-1, Various techniques to generate digital elevation models-2, Various techniques to generate digital elevation models-3, Digital Elevation Models and different types of resolutions, Demonstration through GIS software

Week 9: How to assess quality of a DEM, Integration of DEMs with satellite data, Common derivatives of DEMs - Slope and aspect-01, Common derivatives of DEMs - Slope and aspect-02, Demonstration through GIS software

Week 10: Common derivatives of DEMs - Slope and aspect-03, DEMs derivatives-1, DEMs derivatives-2, DEMs derivatives-3, DEMs derivatives-4

Week 11: Triangulated Irregular Network (TIN) and its derivatives, Shaded relief models and their applications, DEM based Surface Hydrologic Modelling-1, DEM based Surface Hydrologic Modelling-2, DEMs and Dam Simulation and its application in groundwater hydrology

Week 12: DEMs Sources, limitations and future of Digital Elevation Models, Applications of DEMs in Viewshed and Flood Hazard Mapping, Applications of DEMs in solar and wind energy potential estimations, Errors in GIS and key elements of maps, Limitations and Rules of GIS



GERMAN - I

PROF. MILIND BRAHME

Department of Humanities and Social Sciences
IIT Madras

INTENDED AUDIENCE : Anyone interested in learning elementary German

INDUSTRIES APPLICABLE TO : Companies / Organisations / Individuals having business / work with Germany, Austria and/or Switzerland

COURSE OUTLINE :

German I is meant to be an introduction to the German language and a basic orientation towards Germany (and to some extent Austria and Switzerland). Learning to understand and articulate oneself in day to day real life situations, and to begin to make sense of Germany as a cultural space are the overall objectives of the course. Serious learners should be able to grasp the basic sentence structure and build a good foundational vocabulary through this course.

ABOUT INSTRUCTOR :

Prof. Milind Brahme has an MA, M Phil and a PhD in German language and literature from the Centre of German Studies, JNU. He has been on the faculty of IIT Madras since 2003, and has more than 25 years of experience of teaching German language and literature in diverse situations and contexts.

COURSE PLAN :

Week 1: Themes: Introducing oneself and others; Grammar: W questions, personal pronouns, simple sentence, verb conjugation

Week 2: Themes: hobbies, the week, numbers, the alphabet, months, seasons / Grammar : articles , plural, the verbs to have and to be

Week 3: Theme: In the city / naming places and buildings, means of transport, basic directions / Grammar : definite and indefinite articles; negation - kein and nicht; imperative

Week 4: Themes: food, drink, family / groceries and meals / Grammar : the accusative

Week 5: Theme: Everyday life, telling time, making appointments / Grammar : prepositions am, um, von..bis; modal verbs, possessive articles

Week 6: Leisure activity, celebrations / Grammar: separable verbs, the accusative, past tense of to have and to be

Week 7: Contacts, writing letters / Grammar: dative

Week 8: My apartment, rooms, furniture, colours / Grammar: changing prepositions

Week 9: Professions / Grammar : perfect tense

Week 10: Clothes / Grammar: perfect tense and dative

Week 11: Health and the body / Grammar: the imperative and modal verbs

Week 12: Holiday and weather



GPS SURVEYING

PROF. JAYANTA KUMAR GHOSH

Department of Civil Engineering

IIT Roorkee

- INTENDED AUDIENCE** : Diploma/Degree/Master/Doctoral students; Field surveyors; Professional persons dealing with GPS surveying.
Application based.As core course (partial) for Civil Engineering,Geo-spatial Technology etc.
As elective course (partial) for Earth Sciences,Geography etc for all domains in which GPS surveying may be applied.
May be considered for both course (UG & PG).
Part of any of the degrees: (BE/ME/BSc/MSc etc).
- PRE-REQUISITES** : Basics of Physics and mathematics upto 12th standard and familiarity with use of computer.

COURSE OUTLINE :

The objective of the course is to provide optimal insights into land surveying using GPS (Global Positioning System). The course starts with an introduction to land surveying leading to GPS as the state-of-art for surveying of land. Then, different aspects of GPS systems such as GPS architecture, GPS signals, GPS receivers, GPS software has been discussed followed by GPS positioning & GPS observables. Next, it provides GPS processing fundamentals consisting of pre-processing and processing steps under different processing strategies followed by quality assessment and field procedure of GPS surveying. The course concludes with a detail demonstration of GPS field surveying followed by processing of collected data.

ABOUT INSTRUCTOR :

Prof. Jayanta Kumar Ghosh is working as Associate Professor in the Civil Engineering Department (Geomatics Engineering Group) of Indian Institute of Technology Roorkee. He is engaged in teaching, research and consultancy works in Geomatics engineering for more than 30 years. He is pioneer in introducing courses on GPS surveying in the UG & PG curriculum of Civil Engineering in India, since 1999. He has conducted many short term courses on GPS Surveying for the building professionals as early as 2002. He has more than 85 publications in the International and National journals and conferences of repute. He is member of different National and International technical associations.

COURSE PLAN :

Week 1: Introduction; GPS System

Week 2: GPS Positioning; GPS Observables

Week 3: GPS Data Processing

Week 4: GPS Field Surveying; GPS Field Data Processing

Graph Theory - Video course

COURSE OUTLINE

In computer science, graph theory is used extensively. The intension of this course is to introduce the subject of graph theory to computer science students in a thorough way.

While the course will cover all elementary concepts such as coloring, covering, hamiltonicity, planarity, connectivity and so on, it will also introduce the students to some advanced concepts.

COURSE DETAIL

Sl.No.	Topics	No.of Hours
1	Vertex Cover	1
2	Matchings	3
3	Pathcover	1
4	Connectivity	3
5	Hamiltonicity	3
6	Vertex Coloring	4
7	Edge Coloring	3
8	Other Coloring Problems	2
9	Perfect graphs	2
10	Planar graphs	3
11	Other special classes of graphs	2
12	Network flow	3
13	Introduction to minor theory	3



NP-TEL

NPTEL

<http://nptel.iitm.ac.in>

Computer Science and Engineering

Coordinators:

Dr. L. Sunil Chandran
Department of Computer Science and
Automation IISc Bangalore

14	Probabilistic Methods: Basics	3
15	Markov, Chebishey Inequalities	1
16	Lovasz Local Lemma	2
17	Random graph	1
	Total	40

References:

1. R. Diestel, "Graph Theory", Springer-Verlag, 2nd edition, 2000.
2. N. Alon and J. Spenser, "Probabilistic Methods", John Wiley and Sons, 2nd edition, 2000.



HUMAN BEHAVIOUR

PROF. NAVEEN KASHYAP

Department of Humanities and Social Sciences
IIT Guwahati

INTENDED AUDIENCE : UG/PG/PhD students

COURSE OUTLINE:

We as intelligent beings have always wondered why we do what we do. The most interesting knowledge that humans beings would kill to possess would be the knowledge to control other people. The basic premise of being human is individual difference (we are all different). One science that helps people in understanding other people and scientifically predicting their actions is the science of psychology. In the present course, I will make an attempt to simplify the science of human behavior.

ABOUT INSTRUCTOR :

Prof. Naveen Kashyap, Ph.D is as Associate Professor of Psychology at the Indian Institute of Technology Guwahati. His research interests are sleep and human cognitive processes. Dr Kashyap has been teaching courses like cognitive psychology, introduction to psychology, consumer psychology, advance cognitive process and research methodology to UG and PG students of IITG Guwahati for the past 10 years.

COURSE PLAN :

Week 1 : Introduction to the science of human behavior

Week 2 : Sensation & Perception-I

Week 3 : Perception-II, Learning

Week 4 : Memory and Language-I

Week 5 : Language-II and Emotion

Week 6 : Intelligence

Week 7 : Personality

Week 8 : Social influence and cognition



INTRODUCTION TO AEROSPACE ENGINEERING-FLIGHT

PROF. RAJKUMAR S. PANT

Department of Aerospace Engineering
IIT Bombay

INTENDED AUDIENCE : Any discipline of Engineering, who are interested in the subject

INDUSTRY SUPPORT : DRDO, HAL, NAL, IAF

COURSE OUTLINE :

The aim of this course is to provide a general overview of the field of Aeronautical Engineering to interested students. The course will consist of ten Capsules, each consisting of two Lectures. Each Lecture will cover a specific concept or area relevant to the subject. An attempt will be made to cover the contents in an interesting manner, by a judicious use of a mix of powerpoint presentations, in-class activities, quizzes, innovative and hands on assignments that will not only increase the awareness of the students, but also satiate their curiosity and desire to know more about the various concepts related to the subject.

ABOUT INSTRUCTOR :

Prof. Rajkumar S. Pant has Bachelors, Masters and Ph.D. degrees in Aerospace Engineering. His areas of specialization include Aircraft Conceptual Design, Air Transportation, and Optimization. He has been a member of faculty of Aerospace Engineering Department at the Indian Institute of Technology Bombay since December 1989. Prof. Pant is an alumnus of College of Aeronautics, Cranfield University, UK, where he earned his Ph.D. under Commonwealth Scholarship Scheme, IIT Madras, where he did his Masters in Aeronautical Engineering, and PEC Chandigarh where he underwent his undergraduate studies in Aeronautical Engineering. He has also worked for five years in Hindustan Aeronautics Limited in the Design & Engineering Department at Kanpur (3.5 years) and Nasik (1.5 years) Divisions. He has published and presented ~ 220 scientific papers, of which ~ 170 are in international journals and conferences. He has also visited several top ranking institutes and universities all over the world. Prof. Pant was a Visiting Professor at School of Mechanical & Aerospace Engineering at Nanyang Technological University, Singapore in 2015-16, visiting faculty at Department of Aerospace & Ocean Engineering at Virginia Polytechnic Institute and State University in 2010-11, and a visiting researcher at Instituto Tecnológico de Aeronáutica, Brazil in 2012, Texas A&M University in 2011, Cambridge University in 2008, and Imperial College London in 2006. In November 2012, he was appointed as a Special Visiting Researcher under the Science Without Borders program of the Brazilian Government for three years

COURSE PLAN :

Week 1: Atmosphere and its properties

Week 2: Nomenclature of aircraft components

Week 3: Fluid Mechanics – I : Incompressible flow, Bernoulli's Equation, Coanda Effect, and Mach No..

Week 4: Fluid Mechanics –II : Viscous Flow, Boundary Layer, Pressure Measurement

Week 5: Aerodynamics – I : Airfoils, and Lift Generation Theories

Week 6: Aerodynamics – II : Critical Mach no., Types of Drag

Week 7: Propulsion : Types of Aircraft Engines

Week 8: Aircraft Performance - I : Steady Level Flight and Altitude effects

Week 9: Aircraft Performance- II : Glide, Climb, Ceilings, Turn, and Pull up

Week 10: Aircraft Longitudinal Stability, and V-n Diagram

Week 11: Aircraft Performance- III : Takeoff and Landing, Range and Endurance, Range-Payload Diagram

Week 12: Flapping Wing Aerodynamics



INTRODUCTION TO BRAIN & BEHAVIOUR

PROF. ARK VERMA

Department of Humanities and Social Sciences
IIT Kanpur

TYPE OF COURSE : Rerun | Core | PG

COURSE DURATION : 8 weeks (21 Feb' 22 - 15 Apr' 22)

EXAM DATE : April 24, 2022

INTENDED AUDIENCE : Students across various disciplines from the Cognitive Sciences, Neurosciences, Psychology doing either their Bachelors or Masters, and even PhD may benefit from this course.

COURSE OUTLINE :

The course is meant to familiarise the students with the neural basis of mental/cognitive processes. The course will stress on both how the mental functions operate to give rise to human behaviour and also simultaneously show how these processes are implemented in the human brain.

ABOUT INSTRUCTOR :

Prof. Ark Verma have done my Bachelor's Degree in Psychology & English Literature from the University of Allahabad in 2007. After that I did my Master's Degree in Cognitive Science at the Centre of Behavioral & Cognitive Sciences, University of Allahabad in 2009. I joined the PhD program in the Department of Experimental Psychology at Ghent University, Belgium in January 2010 & was awarded my PhD in 2014. I joined IIT Kanpur as an Assistant Professor of Psychology in May 2015. My research lies in the field of Cognitive Psychology (Lateralisation, Symmetry Detection, Attention) & Psycholinguistics (Visual Word Recognition & Bilingualism).

COURSE PLAN :

Week 1 : A Brief History of Cognitive Neuroscience. Structure and Function of the Nervous System.

Week 2 : Methods in Cognitive Neuroscience

Week 3 : Neural Basis of Sensation and Perception.

Week 4 : Neural Basis of Object Recognition.

Week 5 : Neural Basis of Attention and Consciousness.

Week 6 : Neural Basis of Learning and Memory.

Week 7 : Neural Basis of Language & Cognitive Control.

Week 8 : Special Topics in Cognitive Neuroscience.



INTRODUCTION TO EMBEDDED SYSTEM DESIGN

PROF. DHANANJAY V. GADRE

Department of Electrical, Electronics and Communications Engineering
Netaji Subhas University of Technology,

PROF. BADRI SUBUDHI

Department of Electrical, Electronics and Communications Engineering
IIT Jammu

PRE-REQUISITES : Anyone with understanding of basic electronic components and circuits, digital electronics and C programming.

INTENDED AUDIENCE : Undergraduate students in engineering and science.

INDUSTRIES APPLICABLE TO : Supported by Texas Instruments.

COURSE OUTLINE :

Embedded Systems surround us in the form of gadgets and devices that we use. There is no aspect of human lives, which is untouched by such devices at home or for health diagnostics, transportation, entertainment. Learning about Embedded Systems will give the skills to design and manufacture embedded system products of the future which will help participants towards better employability. This course teaches embedded system design using a building block approach, which allows one to visualize the requirement of an embedded system and then to design it efficiently. The course will teach embedded system design using a microcontroller, namely Texas Instruments MSP430 low power microcontroller. The course will introduce various interfacing techniques for popular input devices including sensors, output devices and communication protocols. It will teach power supply design for embedded applications. It will also teach effective embedded programming techniques in C and how to maintain code using GIT. It will have a significant practical component, which will be achieved through any available MSP430 microcontroller kit

ABOUT INSTRUCTOR :

Dhananjay V. Gadre (New Delhi, India) completed his Ph.D. in Instrumentation and Control Engineering from University of Delhi. He has a M.Engr. (Computer Engineering) from the University of Idaho, USA after his M.Sc. (Electronic Science) from the University of Delhi, South Campus and B.Sc. (General with Electronics) from the Atma Ram Sanatan Dharma College, University of Delhi.

Prof. Gadre teaches at the Netaji Subhas University of Technology (formerly Netaji Subhas Institute of Technology) in the Department of Electronics and Communication Engineering, currently as an Associate Professor. He is also the founder director of CEDT and TI-CEPD.

At NSUT, he established two open access laboratories, namely Centre for Electronics Design and Technology (CEDT) and Texas Instruments Centre for Embedded Product Design (TI-CEPD). CEDT started functioning at NSUT (NSIT at the time) under his guidance in 2003 and has trained more than 5000 students in various activities related to hands-on electronics and system design. TI-CEPD started as a result of an MOU between Texas Instruments India and NSIT in 2012, under his direction. At TI-CEPD, he organized month-long, hands-on "Internship Workshops on Embedded System Design" for undergraduate and postgraduate engineering and science students, PhD scholars and young faculty and 12 such workshops were organized between June 2013 and July 2017 benefiting around 1000 participants. Activities in these two labs have resulted in many projects, products, and publications including books as well as mentoring of a few startups and providing help and guidance to science related NGOs.

Since 2001, he has been a member of an expert committee constituted by Centre for Development of Advanced Computing (CDAC), Pune for their flagship post graduate diploma program in Embedded System Design (DESD). This program has been running continuously for more than 20 years and has graduated more than 15,000 professionals in this field. Since January 2018, he has been an editor of IETE Journal of Education. Also in 2018, he received an invitation to be an adjunct faculty at IIT Jammu.

Prof. Gadre is keenly interested in creating content and pedagogy material for online learning. In September 2020, his first Massive Open Online Course (MOOC) on 'Introduction to Embedded System Design' was launched on the NPTEL platform of the Swayam portal of Government of India. This course is suitable for undergraduate and postgraduate students in science and engineering, and has been supported by Texas Instruments. This course was offered again in the January 2021 session, January 2023 session and January 2024 session at the NPTEL platform. More than seventy thousand students registered for these three editions of his MOOC. Incidentally, this is the only MOOC by any faculty member of DU/IGDTUW/NSUT/JMI/IPU.

Since 2016 he has been mentoring schools to acquire an 'Atal Tinkering Laboratory' under a Niti Aayog scheme of the Government of India and to help the selected schools run these laboratories efficiently. In December 2020, AICTE launched the IDEA Lab scheme. Prof. Gadre was co-opted as a founding member of the National Steering Committee to oversee the effective operation and implementation of the IDEA Lab scheme.

In his professional career of 34 years, he taught at the SGTB Khalsa College, University of Delhi followed by a stint as a scientific officer at the Inter University Centre for Astronomy and Astrophysics (IUCAA), Pune, designing instrumentation for use in astronomy. He has lectured and demonstrated his work extensively across the length and breadth of India and five continents, including at the World Economic Forum at Davos in Switzerland on topics related to electronics and embedded systems.

Prof. Gadre is the author of several professional articles and six books. One of his books has been translated into Chinese and another one into Greek. His recent book "TinyAVR Microcontroller Projects for the Evil Genius", published by McGraw Hill International (New York) consists of more than 30 hands-on projects and has been translated into Chinese and Russian. His latest book on TIVA ARM Cortex M4 microcontrollers is published by Springer Nature.

His professional interests include scientific instrumentation, digital systems design and computer architecture, embedded systems and Internet of Things. He is a licensed radio amateur with a call sign VU2NOX since 1986 and hopes to design, build and launch an amateur radio satellite in the near future.

Prof. Badri N Subudhi received M.Tech. in Electronics and System Communication from National Institute of Technology, Rourkela, India, in 2008-09. He worked for his PhD from Machine Intelligence Unit, Indian Statistical Institute, Kolkata, India in year 2014 (degree from Jadavpur University). Currently he is serving as an Assistant Professor at Indian Institute of Technology Jammu, India. Prior to this he was working as an Assistant Professor at NIT Goa from July 2014 to March 2017. He received CSIR senior research fellowship for the year 2011-2015. He was nominated as the Young Scientist Awardees by Indian Science Congress Association for the year 2012-2013. He was awarded with Young Scientist Travel grant award from DST, Government of India and Council of Scientific and Industrial Research, India in the year 2011. He is the recipient of Bose-Ramagnosi Award for the year 2010 from DST, Government of India under India-Trento Programme for Advanced Research (ITPAR). He was a visiting scientist at University of Trento, Italy during Aug. 2010 to Feb 2011. His research interests include Video Processing, Image Processing, Medical Image Processing, Machine Learning, Pattern Recognition, and Remote Sensing Image Analysis.

COURSE PLAN:

Week 1: Introduction to Embedded Systems and Computer Systems Terminology. Modular approach to Embedded System Design using Six-Box model: Input devices, output devices, embedded computer, communication block, host and storage elements and power supply.

Week 2: Microcontroller Based Embedded System Design. Salient Features of Modern Microcontrollers. Elements of Microcontroller Ecosystem and their significance.

Week 3: Design of Power Supply for Embedded Systems. Linear Regulator Topologies. Switching Power Supply Topologies. Power Supply Design Considerations for Embedded Systems.

Week 4: Introduction to MSP430 Microcontroller. MSP430 CPU Architecture. Programming Methods for MSP430. Introduction to Lunchbox Platform.

Week 5: Fundamentals of Physical Interfacing. Connecting Input Devices: Switches, Keyboard and Output devices: LEDs, Seven Segment Displays(SSD). Assignment: MCQ/MSQ

Week 6: Advanced Physical Interfacing: Driving load - high side, low side and H-bridge. Multiplexing displays including Charlieplexing. Shaft encoder.

Week 7: Programming the MSP430. Basics of version control system - Git. Installing and using Code Composer Studio(CCS). Introduction to Embedded C. Interfacing LEDs and Switches with MSP430 using Digital Input and Output.

Week 8: MSP430 Clock and Reset System. MSP430 Clock sources and distribution. Types of Reset sources. Handling Interrupts in MSP430. Writing efficient Interrupt Service Routine (ISR).

Week 9: Interfacing Seven Segment Displays and Liquid Crystal Displays with MSP430. Low Power Modes in MSP430. Introduction to MSP430 Timer Module and its Modes of Operation.

Week 10: Generating Pulse Width Modulation (PWM) using Timer Capture Mode. ADC operation in MSP430. Interfacing analog inputs. Generating random numbers using LFSR and other methods. Adding DAC to MSP430. Custom Waveform generation using MSP430.

Week 11: Timer Capture Modes. Measuring frequency and time period of external signals and events. Serial Communication Protocols: UART, SPI, I2C. Interfacing Universal Serial Communication Interface (USCI) Module of the MSP430 for UART Communication. Advanced Coding Exercises based on Interrupt driven Programming. Building an Electronics Project.

Week 12: Circuit Prototyping techniques. Designing Single Purpose Computers using Finite State Machine with Datapath (FSMD) approach. MSP430 Based Project Design and Implementation. Recap of Course Coverage.



INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS

PROF. SUDIP MISRA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Basic knowledge of computer and internet

INTENDED AUDIENCE : CSE, IT, ECE, EE, Instrumentation Engg, Industrial Engineering, Industry Professionals

INDUSTRIES APPLICABLE TO : All Industrial Sectors

COURSE OUTLINE :

Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing. Technologies such as Cyber Physical Systems (CPS), Internet of Things (IoT), Cloud Computing, Machine Learning, and Data Analytics are considered to be the different drivers necessary for the transformation. Industrial Internet of Things (IIoT) is an application of IoT in industries to modify the various existing industrial systems. IIoT links the automation system with enterprise, planning and product lifecycle. This course has been organized into the following modules:.

ABOUT INSTRUCTOR :

Prof. Sudip Misra is a Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Kharagpur. Prior to this he was associated with Cornell University (USA), Yale University (USA), Nortel Networks (Canada) and the Government of Ontario (Canada). He received his Ph.D. degree in Computer Science from Carleton University, in Ottawa, Canada. He has several years of experience working in the academia, government, and the private sectors in research, teaching, consulting, project management, architecture, software design and product engineering roles. His current research interests include Wireless Ad Hoc and Sensor Networks, Internet of Things (IoT), Computer Networks, Learning Systems, and algorithm design for emerging communication networks. Dr. Misra is the author of over 260 scholarly research papers, including 140+ reputed journal papers. He has won seven research paper awards in different conferences. Recently, he and his students won Samsung Innovation Award and the IEEE ComSoc Student Competition. He was awarded the fellow of NASI. He was also awarded the IEEE ComSoc Asia Pacific Outstanding Young Researcher Award at IEEE GLOBECOM 2012, Anaheim, California, USA. He was also the recipient of several academic awards and fellowships such as the Young Scientist Award (National Academy of Sciences, India), Young Systems Scientist Award (Systems Society of India), Young Engineers Award (Institution of Engineers, India), (Canadian) Governor General's Academic Gold Medal at Carleton University, the University Outstanding Graduate Student Award in the Doctoral level at Carleton University and the National Academy of Sciences, India - Swarna Jayanti Puraskar (Golden Jubilee Award). Dr. Misra was also awarded the Canadian Government's prestigious NSERC Post-Doctoral Fellowship and the Humboldt Research Fellowship in Germany. Dr. Misra has been serving the editorial boards of distinguished journals such as the Transactions on Vehicular Technology, Transactions on Mobile Computing, International Journal of Communication Systems (Wiley) and the IET Wireless Sensor Systems (UK). In the past, he served as the Associate Editor/Editorial Board Member of the Telecommunication Systems Journal (Springer), Security and Communication Networks Journal (Wiley), and the EURASIP Journal of Wireless Communications and Networking, IET Communications Journal, and the Computers and Electrical Engineering Journal (Elsevier). Dr. Misra has published 10 books in the areas of wireless ad hoc networks, wireless sensor networks, wireless mesh networks, communication networks and distributed systems, network reliability and fault tolerance, and information and coding theory, published by reputed publishers such as Cambridge University Press, Springer, Wiley, and World Scientific.

COURSE PLAN:

Week 1 : Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II

Week 2 : Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories

Week 3 : Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis

Week 4 : Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.

Week 5 : IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.

Week 6 : Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.

Week 7 : Industrial IoT- Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.

Week 8 : Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.

Week 9 : Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II.

Week 10 : Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.

Week 11 : Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

Week 12 : Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies :

Case study - I : Milk Processing and Packaging Industries

Case study - II: Manufacturing Industries - Part I

Case study - III : Manufacturing Industries - Part II

Case study - IV : Student Projects - Part I

Case study - V : Student Projects - Part II

Case study - VI : Virtual Reality Lab

Case study - VII : Steel Technology Lab



INTRODUCTION TO INTERNET OF THINGS

PROF. SUDIP MISRA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Basic programming knowledge

INTENDED AUDIENCE : CSE, IT, ECE, EE, Instrumentation Engineering, Industrial Engineering

COURSE OUTLINE :

Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

ABOUT INSTRUCTOR :

Prof. Sudip Misra is a Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Kharagpur. Prior to this he was associated with Cornell University (USA), Yale University (USA), Nortel Networks (Canada) and the Government of Ontario (Canada). He received his Ph.D. degree in Computer Science from Carleton University, in Ottawa, Canada. He has several years of experience working in the academia, government, and the private sectors in research, teaching, consulting, project management, architecture, software design and product engineering roles. His current research interests include Wireless Ad Hoc and Sensor Networks, Internet of Things (IoT), Computer Networks, Learning Systems, and algorithm design for emerging communication networks. Dr. Misra is the author of over 260 scholarly research papers, including 140+ reputed journal papers. He has won seven research paper awards in different conferences. Recently, he and his students won Samsung Innovation Award and the IEEE ComSoc Student Competition. He was awarded the fellow of NASI. He was also awarded the IEEE ComSoc Asia Pacific Outstanding Young Researcher Award at IEEE GLOBECOM 2012, Anaheim, California, USA. He was also the recipient of several academic awards and fellowships such as the Young Scientist Award (National Academy of Sciences, India), Young Systems Scientist Award (Systems Society of India), Young Engineers Award (Institution of Engineers, India), (Canadian) Governor General's Academic Gold Medal at Carleton University, the University Outstanding Graduate Student Award in the Doctoral level at Carleton University and the National Academy of Sciences, India - Swarna Jayanti Puraskar (Golden Jubilee Award). Dr. Misra was also awarded the Canadian Government's prestigious NSERC Post-Doctoral Fellowship and the Humboldt Research Fellowship in Germany. Dr. Misra has been serving the editorial boards of distinguished journals such as the Transactions on Vehicular Technology, Transactions on Mobile Computing, International Journal of Communication Systems (Wiley) and the IET Wireless Sensor Systems (UK). In the past, he served as the Associate Editor/Editorial Board Member of the Telecommunication Systems Journal (Springer), Security and Communication Networks Journal (Wiley), and the EURASIP Journal of Wireless Communications and Networking, IET Communications Journal, and the Computers and Electrical Engineering Journal (Elsevier). Dr. Misra has published 10 books in the areas of wireless ad hoc networks, wireless sensor networks, wireless mesh networks, communication networks and distributed systems, network reliability and fault tolerance, and information and coding theory, published by reputed publishers such as Cambridge University Press, Springer, Wiley, and World Scientific.

COURSE PLAN :

Week 1: Introduction to IoT: Part I, Part II, Sensing, Actuation, Basics of Networking: Part-I

Week 2: Basics of Networking: Part-II, Part III, Part IV, Communication Protocols: Part I, Part II

Week 3: Communication Protocols: Part III, Part IV, Part V, Sensor Networks: Part I, Part II

Week 4: Sensor Networks: Part III, Part IV, Part V, Part VI, Machine-to-Machine Communications

Week 5: Interoperability in IoT, Introduction to Arduino Programming: Part I, Part II, Integration of Sensors and Actuators with Arduino: Part I, Part II

Week 6: Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi

Week 7: Implementation of IoT with Raspberry Pi (contd), Introduction to SDN, SDN for IoT

Week 8: SDN for IoT (contd), Data Handling and Analytics, Cloud Computing

Week 9: Cloud Computing(contd), Sensor-Cloud

Week 10: Fog Computing, Smart Cities and Smart Homes

Week 11: Connected Vehicles, Smart Grid, Industrial IoT

Week 12: Industrial IoT (contd), Case Study: Agriculture, Healthcare, Activity Monitoring



INTRODUCTION TO INTERNET OF THINGS

PROF. SUDIP MISRA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Basic programming knowledge

INTENDED AUDIENCE : CSE, IT, ECE, EE, Instrumentation Engineering, Industrial Engineering

COURSE OUTLINE :

Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

ABOUT INSTRUCTOR :

Prof. Sudip Misra is a Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Kharagpur. Prior to this he was associated with Cornell University (USA), Yale University (USA), Nortel Networks (Canada) and the Government of Ontario (Canada). He received his Ph.D. degree in Computer Science from Carleton University, in Ottawa, Canada. He has several years of experience working in the academia, government, and the private sectors in research, teaching, consulting, project management, architecture, software design and product engineering roles. His current research interests include Wireless Ad Hoc and Sensor Networks, Internet of Things (IoT), Computer Networks, Learning Systems, and algorithm design for emerging communication networks. Dr. Misra is the author of over 260 scholarly research papers, including 140+ reputed journal papers. He has won seven research paper awards in different conferences. Recently, he and his students won Samsung Innovation Award and the IEEE ComSoc Student Competition. He was awarded the fellow of NASI. He was also awarded the IEEE ComSoc Asia Pacific Outstanding Young Researcher Award at IEEE GLOBECOM 2012, Anaheim, California, USA. He was also the recipient of several academic awards and fellowships such as the Young Scientist Award (National Academy of Sciences, India), Young Systems Scientist Award (Systems Society of India), Young Engineers Award (Institution of Engineers, India), (Canadian) Governor General's Academic Gold Medal at Carleton University, the University Outstanding Graduate Student Award in the Doctoral level at Carleton University and the National Academy of Sciences, India - Swarna Jayanti Puraskar (Golden Jubilee Award). Dr. Misra was also awarded the Canadian Government's prestigious NSERC Post-Doctoral Fellowship and the Humboldt Research Fellowship in Germany. Dr. Misra has been serving the editorial boards of distinguished journals such as the Transactions on Vehicular Technology, Transactions on Mobile Computing, International Journal of Communication Systems (Wiley) and the IET Wireless Sensor Systems (UK). In the past, he served as the Associate Editor/Editorial Board Member of the Telecommunication Systems Journal (Springer), Security and Communication Networks Journal (Wiley), and the EURASIP Journal of Wireless Communications and Networking, IET Communications Journal, and the Computers and Electrical Engineering Journal (Elsevier). Dr. Misra has published 10 books in the areas of wireless ad hoc networks, wireless sensor networks, wireless mesh networks, communication networks and distributed systems, network reliability and fault tolerance, and information and coding theory, published by reputed publishers such as Cambridge University Press, Springer, Wiley, and World Scientific.

COURSE PLAN :

Week 1: Introduction to IoT: Part I, Part II, Sensing, Actuation, Basics of Networking: Part-I

Week 2: Basics of Networking: Part-II, Part III, Part IV, Communication Protocols: Part I, Part II

Week 3: Communication Protocols: Part III, Part IV, Part V, Sensor Networks: Part I, Part II

Week 4: Sensor Networks: Part III, Part IV, Part V, Part VI, Machine-to-Machine Communications

Week 5: Interoperability in IoT, Introduction to Arduino Programming: Part I, Part II, Integration of Sensors and Actuators with Arduino: Part I, Part II

Week 6: Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi

Week 7: Implementation of IoT with Raspberry Pi (contd), Introduction to SDN, SDN for IoT

Week 8: SDN for IoT (contd), Data Handling and Analytics, Cloud Computing

Week 9: Cloud Computing(contd), Sensor-Cloud

Week 10: Fog Computing, Smart Cities and Smart Homes

Week 11: Connected Vehicles, Smart Grid, Industrial IoT

Week 12: Industrial IoT (contd), Case Study: Agriculture, Healthcare, Activity Monitoring



INTRODUCTION TO PROGRAMMING IN C

PROF. SATYADEV NANDAKUMAR

Dept. of Computer Science and Engineering
IIT Kanpur

INTENDED AUDIENCE : Any interested learners.

PRE-REQUISITES : No prior programming required; mathematical maturity of a second level UG student in science or engineering.

COURSE OUTLINE :

This is a course in programming in C. No prior programming experience is assumed; however, mathematical maturity at the level of a second year science or engineering undergraduate is assumed. We emphasize solving problems using the language, and introduce standard programming techniques like alternation, iteration and recursion. We will briefly glimpse the basics of software engineering practices like modularization, commenting, and naming conventions which help in collaborating and programming in teams.

ABOUT INSTRUCTOR :

Prof. Satyadev Nandakumar is an Assistant Professor from the Department of Computer Science and Engineering IIT Kanpur who specialises in Computable Analysis, Algorithmic Information Theory, Symbolic Dynamics. His research interests includes Theoretical Computer Science, Algorithmic Information Theory, Computable Analysis.

COURSE PLAN :

Week 01 : Introduction. Straight-Line Code. Variables, Operators, Expressions and Conditionals.

Week 02 : Loops.

Week 03 : Functions.

Week 04 : One-Dimensional Arrays and Pointers.

Week 05 : Recursion.

Week 06 : Multi-dimensional Arrays, Linked Lists.

Week 07 : Operating on Files.

Week 08 : Organizing C projects, working with multiple source directories, makefiles.



INTRODUCTION TO PSYCHOLOGY

PROF. BRAJ BHUSHAN

Department of Humanities and Social Sciences

IIT Kanpur

INTENDED AUDIENCE : Elective UG, BE, BSc

INDUSTRIES APPLICABLE TO : HR section the companies

COURSE OUTLINE :

This course is designed for better understanding of the self and others. It will help you understand the how and why of thinking, feeling, and action. This introductory psychology course will cover the major psychological constructs and principles, primarily focusing on the perceptual processes, learning, memory, emotions, genetic and environmental determinants of behavior and personality. In the last week it will also demonstrate some lab sessions whereby the relevant construct and phenomena can be empirically tested.

ABOUT INSTRUCTOR :

Prof. Braj Bhushan is a professor of psychology at IIT Kanpur.

COURSE PLAN :

Week 1: Why Psychology? Major milestones in psychology, Major areas of psychology, Major methods used in psychology, Redefining boundaries of the discipline

Week 2: Perception

Week 3: Learning

Week 4: Memory

Week 5: Emotion

Week 6: Genetic and Environmental bases of behaviour

Week 7: Personality

Week 8: Lab session: Perception



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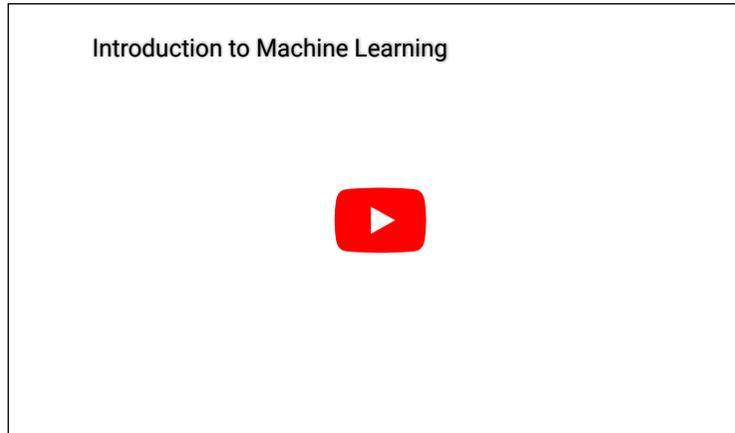
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Introduction to Machine Learning

By Prof. Balaraman Ravindran | IIT Madras

Learners enrolled: 33946



ABOUT THE COURSE :

With the increased availability of data from varied sources there has been increasing attention paid to the various data driven disciplines such as analytics and machine learning. In this course we intend to introduce some of the basic concepts of machine learning from a mathematically well motivated perspective. We will cover the different learning paradigms and some of the more popular algorithms and architectures used in each of these paradigms.

Summary

Course Status : Completed

Course Type : Elective

Duration : 12 weeks

Category :

- Computer Science and Engineering
- Artificial Intelligence
- Data Science
- Programming
- Robotics

Credit Points : 3

Level : Undergraduate/Postgraduate

Start Date : 23 Jan 2023

End Date : 14 Apr 2023



About Swayam (<https://swayam.gov.in/about>)

PREREQUISITE: This is an elective course. Intended for senior UG/PG students.
(<https://swayam.gov.in/>)

PREREQUISITES: We will assume that the students know programming for some of the assignments. If the students have done introductory courses on probability theory and linear algebra it would be helpful. We will review some of the basic topics in the first two weeks as well.

INDUSTRY SUPPORT: Any company in the data analytics/data science/big data domain would value this course.

Enrollment | All Courses | 06 Feb 2023 ()
Ends :

Exam

Registration 17 Mar 2023

Ends :

Exam Date : 30 Apr 2023 IST

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

This is an AICTE approved FDP course

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(https://www.addtoany.com/share?url=https%3A%2F%2Fonlinecourses.nptel.ac.in%2Fnoc23_cs18%2Fpreview&title=%20Course)

Course layout

Week 0: Probability Theory, Linear Algebra, Convex Optimization - (Recap)

Week 1: Introduction: Statistical Decision Theory - Regression, Classification, Bias Variance

Week 2: Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares

Week 3: Linear Classification, Logistic Regression, Linear Discriminant Analysis

Week 4: Perceptron, Support Vector Machines

Week 5: Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation

Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Pruning, Multiway Splits, Missing Values, About Swayam (<https://swayam.gov.in/about>) | All Courses |

(<https://swayam.gov.in/>)

Week 7: Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting

Week 8: Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks

Week 9: Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation

Week 10: Partitional Clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density-based Clustering

Week 11: Gaussian Mixture Models, Expectation Maximization

Week 12: Learning Theory, Introduction to Reinforcement Learning, Optional videos (RL framework, TD learning, Solution Methods, Applications)

Books and references

1. The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman (freely available online)
2. Pattern Recognition and Machine Learning, by Christopher Bishop (optional)

Instructor bio



Prof. Balaraman Ravindran

IIT Madras

Prof. Balaraman Ravindran is currently an Professor in Computer Science at IIT Madras and Mindtree Faculty Fellow . He has nearly two decades of research experience in machine learning and specifically reinforcement learning. Currently his research interests are centered on learning from and through interactions and span the areas of data mining, social network analysis, and reinforcement learning.

Course certificate

The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.

The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).

Date and Time of Exams: **30 April 2023** Morning session 9am to 12 noon; Afternoon



m.

Announcements will be made when the registration form is published. [About Swayam \(https://swayam.gov.in/about\)](https://swayam.gov.in/about) | [All Courses](#) | [0](#)

[\(https://swayam.gov.in/\)](https://swayam.gov.in/)

The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.

<https://swayam.gov.in/noc-details/NPTEL>
Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE

Average assignment score = 25% of average of best 8 assignments out of the total 12 assignments given in the course.

Exam score = 75% of the proctored certification exam score out of 100

Final score = Average assignment score + Exam score

YOU WILL BE ELIGIBLE FOR A CERTIFICATE ONLY IF AVERAGE ASSIGNMENT SCORE $\geq 10/25$ AND EXAM SCORE $\geq 30/75$. If one of the 2 criteria is not met, you will not get the certificate even if the Final score $\geq 40/100$.

Certificate will have your name, photograph and the score in the final exam with the breakup. It will have the logos of NPTEL and IIT Madras. It will be e-verifiable at npTEL.ac.in/noc (<http://npTEL.ac.in/noc>).

Only the e-certificate will be made available. Hard copies will not be dispatched.

Once again, thanks for your interest in our online courses and certification. Happy learning.

- NPTEL team



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Initiative by : Ministry of Education (Govt of India)



MUNICIPAL SOLID WASTE MANAGEMENT

PROF. AJAY KALAMDHAD

Department of Civil Engineering
IIT Guwahati

INTENDED AUDIENCE : PG Level course for Environmental Engineering and UG level for Civil Engineering

INDUSTRY SUPPORT : Synergy waste management Pvt Ltd, UPL Environmental Engineers Pvt Ltd, Green power systems, A2Z group, Timarpu-Okhla waste management pvt ltd, Ramky Enviro Engineers Limited

COURSE OUTLINE :

The problems affiliated with solid waste management (SWM) in today's sprawling civilized and urbanized society are intricate because of the quantity and varied nature of wastes, the funding restriction for public disposal, interference of technology (energy and raw materials), and complex infrastructure development network in urban cities. As a result, if SWM is to achieve in consummate approach, the fundamentals aspects need to be identified. Thus, there is dire need to group the activities from the generation to the disposal point. The six different functional elements (generation, handing and separations, storage and processing at source, collection, the transformation of wastes, transfer and transport, and final disposal) for the engineering comparison and treatment need to be understood in detail. The understanding of the functional element is important because it helps in evaluating the impacts of projected changes and technological developments. Solid waste management is an essential part of every society, but it is also one of the most neglected one. An in-depth understanding of the subject is required to tackle the current solid waste management crisis effectively. This course attempts to familiarize various steps involved in solid waste management.

ABOUT INSTRUCTOR :

Prof. Ajay Kalamdhad is a Professor in the Department of Civil Engineering, Indian Institute of Technology Guwahati. He received his PhD from Indian Institute of Technology Roorkee in the year of 2008 and started working as a Lecturer in Visvesvaraya National Institute of Technology from September 2008. He joined Indian Institute of Technology Guwahati in June 2009 as an Assistant Professor. His research interests include Solid waste management, Mechanical composting and vermicomposting, Anaerobic digestion, Analysis of solid wastes, Microbiology of composting, Biosorption and Water & Wastewater Treatment. He has published numerous papers in various reputed journals. He is also the head of Waste Management Research Group (WMRG), a group that focuses on the biological treatment of various wastes.

COURSE PLAN :

- Week 1:** Evolution of Solid Waste Management
- Week 2:** Sources/Types and Characteristics of Solid Waste
- Week 3:** Generation of Solid Waste
- Week 4:** Waste Handling, Separation, storage, and Processing
- Week 5:** Collection of Solid Waste
- Week 6:** Transfer and Transport
- Week 7:** Separation and processing of Solid Waste
- Week 8:** Chemical Transformation (combustion/incineration)
- Week 9:** Biological Treatment (Composting)
- Week 10:** Biological Treatment (Anaerobic Digestion)
- Week 11:** Disposal of Solid Waste
- Week 12:** ISWM and legislation



NATURAL HAZARDS

PROF. JAVED N. MALIK

Department of Civil Engineering
IIT Kanpur

PRE-REQUISITES : Basic knowledge of Earth Science or Natural Disasters is recommended.

INTENDED AUDIENCE : PG students of Science and Engineering, Advance UG students too can take this course.

COURSE OUTLINE :

The course introduces students to natural disasters and their phenomenon, ground deformations, land-level changes, event recurrence intervals, associated environmental and depositional changes, sedimentation patterns, and all the related hazards. Some of the well-known natural disasters are earthquakes, landslides, floods, tsunamis, volcanic eruptions, storms, and cyclones etc. which cause different types of natural hazards in the associated environment and landscape. This course will emphasize their mechanism, origin, and impacts in the associated regions such as mainland, hilly terrain, floodplain/alluvial plain, and coastal regions etc., and also focus on the approaches for mitigating and minimizing hazards along with related hazard assessment.

ABOUT INSTRUCTOR :

Prof. Javed N. Malik finished his Ph. D in 1998 from M. S. University Baroda, Vadodara. Gujarat (Geology), did Post-Doctorate (Japan Society for Promotion of Science) from (1999-2001) Hiroshima University, JAPAN. Joined IIT Kanpur in 2001.

COURSE PLAN :

- Week 1:** Natural Hazards and Disasters ,Natural Hazards and Disasters ,Human Impact on Natural Disaster
- Week 2:** Mitigating Hazards,Plate Tectonics and related Hazards,Plate Tectonics and related Hazards
- Week 3:** Earthquakes and their causes,Earthquakes and their causes,Ground Motion and Failures
- Week 4:** Tsunami: Gaint Tsunamis,Tsunami: Gaint Tsunamis ,Tsunami: Generation and Movement
- Week 5:** Tsunami Hazard Assessment,Tsunami Hazard Assessment,Volcanic Hazard
- Week 6:** Landslide and their causes, Type of downslope movement, associated hazard,Landslide and their causes
- Week 7:** Floods and Human Interaction,Flood Frequency and Recurrence Interval,Flood Frequency and Recurrence Interval
- Week 8:** Storms: Tropical Cyclone,Storms: Tropical Cyclone,Hurricane, Tornado, Storm damage and safety,Wildfires



POWER QUALITY IMPROVEMENT TECHNIQUE

PROF. AVIK BHATTACHARYA

Department of Electrical and Electronics Engineering
IIT Roorkee

PRE-REQUISITES : Power Electronics

INTENDED AUDIENCE : Final year B.Tech, M.Tech students of Power Electronics and power system, Power electronics Engineer / Experts from industry

INDUSTRIES APPLICABLE TO : ABB, GE, Statcon Energeia, CESC, NTPC, NHPC all state electric supply board, AAI

COURSE OUTLINE :

The power quality of modern power distribution system is vulgarized due to the increased use of distributed sources, adjustable speed drive, nonlinear load and unbalanced load. The main challenge in the distribution system is the mitigation of power quality problems produced by load disturbances and supply disturbances. It can be mitigated by passive filters as well as active filters. The passive filters are economically cheap but their performance is poor compared to the active power filters. Hence active power filters are preferred in the modern power system.

ABOUT INSTRUCTOR :

Prof. Avik Bhattacharya is working as Assistant Professor in IIT Roorkee from February 2014. Before joining IIT Roorkee he was research and development team of Danfoss Solar inverter and ABB. He has over a decade of experience in power quality issues and published four IEEE transaction on it. He is also teaching this course in IIT Roorkee for past two years for UG and PG (B.Tech fourth year and M.Tech) . His teaching is right blending of Industry, research and academic interest

COURSE PLAN :

Week 1 : Concept of Power Quality: Frequency variations, voltage variations- sag and swell, waveform distortion –dc offset,harmonics, inter-harmonics, notching and noise.

Week 2 : Representation of harmonics, waveform, harmonic power,measures of harmonic distortion; Current and voltage limits of harmonic distortions: IEEE, IEC, EN, NORSO

Week 3 : Causes of Harmonics: 2-pulse, 6-pulse and 12-pulse converter configurations, input current waveforms and their harmonic spectrum; Input supply harmonics of AC regulator, integral cycle control, cycloconverter, transformer, rotating machines, ARC furnace, TV and battery charger.

Week 4 : Elimination/ Suppression of Harmonics: High power factor converter, multi-pulse converters using transformer connections
(delta, polygon)

Passive Filters: Types of passive filters, single tuned and high pass filters, filter design criteria, double tuned filters, damped filters
and their design

Week 5 : PWM Inverter: Voltage sourced active filter, current sourced active filter, constant frequency control, constant tolerance band control,variable tolerance band control.

Week 6 : Active Power Filters: Compensation principle, classification of active filters by objective, system configuration, power circuit andcontrol strategy

Week 7 : Hybrid Shunt Active power filter: Principle of operation, analysis and modelling

Week 8 : Unified power quality conditioner, voltage source and current source configurations, principle of operation for sag, swell and flicker control



PRIVACY AND SECURITY IN ONLINE SOCIAL MEDIA

PROF. PONNURANGAM KUMARAGURU

Department of Computer Science and Engineering
IIIT Hyderabad

PRE-REQUISITES : Basic / Intermediate programming course. Understanding of Python will be necessary for the course. Should be able to quickly learn APIs, and to collect data from social networks.

INTENDED AUDIENCE : Interested students

INDUSTRIES APPLICABLE TO : Any company which is interested in social media / networks data will be interested in recruiting the students finishing the course.

COURSE OUTLINE :

With increase in the usage of the Internet, there has been an exponential increase in the use of online social media and networks on the Internet. Websites like Facebook, YouTube, LinkedIn, Twitter, Flickr, Instagram, Google+, FourSquare, Pinterest, Tinder, and the likes have changed the way the Internet is being used. However, widely used, there is a lack of understanding of privacy and security issues on online social media. Privacy and security of online social media need to be investigated, studied and characterized from various perspectives (computational, cultural, psychological, etc.). Student completing the course will be able to appreciate various privacy and security concerns (spam, phishing, fraud nodes, identity theft) on Online Social Media and Student will be able to clearly articulate one or two concerns comprehensively on one Online Social Media, this will be achieved by homework.

ABOUT INSTRUCTOR :

Prof.Ponnurangam Kumaraguru ("PK") is a Professor of Computer Science at IIIT-Hyderabad. He is a Visiting Faculty at IIT Kanpur and an Adjunct faculty at IIIT Delhi. PK is an ACM India Council Member, and Chair of the Publicity & Membership Committee of ACM India. PK is a TEDx and an ACM Distinguished & ACM India Eminent Speaker. PK received his Ph.D. from the School of Computer Science at Carnegie Mellon University (CMU). His Ph.D. thesis work on anti-phishing research at CMU contributed in creating an award-winning startup - Wombat Security Technologies, wombatsecurity.com. Wombat was acquired in March 2018 for USD 225 Million. PK was listed in the World's 2% Scientists by Stanford University in Nov 2020. He is a senate member of IIIT Una, and is on various Board of Studies / Academic Council of different institutes across the country. PK has been teaching on NPTEL for the last 5 years, with great feedback from students. He has co-authored research papers in the field of Privacy and Security in Online Social Media, Cyber Security, Computational Social Science, Social Computing, Data Science for Social Good, amongst others. PK's research work regularly gets featured on news media, including print, online, and TV within India and across the world; to list a few, BBC, CBC, CBS, CNN, Doordarshan, Economic Times, Indian Express, NBC, New Scientist, NewYorker, Reuters, Times of India, USA Today, Washington Post, and many more. PK Spear heads ACM India's programs on improving the quality of PhD students in Computing in India -- PhDClinic & Anveshan Setu Fellowship. In his Dean's role at IITD, he managed a team of 15 faculty members and 10+ admin staff, including Associate Dean of Student Affairs, overseeing hostel, sports centre, health centre, student {well-being, clubs, mentorship program}, technical & cultural fests. He was the Founding Head of Cybersecurity Education and Research Centre (CERC) at IIIT-Delhi. PK started and successfully manages PreCog (precog.iiitd.edu.in), a research group at IIIT-Delhi and IIIT Hyderabad. In addition to his contributions to academia, PK is on advisory role on various government organizations, government committees, including a 8 member committee on Non-Personal Data by Government of India, chaired by Mr. Kris Gopalakrishnan.

COURSE PLAN :

Week 1: What is Online Social Networks, data collection from social networks, challenges, opportunities, and pitfalls in online social networks, APIs

Week 2: Collecting data from Online Social Media.

Week 3: Trust, credibility, and reputations in social systems

Week 4: Trust, credibility, and reputations in social systems, cont'd

Week 5: Online social Media and Policing

Week 6: Information privacy disclosure, revelation and its effects in OSM and online social networks

Week 7: Phishing in OSM & Identifying fraudulent entities in online social networks

Week 8: Refresher for all topics

Week 9 to 12 : Research paper discussion



PROBLEM SOLVING THROUGH PROGRAMMING IN C

PROF. ANUPAM BASU

Department of Computer Science and Engineering
IIT Kharagpur

INTENDED AUDIENCE : BE/BTech in all disciplines BCA/MCA/M. Sc

INDUSTRIES APPLICABLE TO : All IT Industries

COURSE OUTLINE : This course is aimed at enabling the students to

- Formulate simple algorithms for arithmetic and logical problems
- Translate the algorithms to programs (in C language)
- Test and execute the programs and correct syntax and logical errors
- Implement conditional branching, iteration and recursion
- Decompose a problem into functions and synthesize a complete program using divide and conquer approach
- Use arrays, pointers and structures to formulate algorithms and programs
- Apply programming to solve matrix addition and multiplication problems and searching and sorting problems
- Apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration

ABOUT INSTRUCTOR :

Prof. Anupam Basu is Professor in the Dept. of Computer Science Engineering, IIT Kharagpur, and has been an active researcher in the areas of Cognitive and Intelligent Systems, Embedded Systems and Language Processing, Presently he is acting as the Chairman and Head of the Center for Educational Technology, IIT Kharagpur. He has developed several embedded system based tools empowering the physically challenged and has led several national projects in the area. He has taught at the University of California, Irvine at the Center for Embedded Systems. He is an Alexander von Humboldt Fellow and a Fellow of the Indian National Academy of Engineering. The awards won by him include the State Award for the Best Contribution to the Cause of Empowerment of the Disabled (2014), Universal Design Award 2011, for contributions in design for the disabled, by National Council for Promotion of Employment of Disabled Persons, India, the National Award for the Best Technology Innovation for the Physically Disabled (2007) and the Da-Vinci Award 2004 from the Engineering Society of Detroit.

COURSE PLAN :

- Week 1:** Introduction to Problem Solving through programs, Flowcharts/Pseudo codes, the compilation process, Syntax and Semantic errors, Variables and Data Types
- Week 2:** Arithmetic expressions, Relational Operations, Logical expressions; Introduction to Conditional Branching
- Week 3:** Conditional Branching and Iterative Loops
- Week 4:** Arranging things : Arrays
- Week 5:** 2-D arrays, Character Arrays and Strings
- Week 6:** Basic Algorithms including Numerical Algorithms
- Week 7:** Functions and Parameter Passing by Value
- Week 8:** Passing Arrays to Functions, Call by Reference
- Week 9:** Recursion
- Week 10:** Structures and Pointers
- Week 11:** Self-Referential Structures and Introduction to Lists
- Week 12:** Advanced Topics



PROGRAMMING IN JAVA

PROF. DEBASIS SAMANTA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : This course requires that the students are familiar with programming language such as C/C++ and data structures, algorithms.

INTENDED AUDIENCE : The undergraduate students from the engineering disciplines namely CSE, IT, EE, ECE, etc. might be interested for this course.

INDUSTRIES APPLICABLE TO : All IT companies.

COURSE OUTLINE :

With the growth of Information and Communication Technology, there is a need to develop large and complex software. Further, those software should be platform independent, Internet enabled, easy to modify, secure, and robust. To meet this requirement object-oriented paradigm has been developed and based on this paradigm the Java programming language emerges as the best programming environment. Now, Java programming language is being used for mobile programming, Internet programming, and many other applications compatible to distributed systems. This course aims to cover the essential topics of Java programming so that the participants can improve their skills to cope with the current demand of IT industries and solve many problems in their own field of studies.

ABOUT INSTRUCTOR :

Prof. Debasis Samanta holds a Ph.D. in Computer Science and Engineering from Indian Institute of Technology Kharagpur. His research interests and work experience spans the areas of Computational Intelligence, Data Analytics, Human Computer Interaction, Brain Computing and Biometric Systems. Prof. Samanta currently works as a faculty member at the Department of Computer Science Engineering at IIT Kharagpur.

COURSE PLAN :

Week 1: Overview of Object-Oriented Programming and Java

Week 2: Java Programming Elements

Week 3: Input-Output Handling in Java

Week 4: Encapsulation

Week 5: Inheritance

Week 6: Exception Handling

Week 7: Multithreaded Programming

Week 8: Java Applets and Servlets

Week 9: Java Swing and Abstract Windowing Toolkit (AWT)

Week 10: Networking with Java

Week 11: Java Object Database Connectivity (ODBC)

Week 12: Interface and Packages for Software Development



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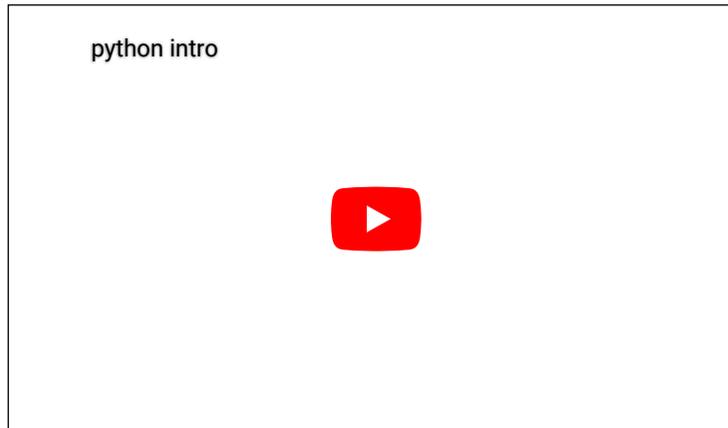
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Programming, Data Structures And Algorithms Using Python

By Prof. Madhavan Mukund | Chennai Mathematical Institute

Learners enrolled: 41331



This course is an introduction to programming and problem solving in Python. It does not assume any prior knowledge of programming. Using some motivating examples, the course quickly builds up basic concepts such as conditionals, loops, functions, lists, strings and tuples. It goes on to cover searching and sorting algorithms, dynamic programming and backtracking, as well as topics such as exception handling and using files. As far as data structures are concerned, the course covers Python dictionaries as well as classes and objects for defining user defined datatypes such as linked lists and binary search trees.

Summary

Course Status :	Completed
Course Type :	Elective
Duration :	8 weeks
Category :	<ul style="list-style-type: none">Computer Science and EngineeringProgrammingData ScienceArtificial IntelligenceFoundations of Computing
Credit Points :	2
Level :	Undergraduate
Start Date :	24 Jan 2022
End Date :	18 Mar 2022



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(<https://swayam.gov.in/>)

INTENDED AUDIENCE: Students in any branch of mathematics/science/engineering, 1st

Exam Date : 27 Mar 2022 IST



PREREQUISITES: School level mathematics.

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

INDUSTRY SUPPORT: This course should be of value to any company requiring programming skills.

This is an AICTE approved FDP course

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(https://www.addtoany.com/share?url=https%3A%2F%2Fonlinecourses.nptel.ac.in%2Fnoc22_cs26%2Fpreview&title=P%20Course)

Course layout

Week 1

Informal introduction to programmin, algorithms and data structures viagcd
 Downloading and installing Python
 gcd in Python: variables, operations, control flow - assignments, condition-als, loops, functions

Week 2

Python: types, expressions, strings, lists, tuples
 Python memory model: names, mutable and immutable values
 List operations: slices etc
 Binary search
 Inductive function denitions: numerical and structural induction
 Elementary inductive sorting: selection and insertion sort
 In-place sorting



analysis: input size, asymptotic complexity, About Swayam (<https://swayam.gov.in/about>) | All Courses |

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(<https://swayam.gov.in/>)

Merge sort



Quick sort

Stable sorting

(https://swayam.gov.in/nc_details/NPTEL)

Week 4

Dictionaries

More on Python functions: optional arguments, default values

Passing functions as arguments

Higher order functions on lists: map, lter, list comprehension

Week 5

Exception handling

Basic input/output

Handling files

String processing

Week 6

Backtracking: N Queens, recording all solutions

Scope in Python: local, global, nonlocal names

Nested functions

Data structures: stack, queue

Heaps

Week 7

Abstract datatypes

Classes and objects in Python

"Linked" lists: find, insert, delete

Binary search trees: find, insert, delete

Height-balanced binary search trees

Week 8

Efficient evaluation of recursive definitions: memoization

Dynamic programming: examples

Other programming languages: C and manual memory management

Other programming paradigms: functional programming

Books and references

NIL



(<https://swayam.gov.in/>)



**Prof. Madhavan
Mukund**

Chennai
Mathematical
Institute

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Prof. Madhavan Mukund studied at IIT Bombay (BTech) and Aarhus University (PhD). He has been a faculty member at Chennai Mathematical Institute since 1992, where he is presently Executive Director. His main research area is formal verification. He has active research collaborations within and outside India and serves on international conference programme committees and editorial boards of journals.

He has served as President of both the Indian Association for Research in Computing Science (IARCS) (2011-2017) and the ACM India Council (2016-2018). He has been the National Coordinator of the Indian Computing Olympiad since 2002. He served as the Executive Director of the International Olympiad in Informatics from 2011-2014.

In addition to the NPTEL MOOC programme, he has been involved in organizing IARCS Instructional Courses for college teachers. He is a member of ACM India's Education Committee. He has contributed lectures on algorithms to the Massively Empowered Classroom (MEC) project of Microsoft Research and the QEEE programme of MHRD.

Course certificate

The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.

The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).

Date and Time of Exams: **27 March 2022** Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.

Registration url: Announcements will be made when the registration form is open for registrations.

The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.

Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE


 ve an unproctored programming exam also apart from the Proctored
 k announcement section for date and time. About Swayam (<https://swayam.gov.in/about>) | All Courses |
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()


 Final score = Assignment score + Unproctored programming exam score + Proctored
 Exam score
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Assignment score = 25% of average of best 6 assignments out of the total 8 assignments given in the course.

- (All assignments in a particular week will be counted towards final scoring - quizzes and programming assignments).
- Unproctored programming exam score = 25% of the average scores obtained as part of Unproctored programming exam - out of 100
- Proctored Exam score =50% of the proctored certification exam score out of 100

YOU WILL BE ELIGIBLE FOR A CERTIFICATE ONLY IF ASSIGNMENT SCORE >=10/25 AND UNPROCTORED PROGRAMMING EXAM SCORE >=10/25 AND PROCTORED EXAM SCORE >= 20/50.

If any one of the 3 criteria is not met, you will not be eligible for the certificate even if the Final score >= 40/100.

Certificate will have your name, photograph and the score in the final exam with the breakup. It will have the logos of NPTEL and IIT Madras .It will be e-verifiable at npTEL.ac.in/noc (<http://npTEL.ac.in/noc>).

Only the e-certificate will be made available. Hard copies will not be dispatched.

Once again, thanks for your interest in our online courses and certification. Happy learning.

- NPTEL team



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Initiative by : Ministry of Education (Govt of India)



PROJECT PLANNING & CONTROL

PROF. KOSHY VARGHESE

Department of Civil Engineering
IIT Madras

INTENDED AUDIENCE : UG/PG/Industry Participants

PRE-REQUISITES : Basic Mathematics with Probability & Statistics

INDUSTRIES APPLICABLE TO : All leading construction companies.

COURSE OUTLINE :

This course will cover the basic concepts in Project Planning and Control with a focus on construction projects. The course is relevant to Civil Engineering senior level undergraduate as well as post-graduate students in the area of construction management. Practicing engineers who are part of the planning team on construction projects will also benefit from the concepts covered in the course.

ABOUT INSTRUCTOR :

Prof. Koshy Varghese is a Professor with the Building Technology & Construction Management Division of Department of Civil Engineering, Indian Institute of Technology Madras (IITM). Prof. Varghese earned his Doctoral Degree at the University of Texas at Austin in 1992 and worked as a Post-Doctoral Fellow for a year after which he joined IIT Madras. Prof. Varghese is a pioneer in construction management education and research in India and He has received numerous academic honors, and he is on the editorial-board of several international journals. He is also a Member of the Board of Directors of ILCE (Institute for Lean Construction Excellence).

COURSE PLAN :

Week 01 : Introduction, Course Context, Construction Project Management

Week 02 : Time Management, Work Breakdown Structure (WBS), Gantt Charts

Week 03 : Duration Estimation, Network Representation & Analysis -1

Week 04 : Network Representation & Analysis -2; Two-Span Bridge: Scheduling, Network Analysis and Application

Week 05 : Time-Cost Trade-off (Crashing)

Week 06 : Resource Scheduling

Week 07 : Precedence Diagramming Method (PDM), Project Monitoring & Control

Week 08 : Project Monitoring & Control (Earned Value Concepts), Uncertainty in Project Schedules (PERT), Course Summary

Week 1:

BASICS OF PYTHON SPYDER (TOOL)

- Introduction Spyder
- Setting working Directory
- Creating and saving a script file
- File execution, clearing console, removing variables from environment, clearing environment
- Commenting script files
- Variable creation
- Arithmetic and logical operators
- Data types and associated operations

Week 2:

Sequence data types and associated operations

- Strings
- Lists
- Arrays
- Tuples
- Dictionary
- Sets
- Range

NumPy

- ndarray

Week 3:

Pandas dataframe and dataframe related operations on Toyota Corolla dataset

1. Reading files
2. Exploratory data analysis
3. Data preparation and preprocessing

Data visualization on Toyoto Corolla dataset using matplotlib and seaborn libraries

1. Scatter plot
2. Line plot
3. Bar plot
4. Histogram
5. Box plot
6. Pair plot

Control structures using Toyota Corolla dataset

1. if-else family
2. for loop
3. for loop with if break
4. while loop

Week 4: CASE STUDY

Regression

1. Predicting price of pre-owned cars

Classification

1. Classifying personal income



QUALITATIVE RESEARCH METHODS AND RESEARCH WRITING

PROF. ARADHNA MALIK
Department of Management Studies
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | PG
COURSE DURATION : 12 weeks (18 Jan' 21 - 09 Apr' 21)
EXAM DATE : 24 Apr 2021

PRE-REQUISITES : Bachelors Degree

INTENDED AUDIENCE : Interested Students

INDUSTRIES APPLICABLE TO : Education.

COURSE OUTLINE :

Qualitative research methods serve to explore the grey areas that remain outside the confines of quantitative predictive research in human behavior. Training in qualitative research is absolutely essential to understand and explore the dynamic nature of the society in which we function. This course introduces students to qualitative research and helps them understand how qualitative research supplements quantitative inquiry in human behavior and the social sciences.

ABOUT INSTRUCTOR :

Prof. Aradhna Malik earned her Masters in Child Development from Panjab University, Chandigarh, India and PhD from University of Denver, USA. She has been serving Indian Institute of Technology Kharagpur as faculty in the School of Management since 2008. Aradhna teaches intercultural communication, business ethics and organizational behavior to Undergraduate, Masters and Doctoral level students. Her research and academic interests include, ageing, orality, human technology interaction, intercultural communication, communication disorders, management of public health and neuro linguistic programming (NLP).

COURSE PLAN :

Week 1: Introduction to qualitative research, Introduction, The Qualitative Researcher

Week 2: Major paradigms & perspectives, Dominant paradigms of qualitative research, Interpretivist thinking, Verstehen

Week 3: Major paradigms & perspectives (Contd.), Critical theory, Characteristics of critical theory

Week 4: Strategies of inquiry, Introduction to qualitative inquiry, Qualitative research design

Week 5: Strategies of inquiry (Contd.), Grounded Theory, Participatory Action Research

Week 6: Methods of collecting & analyzing empirical materials, Observations, Interviewing

Week 7: Methods of collecting & analyzing empirical materials (Contd.), Analyzing talk & text

Week 8: Interpretation, evaluation & presentation, The problem of criteria, Interpretation

Week 9: What, why and how of technical and research writing.

Week 10: Literature review.

Week 11: Writing about methods, results, and discussion of results.

Week 12: Referencing, academic integrity, and writing for different types of readers



RENEWABLE ENERGY ENGINEERING: SOLAR, WIND AND BIOMASS ENERGY SYSTEMS

Prof. R. Anandalakshmi

Department of Chemical Engineering
IIT Guwahati

Prof. Vaibhav Vasant Goud

Department of Chemical Engineering
IIT Guwahati

INTENDED AUDIENCE : The target audience for this course is

1. B.Tech/M.Tech/PhD students or faculties interested in acquiring knowledge of solar, wind and biomass renewable energy systems
2. Chemical engineer/Mechanical engineer or Biosciences and Bioengineer designing renewable energy systems such as solar, wind and biomass systems
3. Executives, engineers and researchers from manufacturing, service and government organizations including R&D laboratories working in the area of energy engineering.

INDUSTRIES APPLICABLE TO : All Energy Industries and Energy Equipment Manufacturing Industries

COURSE OUTLINE :

In this course an attempt has been made to standardize the course material and to emphasize on the fundamental of non-conventional energy sources (solar, wind, and biomass). Harnessing the energy through these sources using efficient technologies is expected to play an important role in serving as clean energy source for mankind. Thus, processes to harness energy are steadily gaining technical and economic importance worldwide. Therefore, it is necessary for energy planners/ users to know the facts as well as limitations of these technologies. This course aims at bringing the technological developments and research trends in the field of non-conventional energy sources with emphasis on engineering and design aspects. After attending this course students will have insight of biomass types, classifications, selective utilization of biomass resource for extraction of energy, bio-digester, wind machine and thermo-digester design.

ABOUT INSTRUCTOR :

Prof. R. Anandalakshmi is an Associate Professor in the Department of Chemical Engineering, Indian Institute of Technology, Guwahati. Her research interests are in the area of Computational Heat Transfer and Fluid Flow, Process Modeling and Simulation, Solar Thermal Energy Conversion, Energy Efficient Design of Thermal Systems, Microwave Assisted Food and Material Processing, Food Packaging and Preservation, Refrigeration and Air-conditioning Systems

Prof. Vaibhav V. Goud is Professor in the Department of Chemical Engineering, Indian Institute of Technology Guwahati, India since 2018. Principal research interests of Dr. Goud are in the fields of reaction engineering, renewable energy, supercritical fluids, bio lubricants. He has published more than 120 papers in international peer reviewed journals and made presentations of his research in several national/ international conferences. He has also written 14 book chapters in the area of renewable energy. He has taught energy resources as an elective course to UG, PG and Ph.D. students at IIT Guwahati for six consecutive years (2014, 2015, 2016, 2017, 2018 and 2019).

COURSE PLAN :

Week 1: Solar Energy: Basics and Concepts

Week 2: Non-Concentrating Solar Collectors

Week 3: Non-Concentrating Solar Collectors : Practice Problems

Week 4: Concentrating Solar Collectors

Week 5: Storage Systems

Week 6: Biomass types and characterization

Week 7: Biochemical conversion processes

Week 8: Biochemical conversion processes (Contd.)

Week 9: Bioconversion of substrates into alcohol and thermo-chemical conversion of biomass

Week 10: Bioconversion of substrates into alcohol and thermo-chemical conversion of biomass (Contd.)

Week 11: Wind Energy: Basics: Turbine terms, types and theories

Week 12: Characteristics and Power Generation from Wind Energy



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Software Testing

By Prof. Meenakshi D'souza | IIIT Bangalore

Learners enrolled: 15572

Software Testing _ Course Introduction



ABOUT THE COURSE :

This course will cover various techniques for test case design, as used for testing of software artifacts including requirements, design and code. We will discuss algorithms and techniques for test case design based on graphs, logic, syntax of programming

Summary

Course Status : Completed
Course Type : Elective
Duration : 12 weeks
Category :

- Computer Science and Engineering

Credit Points : 3
Level : Undergraduate/Postgraduate
Start Date : 25 Jul 2022
End Date : 14 Oct 2022
Enrollment Ends : 08 Aug 2022
Exam Date : 30 Oct 2022 IST





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INTENDED AUDIENCE: Any Interested Learners

PRE-REQUISITES: Programming, Algorithms, Discrete Mathematics (basics)

INDUSTRY SUPPORT: The material

of this course has been used to offer training for Samsung, ABB and Mindtree. The course will be useful for any firm that does tests their software.

inputs. Special techniques for testing object-oriented features and web

so be discussed. The course will end with a About Swayam (<https://swayam.gov.in/about>)

cover test cases for both white-box and black-box.

Note: This exam date is subjected to change based

on the availability. You can check final exam date ()

on your hall ticket.

This is an AICTE approved FDP course

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(https://www.addtoany.com/share?url=https%3A%2F%2Fonlinecourses.nptel.ac.in%2Fnoc22_cs61%2Fpr%20Course)

Course layout

Week 1: Techniques and algorithms for test case design: Graphs based testing-structural coverage criteria.

Week 2: Graphs based testing: Data flow coverage criteria

Week 3: Graphs based testing: Data flow coverage criteria

Week 4: Graphs coverage for source code, design elements and requirements

Week 5: Techniques and algorithms for test case design: Logic based testing-Predicates, logic based coverage criteria

Week 6: Specification based logic coverage, logic coverage on finite state machines

Week 7: Input space partitioning: Input domain modeling, combination strategies criteria

Week 8: Syntax based testing: Coverage criteria based on syntax, mutation testing

Week 9: Test case design (as learnt above) applied to object-oriented applications

Week 10: Test case design (as learnt above) applied to web applications

Week 11: Symbolic testing

Week 12: Concolic testing, Conclusion





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Instructor bio

(https://swayam.gov.in/nc_details/NPTEL)



**Prof. Meenakshi
D'souza**

IIIT Bangalore

Prof. Meenakshi D'souza is currently an Associate Professor at IIIT-Bangalore. Meenakshi did her Master TMs in Mathematics from University of Madras, Chennai and her Ph. D. in Theoretical Computer Science from The Institute of Mathematical Sciences, Chennai. She joined the research department of Honeywell Technology Solutions, Bangalore soon after completing her Ph. D. and worked there in the areas of Formal Verification of Software Design, Model Based Development and Physical Access Control before joining IIIT-Bangalore. Her research interests are in Formal Methods, Model Based Development, Software Testing and Automata Theory.

Course certificate

The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.

The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).

Date and Time of Exams: **30 October 2022** Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.

Registration url: Announcements will be made when the registration form is open for registrations.

The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.

Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE

Average assignment score = 25% of average of best 8 assignments out of the total 12





in the course.

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Final score = Average assignment score + Exam score



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Certificate will have your name, photograph and the score in the final exam with the breakup. It will have the logos of NPTEL and IIT Madras. It will be e-verifiable at nptel.ac.in/noc (<http://nptel.ac.in/noc>).

Only the e-certificate will be made available. Hard copies will not be dispatched.

Once again, thanks for your interest in our online courses and certification. Happy learning.

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Initiative by : Ministry of Education (Govt of India)





Strength Of Materials - IITM

Prof. K. Ramesh

Department of Mechanical Engineering
IIT Madras

INTENDED AUDIENCE: Undergraduate students and practicing engineers/scientists from mechanical sciences Industries and Research laboratories

PREREQUISITES: Engineering Mechanics

INDUSTRY SUPPORT: All Mechanical, Aerospace and Structural Design Industries dealing with structural design would require this

COURSE OUTLINE:

The course will cover the basics of mechanics of deformable solids undergoing small deformations. The syllabus includes: Concepts of state of stress, strain and stress-strain and stress-strain-temperature relations. Exposure to experimental evaluation of stresses by photoelasticity and strain gauges. Stresses developed in torsion, bending, and shear-stresses in bending for slender members. Exposure to unsymmetrical bending and shear center. Bending deflection by various methods with particular emphasis to method of superposition. Stability of columns. Concepts of stress concentration, stress intensification and theories of failures. Extensive use of animations with supportive experimental results will be the unique feature of the course

ABOUT THE INSTRUCTOR:

Prof .K. Ramesh is currently the K Mahesh Chair Professor at the Department of Applied Mechanics, IIT Madras; and formerly a Professor at the Department of Mechanical Engineering, IIT Kanpur. He has made significant contributions to the advancement of Digital Photoelasticity. He received his undergraduate degree in Mechanical Engineering from the Regional Engineering College, Trichy (now NIT, Trichy), Postgraduate degree from the Indian Institute of Science, Bangalore and the Doctoral Degree from the Indian Institute of Technology Madras.

He has made significant contributions to the advancement of Digital Photoelasticity. This has resulted in a Monograph on Digital Photoelasticity Advanced Techniques and Applications (2000), Springer, a chapter on Photoelasticity in the Springer Handbook of Experimental Solid Mechanics (2009), a chapter on Digital Photoelasticity in the book on Digital Optical Measurement Techniques and Applications (2015), Artech House London and a recently published book on Developments in Photoelasticity - A renaissance (2021), IOP Publishing, UK. He has over 190 publications to date of which two have been reproduced in the Milestone Series of SPIE. His research has been funded by organizations such as ARDB, ISRO, DST, EU (FP7) and NSF. He received the Zandman award for the year 2012, the first Indian to receive it since its inception in 1989, instituted by the Society for Experimental Mechanics, USA for his outstanding research contributions in applications utilizing photoelastic coatings.

He has been a Fellow of the Indian National Academy of Engineering since 2006. He received several awards such as Distinguished Alumnus Award of NIT, Trichy (2008), President of India Cash Prize (1984). He has been a member of the Editorial Boards of the International Journals: Strain (since 2001), Journal of Strain Analysis for Engineering Design (2009–10), Optics and Lasers in Engineering, and a steering committee member of Asian Society for Experimental Mechanics since its inception in 2000.

For Details See: <https://home.iitm.ac.in/kramesh>

COURSE PLAN:

Week 1: Introduction to the course, Stress vector

Week 2: Stress tensor, Equilibrium conditions, Mohr's circle

Week 3: Proof of Mohr's circle, Principal stress and its directions, Octahedral and deviatoric stresses

Week 4: Free surface, Stress and Strain measurement (Photoelasticity and various strain measurement techniques)

Week 5: Strain Tensor, Tension test

Week 6: Stress strain relations, Interrelations between elastic constants, Thermal strain

Week 7: Torsion

Week 8: Bending - Euler Bernoulli hypothesis, Flexure formula, Engineering analysis

Week 9: Bending - Shear stresses, Composite beams, Shear in I beams and shear centre

Week 10: Unsymmetrical bending, Deflection

Week 11: Deflection, Theories of failure

Week 12: Theories of failure, Stability



THE JOY OF COMPUTING USING PYTHON

PROF. SUDARSHAN IYENGAR

Department of Computer Science and Engineering
IIT Ropar

INTENDED AUDIENCE : Any interested audience

PREREQUISITES : 10th standard/high school

INDUSTRY SUPPORT : Every software company is aware of the potential of a first course in computer science. Especially of a first course in computing, done right.

COURSE OUTLINE :

A fun filled whirlwind tour of 30 hrs, covering everything you need to know to fall in love with the most sought after skill of the 21st century. The course brings programming to your desk with anecdotes, analogies and illustrious examples. Turning abstractions to insights and engineering to art, the course focuses primarily to inspire the learner's mind to think logically and arrive at a solution programmatically. As part of the course, you will be learning how to practice and culture the art of programming with Python as a language. At the end of the course, we introduce some of the current advances in computing to motivate the enthusiastic learner to pursue further directions.

ABOUT INSTRUCTOR :

Prof. Sudarshan Iyengar, Associate Professor at the CSE at IIT Ropar has a Ph.D. from the Indian Institute of Science (IISc). An exemplary teacher who has delivered over 350 popular science talks to students of high school and advanced graduate programmes. Prof. Sudarshan has offered more than 100 hours of online lectures with novel teaching methodologies that have reached lakhs of Students. His research interests include Data Sciences, Social Computing, Social Networks, Collective Intelligence, Crowdsourced Technologies and Secure Computation.

COURSE PLAN :

- Motivation for Computing
- Welcome to Programming!!
- Variables and Expressions : Design your own calculator
- Loops and Conditionals : Hopscotch once again
- Lists, Tuples and Conditionals : Lets go on a trip
- Abstraction Everywhere : Apps in your phone
- Counting Candies : Crowd to the rescue
- Birthday Paradox : Find your twin
- Google Translate : Speak in any Language
- Currency Converter : Count your foreign trip expenses
- Monte Hall : 3 doors and a twist
- Sorting : Arrange the books
- Searching : Find in seconds
- Substitution Cipher : What's the secret !!
- Sentiment Analysis : Analyse your Facebook data
- 20 questions game : I can read your mind
- Permutations : Jumbled Words
- Spot the similarities : Dobble game
- Count the words : Hundreds, Thousands or Millions.
- Rock, Paper and Scissor : Cheating not allowed !!
- Lie detector : No lies, only TRUTH
- Calculation of the Area : Don't measure.
- Six degrees of separation : Meet your favourites
- Image Processing : Fun with images
- Tic tac toe : Let's play
- Snakes and Ladders : Down the memory lane.
- Recursion : Tower of Hanoi
- Page Rank : How Google Works !!



ADVANCED COMPUTER ARCHITECTURE

PROF. JOHN JOSE

Department of Computer Science and Engineering
IIT Guwahati

TYPE OF COURSE : Rerun | Elective | PG

COURSE DURATION : 8 weeks (21 Feb'22 - 15 Apr'22)

EXAM DATE : 24 Apr 2022

PRE-REQUISITES : A basic understanding of Computer Organisation & Architecture or Microprocessors

INTENDED AUDIENCE : Anyone in CSE and related fields (like ECE, EEE, IT etc.) with an interest of exploring Computer Architecture

INDUSTRIES APPLICABLE TO : Intel, AMD, IBM, Nvidia etc

COURSE OUTLINE :

Applications and handheld devices play a major role in ensuring comfort in our day- today life. These applications run on handheld electronic gadgets with high-end microprocessor support. Modern CPU designers handle challenges imposed by these applications with cost effective architectural enhancements. This course provides a deeper insight into the design of high-end microprocessors that will support the future applications.

ABOUT INSTRUCTOR :

Prof. John Jose is an Assistant Professor in Department of Computer Science and Engineering, Indian Institute of Technology, Guwahati. Prior to this he worked as faculty in Rajagiri School of Engineering and Technology and Viswajyothi College of Engineering and Technology, Kerala for 7 years. He completed his Ph.D degree in Department of Computer Science and Engineering, Indian Institute of Technology, Madras. He has guided over 8 M.Tech thesis and is currently supervising 6 PhD thesis and 2 M.Tech thesis. His area of interest is in on-chip interconnection networks and cache management techniques for large multicore systems. He is the principal investigator of two sponsored R&D projects funded by DST, Govt of India. He is having active research collaboration with University of Catania-Italy, ITRI Taiwan, and BITS Pilani-Dubai Campus.

COURSE PLAN :

Week 1: Review of Basic Computer Organization, Performance Evaluation Methods, Introduction to RISC Instruction Pipeline, Instruction Pipeline and Performance.

Week 2: Pipeline Hazards and Analysis, Branch Prediction, MIPS Pipeline for Multi-Cycle Operations.

Week 3: Compiler Techniques to Explore Instruction Level Parallelism, Dynamic Scheduling with Tomasulo's Algorithm and Speculative Execution.

Week 4: Advanced Pipelining and Superscalar Processors, Exploiting Data Level Parallelism: Vector and GPU Architectures, Architectural Simulation using gem5.

Week 5: Introduction to Cache Memory, Block Replacement Techniques and Write Strategy, Design Concepts in Cache Memory.

Week 6: Basic and Advanced Optimization Techniques in Cache Memory, Cache Optimization using gem5.

Week 7: Introduction to DRAM System, DRAM Controllers and Address Mapping, Secondary Storage Systems, Design Concepts in DRAM and Hard Disk.

Week 8: Tiled Chip Multicore Processors(TCMP), Routing Techniques in Network on Chip(NoC), NoC Router Microarchitecture, TCMP and NoC: Design and Analysis, Future Trends in Computer Architecture Research.



ADVANCED MACHINING PROCESSES

PROF. MANAS DAS

Department of Mechanical Engineering
IITGuwahati

INTENDED AUDIENCE : Intended for UG and PG students who plan to take up this subject as their future research area. Also, for practitioner in industries who want to implement new development technologies in advanced machining to their factory.

INDUSTRIES APPLICABLE TO : Bharat Heavy Electricals Limited (BHEL), Hindustan Aeronautics Limited (HAL), Defense Research and Development Organization (DRDO), Die manufacturing industries, Automobile Industries, Machine Tool Industries, Precision medical equipment manufacturing industries, High precision optics and semiconductor industries

COURSE OUTLINE :

There is a need for machine tools and processes which can accurately and easily machine the most difficult-to-machine materials and workpieces with intricate and accurate shapes. In order to meet these challenges, a number of newer material removal processes have now been developed to the level of commercial utilization. These newer methods are also called unconventional in the sense that conventional tools are not employed for metal cutting. Instead, energy in its direct form is used to remove the material from the workpiece. This course aims at bringing the students up-to-date with the latest technological developments and research trends in the field of unconventional / nontraditional / modern machining processes.

ABOUT INSTRUCTOR :

Prof. Manas Das is an Assistant Professor in the Department of Mechanical Engineering, Indian Institute of Technology Guwahati, India since 2012. He received his Masters and Ph.D. degree from Mechanical engineering Department, IIT Kanpur. His research areas include Advanced Finishing and Nano-finishing Processes, Magnetorheological Finishing (MRF) Process, Advanced/Non-traditional Machining Processes, Micromachining processes. Dr. Das has published more than 20 papers in reputed journal and conferences. He has also written 2 book chapters in the area of surface finishing. Presently, he is supervising 5 Ph.D. students in the broad area of manufacturing.

COURSE PLAN :

Week 1 : Introduction to advanced machining processes and their classification
Ultrasonic machining and its modelling and analysis

Week 2 : Abrasive jet machining (AJM)

Water jet cutting (WJC) and Abrasive water jet machining (AWJM)
Magnetic abrasive finishing (MAF) and its modelling

Week 3 : Abrasive flow finishing (AFF) and its modelling
Magnetorheological finishing (MRF)

Week 4 : Magnetorheological abrasive flow finishing (MRAFF) and its modelling and analysis

Week 5 : Electric discharge machining (EDM): Principle, applications, process parameters, and modelling

Electric Discharge Grinding (EDG), Electric Discharge Diamond Grinding (EDDG), and Wire Electric Discharge Machining (W-EDM)

Week 6 : Laser beam machining (LBM)

Plasma arc machining (PAM)
Electron Beam Machining (EBM)

Week 7 : Electro chemical machining (ECM): Principle, applications, and process parameters and modelling

Week 8 : Electrochemical Grinding (ECG), Electrostream Drilling (ESD), Shaped Tube Electrolytic Machining (STEM), Chemical machining (ChM)

Artificial Intelligence - Video course

ARTIFICIAL INTELLIGENCE

The course will cover basic ideas and techniques underlying the design of intelligent computer systems. Topics include:
Introduction to AI and intelligent agents.

Problem Solving : Solving Problems by Searching, heuristic search techniques, constraint satisfaction problems, stochastic search methods.

Game Playing : minimax, alpha-beta pruning.

Knowledge and Reasoning : Building a Knowledge Base :
Propositional logic, first order logic, situation calculus. Theorem Proving in First Order Logic.

Planning, partial order planning.

Uncertain Knowledge and Reasoning, Probabilities, Bayesian Networks.

Learning : Overview of different forms of learning, Learning Decision Trees, Neural Networks.

Introduction to Natural Language Processing.



NP-TEL

NPTEL

<http://nptel.ac.in>

Computer Science and Engineering

Coordinators:

Prof. Anupam Basu

Department of Computer Science
and Engineering IIT Kharagpur

Prof. S. Sarkar

Department of Computer Science
and Engineering IIT Kharagpur



AN INTRODUCTION TO PROGRAMMING THROUGH C++

PROF. ABHIRAM G. RANADE

Department of Computer Science
IIT Bombay

TYPE OF COURSE : Rerun | Core | UG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 24 Apr 2022

PRE-REQUISITES : Standard XII in the Science stream.

INTENDED AUDIENCE : First and second year students in degree programs including Engineering and Science degree programs.

INDUSTRIES APPLICABLE TO : Basic programming is of value to all. C++ allows you to design very fast programs and access low level machine features, but at the same time its libraries provide a very high level programming model. It can be considered a modern, safer version of the C language.

COURSE OUTLINE :

This course provides an introduction to problem solving and programming using the C++ programming language. The topics include: Basic programming notions. Control flow, variables and assignments state-ments, conditional execution, looping, function calls including recursion. Arrays and structures. Elementary aspects of classes. Heap memory. Program design. How human beings solve problems manually. Strategies for translating manual strategies to computer programs. Organizing large programs into units such as functions and classes. Introduction to assertions and invariant. Programming applications. Arithmetic on polynomials, matrices. Root finding. Sorting and searching. Design of editors and simulators, including graphical editors. Elementary animation. A rudimentary graphics system will be discussed. Standard Library of C++. The string, vector and map classes.

ABOUT INSTRUCTOR :

Prof. Abhiram G. Ranade is a Professor of Computer Science and Engineering at IIT Bombay. He obtained a B. Tech. degree in Electrical Engineering from IIT Bombay in 1981. In 1988 he obtained a Ph.D. in Computer Science from Yale University, USA. He was an Assistant Professor of Electrical Engineering and Computer Science at the University of California, Berkeley, USA during 1988-94. Since 1995 he has been a faculty member in IIT Bombay. His research interests are Algorithms, Combinatorial Optimization, Scheduling in Transportation Systems, and Programming Education. He has won Excellence in Teaching Awards of IIT Bombay in 2006-7 and 2010-11.

COURSE PLAN :

Week 1: Introduction to computers using graphics. Notions of program organization, control flow.

Week 2: Basic data types. Variables. Assignment statement. Introduction to program design using examples such as summing infinite series.

Week 3: Statements of C++ for conditional execution and looping.

Week 4: Applications such as computing mathematical functions, root finding.

Week 5: Functions. Parameter passing. Recursion. Correctness issues.

Week 6: Recursive algorithms and recursive drawings. Breaking larger programs into functions.

Week 7: Arrays. Basic array processing strategies including passing arrays to functions. Pointers. Applications illustrating use of arrays to store sets and sequences. Iterating over pairs of objects from an array, Selection sort.

Week 8: Use of arrays to represent textual data. Multidimensional arrays. Command line arguments. Binary search. Merge sort.

Week 9: Structures. Pointers with structures. Structure examples.

Week 10: Dynamic memory allocation. Basic mechanisms and pitfalls.

Week 11: Use of the standard library in designing programs. Design of medium size programs.

Week 12: A program for designing and solving resistive circuits with a graphical user interface.



AN INTRODUCTION TO PROGRAMMING THROUGH C++

PROF. ABHIRAM G. RANADE

Department of Computer Science
IIT Bombay

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ABOUT INSTRUCTOR :

Prof. Abhiram G. Ranade is a Professor of Computer Science and Engineering at IIT Bombay. He obtained a B. Tech. degree in Electrical Engineering from IIT Bombay in 1981. In 1988 he obtained a Ph.D. in Computer Science from Yale University, USA. He was an Assistant Professor of Electrical Engineering and Computer Science at the University of California, Berkeley, USA during 1988-94. Since 1995 he has been a faculty member in IIT Bombay. His research interests are Algorithms, Combinatorial Optimization, Scheduling in Transportation Systems, and Programming Education. He has won Excellence in Teaching Awards of IIT Bombay in 2006-7 and 2010-11.

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Week 9: Structures. Pointers with structures. Structure examples.

Week 10: Dynamic memory allocation. Basic mechanisms and pitfalls.

Week 11: Use of the standard library in designing programs. Design of medium size programs.

Week 12: A program for designing and solving resistive circuits with a graphical user interface.



BIG DATA COMPUTING

PROF. RAJIV MISRA

Department of Computer science and engineering
IIT Patna

PRE-REQUISITES : Data Structure & Algorithms, Computer Architecture, OperatingSystem, Database Management Systems

INDUSTRY SUPPORT : Companies like Amazon, Microsoft, Google, IBM, Facebook

COURSE OUTLINE :

In today's fast-paced digital world , the incredible amount of data being generated every minute has grown tremendously from sensors used to gather climate information, posts to social media sites, digital pictures and videos, purchase transaction records, and GPS signals from cell phone to name a few. This amount of large data with different velocities and varieties is termed as big data and its analytics enables professionals to convert extensive data through statistical and quantitative analysis into powerful insights that can drive efficient decisions. This course provides an in-depth understanding of terminologies and the core concepts behind big data problems, applications, systems and the techniques, that underlie today's big data computing technologies. It provides an introduction to some of the most common frameworks such as Apache Spark, Hadoop, MapReduce, Large scale data storage technologies such as in-memory key/value storage systems, NoSQL distributed databases, Apache Cassandra, HBase and Big Data Streaming Platforms such as Apache Spark Streaming, Apache Kafka Streams that has made big data analysis easier and more accessible. And while discussing the concepts and techniques, we will also look at various applications of Big Data Analytics using Machine Learning, Deep Learning, Graph Processing and many others. The course is suitable for all UG/ PG students and practicing engineers/ scientists from the diverse fields and interested in learning about the novel cutting edge techniques and applications of Big Data Computing.

ABOUT INSTRUCTOR :

Prof. Rajiv Misra is working in Department of Computer Science and Engineering at Indian Institute of Technology Patna, India. He obtained his Ph.D degree from IIT Kharagpur, M.Tech degree in Computer Science and Engineering from the Indian Institute of Technology (IIT) Bombay, and Bachelor's of engineering degree in Computer Science from MNIT Allahabad. His research interests spanned a design of distributed algorithms for Mobile, Adhoc and Sensor Networks, Cloud Computing and Wireless Networks. He has contributed significantly to these areas and published more than 70 papers in high quality journals and conferences, and 2 book chapters. His h-index is 10 with more than 590 citations. He has authored papers in IEEE Transactions on Mobile Computing, IEEE Transaction on Parallel and Distributed Systems, IEEE Systems Journal, Adhoc Networks, Computer Network, Journal of Parallel and Distributed Computing. He has edited a book titled as "Smart Techniques for a Smarter Planet: Towards Smarter Algorithms" for the "Studies in Fuzziness and Soft Computing" book series, Springer (2018). He has supervised four Phd students and currently four Phd students working under his supervision in the area of big data, cloud computing, distributed computing, and sensor networks. He is a senior member of the IEEE and fellow of IETE. He has completed as the Principal Investigator of R&D Project Sponsored by DeITY entitled as "Vehicular Sensor and Mesh Networks based Future ITS". He has mentored the online courses on Cloud Computing, Advanced Graph Theory and Distributed Systems in the platform of NPTEL

COURSE PLAN :

Week 1: Introduction to Big Data

Week 2: Introduction to Enabling Technologies for Big Data

Week 3: Introduction to Big Data Platforms

Week 4: Introduction to Big Data Storage Platforms for Large Scale Data Storage

Week 5: Introduction to Big Data Streaming Platforms for Fast Data

Week 6: Introduction to Big Data Applications (Machine Learning)

Week 7: Introduction of Big data Machine learning with Spark

Week 8: Introduction to Big Data Applications (Graph Processing)



BLOCKCHAIN AND ITS APPLICATIONS

PROF. SANDIP CHAKRABORTY

Department of Computer Science and Engineering
IIT Kharagpur

PROF. SHAMIK SURAL

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Computer Networks; Operating Systems; Cryptography and Network Security

INTENDED AUDIENCE : Undergraduate Students, Postgraduate Students, Industry Associates

INDUSTRIES APPLICABLE TO : IBM; HPE; Intel; Any startups working on Blockchain

COURSE OUTLINE :

In the last few years, Blockchain technology has generated massive interest among governments, enterprises, and academics, because of its capability of providing a transparent, secured, tamper-proof solution for interconnecting different stakeholders in a trustless setup. In January 2021, the Ministry of Electronics and Information Technology (MeiTY), Government of India, published the first draft of the "National Strategy on Blockchain" that highlights 17 potential applications that are of national interest. Against this backdrop, this subject will cover the basic design principles of Blockchain technology and its applications over different sectors. Additionally, the course also provides tutorials on setting up blockchain applications using one of the well-adopted permissionless blockchain platforms -Ethereum, and one permissioned blockchain platform - Hyperledger.

ABOUT INSTRUCTOR :

Prof. Sandip Chakraborty is working as an Associate Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology (IIT) Kharagpur. He obtained his Bachelor of Engineering (BE) degree from Jadavpur University, Kolkata in 2009 and Master of Technology (M Tech) and Doctor of Philosophy (Ph.D.), both from IIT Guwahati, in 2011 and 2014, respectively. The primary research interests of Dr. Chakraborty is in the intersection of Computer Systems, Pervasive Computing, and Human-Computer Interaction. Dr. Chakraborty is leading the System and Mobile Research Lab at IIT Kharagpur, focusing on various aspects of computer systems and networks along with the design and development of ubiquitous and pervasive sensing systems. He is one of the founding members of ACM IMOBILE, the ACM SIGMOBILE chapter in India. He is working as an Area Editor of Elsevier Ad Hoc Networks and Elsevier Pervasive and Mobile Computing journal. He has received various awards and accolades including Excellent Young Teacher Award 2021, INAE Young Engineers' Award, Fellow of National Internet Exchange of India (NIXI), and so on. Further details about his works and publications can be obtained from <https://cse.iitkgp.ac.in/~sandipc/index.html>.

Prof. Shamik Sural is a full professor in the Department of Computer Science and Engineering, Indian Institute of Technology (IIT) Kharagpur. He received the Ph.D. degree from Jadavpur University, Kolkata, India in the year 2000. Before joining IIT Kharagpur in 2002, he spent more than a decade in the Information Technology industry working in India as well as in Michigan, USA. Prof. Sural was a recipient of the Alexander van Humboldt Fellowship for Experienced Researchers in 2009, which enabled him to carry out collaborative research at the Technical University of Munich, Germany. Later in 2018, he was awarded a Humboldt Foundation Alumni Fellowship for a renewed research stay in Germany. He also spent the Fall 2019 semester at Rutgers University, USA as a Fulbright scholar engaged in both teaching and research. During this period, he visited several other universities in the USA for delivering invited lectures. Prof. Sural is a senior member of IEEE and has previously served as the Chairman of the IEEE Kharagpur Section in 2006. He is currently on the editorial boards of IEEE Transactions on Dependable & Secure Computing, IEEE Transactions on Services Computing and Sadhana – a journal of the Indian Academy of Sciences. He has published more than two hundred research papers in reputed international journals and conferences. His research interests include computer security, data mining and multimedia systems.

COURSE PLAN :

Week 1: Introduction to Blockchain Technology and its Importance

Week 2: Basic Crypto Primitives I - Cryptographic Hash

Week 3: Basic Crypto Primitives II - Digital Signature

Week 4: Evolution of the Blockchain Technology

Week 5: Elements of a Blockchain

Week 6: Blockchain Consensus I - Permissionless Models

Week 7: Blockchain Consensus II - Permissioned Models

Week 8: Smart Contract Hands On I - Ethereum Smart Contracts (Permissionless Model) **Week 9:** Smart Contract
Hand On II - Hyperledger Fabric (Permissioned Model)

Week 10: Decentralized Identity Management

Week 11: Blockchain Interoperability

Week 12: Blockchain Applications



GOOGLE CLOUD COMPUTING FOUNDATIONS

Prof. Soumya Kanti Ghosh

Department of Computer Science and Engineering
IIT Guwahati

COURSE OUTLINE :

The Google Cloud Computing Foundations course aims to provide a detailed overview of concepts covering cloud basics, big data, and machine learning and where and how the Google Cloud Platform fits in. The course involves understanding concepts and perform hands-on training (via Qwiklabs platform) to practice the learning. There are 26 labs on Qwiklabs that are part of the course.

Those enrolling for the course should ideally:

- Have basic IT knowledge and be interested in learning more about Cloud and ML.
- Have competency in at least one language (such as Python, Java).
- Be familiar with the basics of shell scripting, SQL.

Disclaimer:

Google may contact you by email to provision benefits and send surveys and other communication related to the Google Cloud Computing Foundations Course.

By joining, you agree to Google Cloud Training tracking your grades and other activity in it's learning program.

ABOUT INSTRUCTOR :

Prof. Soumya K. Ghosh received the Ph.D. and M.Tech. degrees from Department of Computer Science and Engineering, Indian Institute of Technology (IIT), Kharagpur, India. Presently, he is a Professor with Department of Computer Science and Engineering, IIT Kharagpur. Before joining IIT Kharagpur, he worked for the Indian Space Research Organization in the area of satellite remote sensing and geographic information systems. He has more than 200 research papers in reputed journals and conference proceedings. His research interests include spatial data science, spatial web services and cloud computing.

COURSE PLAN :

Week 0: Introduction to the course

Week 1: So, What's the Cloud anyway? Start with a Solid Platform

Week 2: Use GCP to build your Apps

Week 3: Where do I store this stuff?

Week 4: There's an API for that! You can't secure the Cloud right?

Week 5: It helps to network!

Week 6: It helps to network (continued)

Week 7: Let Google keep an eye on things. You have the data, but what are you doing with it?

Week 8: Let machines do the work

COMPUTER GRAPHICS

COURSE LAYOUT

Week 1 : Introduction – historical evolution, issues and challenges, graphics pipeline, hardware and software basics

Week 2 : Object representation – boundary representation, splines, space partitioning

Week 3 : Modeling transformations – matrix representation, homogeneous coordinate system, composition, 3D transformations

Week 4 : Illumination and shading – background, simple lighting model, shading models, intensity representation, color models, texture synthesis

Week 5 : 3D viewing – viewing pipeline, view coordinate system, viewing transformation, projection, window-viewport transformation

Week 6 : Clipping and hidden surface removal – clipping in 2D. 3D clipping algorithms, hidden surface removal

Week 7 : Rendering – scan conversion of line, circle, fill-area and characters, anti-aliasing

Week 8 : Graphics hardware and software – generic architecture, I/O, GPU, Shader programming, graphics software (openGL)



COMPUTER INTEGRATED MANUFACTURING

PROF. JANAKARAJAN RAMKUMAR

Department of Mechanical Engineering
IIT Kanpur

PROF. AMANDEEP SINGH

Department of Mechanical Engineering
IIT Kanpur

PRE-REQUISITES : The student should have completed two semesters of UG Engineering or Science program.

INTENDED AUDIENCE : Students of all Engineering and Science disciplines.

INDUSTRIES APPLICABLE TO : HAL, NAL, SAIL, ISRO

COURSE OUTLINE :

Use of computers in manufacturing in order to design and develop the products has found unprecedented applications. Computer integrated way of manufacturing provides a myriad of benefits such as speed, flexibility, and better control. In this course, Computer Integrated Manufacturing (CIM) approaches are discussed. CAD/CAM tools and their within and between the production systems are presented along with appropriate case studies. Data storage and handling is also the need of contemporary manufacturing systems. This is also catered using software tools. The course is reinforced with the laboratory demonstrations to add a practitioners' touch. Students would develop a process to largely plan, design and develop a product and a production system after completing this course

ABOUT INSTRUCTOR :

Prof. Janakarajan Ramkumar is Professor of Mechanical Engineering Department, and Design Program, at Indian Institute of Technology, Kanpur. He teaches manufacturing science, micro/nano technology, new product development. He has a bachelor's in Production Engineering with his doctorate in Defect quantification in drilling of composites from IIT Madras, India with a best thesis award. Over the years his contribution in teaching and research is remarkable. He has worked for BOSCH group and improved the productivity of the company. His research and teaching focus is on nano technology and inclusive design. He has several international and national patents in his credit and has published more than 100 journal papers

Prof. Amandeep Singh is working as Research Scientist in the Mechanical Engineering Department, and Design Program, Indian Institute of Technology, Kanpur, India. He holds PhD degree from Indian Institute of Technology Kanpur, India, and a bachelor degree in Production Engineering. Dr. Singh has ten years of industrial and academic experience. His research interests are Sustainable Manufacturing Processes and Systems, Simulation of Manufacturing Systems, Product Design and Manufacturing, Applied Ergonomics and Engineering Metrology. He has traveled in countries like US, Canada, and Australia to present his research in various international conferences organized by reputed bodies like CIRP and IEOM. His research is also published in various international reputed journals.

COURSE PLAN :

Week 1: Introduction to Computer Integrated Manufacturing (CIM)

Week 2: Computer Aided Design

Week 3: Computer Aided Manufacturing

Week 4: Computer Numerical Control

Week 5: Computer Aided Process Planning (CAPP)

Week 6: CIM interfaces: CAD vs CAM

Week 7: Data and information in CIM

Week 8: Manufacturing Systems and their design

Week 9: Simulation of Manufacturing Systems

Week 10: Computer Aided Maintenance

Week 11: Computer Integrated Additive Manufacturing

Week 12: Advanced CIM techniques



COMPUTER NETWORKS AND INTERNET PROTOCOL

PROF. SOUMYA KANTI GHOSH

Department of Computer Science and Engineering
IIT Kharagpur

PROF. SANDIP CHAKRABORTY

Department of Computer Science and Engineering
IIT Kharagpur

INTENDED AUDIENCE : CSE, ECE, EE students

INDUSTRIES APPLICABLE TO : IT industries

COURSE OUTLINE :

The domain of Internet has grown in a rapid pace from traditional circuit switched and packet switched small scale networks to modern high-speed mobile and wireless Internet. A large number of methods, architectures and designs came up at every protocol level to cope up with the demands for developing a secure and highly dependable information technology infrastructure. The broad objective of the course is to understand - (i) the architecture and principles of today's computer networks, (ii) the protocols and their functionalities, (iii) the requirements for the future Internet and its impact on the computer network architecture. In this course, we'll broadly cover the basic TCP/IP protocol stack and touch on the next generation computer networks. We'll take a top-down approach to cover different protocols at the TCP/IP protocol stack.

ABOUT INSTRUCTOR :

Prof. Soumya K. Ghosh received Ph.D. and M.Tech. degrees from Department of Computer Science and Engineering, Indian Institute of Technology (IIT, Kharagpur). Presently, he is a Professor with Department of Computer Science and Engineering, IIT Kharagpur. Before joining IIT Kharagpur, he worked for the Indian Space Research Organization in the area of satellite remote sensing and geographic information systems. He has more than 200 research papers in reputed journals and conference proceedings. His research interests include spatial data science, spatial web services and cloud computing.

Prof. Sandip Chakraborty received Ph.D. and M.Tech. degrees from Department of Computer Science and Engineering, Indian Institute of Technology (IIT, Guwahati). Presently, he is an Assistant Professor with Department of Computer Science and Engineering, IIT Kharagpur. He has around 100 research papers in reputed journals and conference proceedings. His research interests include computer systems, distributed systems and mobile computing.

COURSE PLAN :

- Week 1 :** Introduction to Computer Networks History, Circuit Switching and Packet Switching
- Week 2 :** TCP/IP Protocol Stack – Basic Overview
- Week 3 :** Application Layer Services (HTTP, FTP, Email, DNS)
- Week 4 :** Transport Layer Primitives – Connection Establishment and Closure
- Week 5 :** Flow Control and Congestion Control at the Transport Layer
- Week 6 :** Transmission Control Protocol – Basic Features, TCP Congestion Control
- Week 7 :** Network Layer Primitives – IP Addressing
- Week 8 :** IP Routing – Intra Domain Routing Protocols, Inter Domain Routing Protocols (BGP)
- Week 9 :** IP Services – SNMP, ARP
- Week 10 :** Data Link Layer Service Primitives – Forwarding, Flow Control, Error Control
- Week 11 :** Media Access Control - Channel Access Protocols, Framing
- Week 12 :** End to End Principles of Computer Networks



CONSUMER BEHAVIOUR

PROF. SRABANTI MUKHERJEE

Department of Management
IIT Kharagpur

INDUSTRIES APPLICABLE TO : Marketing Department of the companies dealing in B2C and B2B markets

COURSE OUTLINE :

Drawing heavily from the fields of psychology, anthropology and economics; the concepts of Consumer Behaviour puts forth the decision-making processes of buyers, both individually and in groups. It studies the decision-making parameters at both individual as well as group levels as endeavors to understand the consumer preferences and choice heuristics. The course will also bring forth the parameters, process and conflicts while considering family as decision-making unit. The course will sensitize the participants about how the aforesaid concepts will help them in designing appropriate marketing mix and the overall marketing strategy.

ABOUT INSTRUCTOR :

Prof. Srabanti Mukherjee is an Assistant Professor in Marketing at Vinod Gupta School of Management, Indian Institute of Technology Kharagpur, India. She holds a PhD degree from Indian Institute of Engineering Science and Technology Shibpur, India. Prior to joining this Institute she has taught in several premiere institutes including Indian Institute of Management Indore, Indian Institute of Social Welfare and Business Management, IEST Shibpur and Visva Bharti University. Her key teaching interests are consumer behaviour, marketing to the bottom of the pyramid, and advanced marketing research. She has authored a book titled Consumer Behaviour, Cengage Learning India Pvt. Ltd. Apart from publishing quite a few papers in peer-reviewed journals and conferences, she has also registered business cases in Ivey Publishing portal co-distributed through Harvard Business School Publishing.

COURSE PLAN :

Week 1: Introduction to Consumer Behaviour, The Changing Patterns of Consumer Behaviour, Use of Market, Segmentation in Consumer Behaviour, Dimensions of Consumerism, Process of Motivation

Week 2: Theories of Motivation-1, Theories of Motivation-2, Consumer Involvement, Case study on Motivation and Involvement, Consumer perception and imagery

Week 3: Case Study on Consumer Perception formation, Theories of Personality, Self-Concept, Learning theories, Case Study on Consumer Learning Process

Week 4: Attitude Formation-1, Attitude Formation-2, Changing Attitude, Attitude Formation, Case Study on Consumer, Consumers' Value

Week 5: AIO classification of Lifestyle, VALSTM Typology, Application of Lifestyle in Marketing, Culture and subculture, Group as a determinant of buyer behaviour

Week 6: Celebrities as Reference group, Concept of family and family life-cycle, Family Buying Decisions, Case Study on Family Buying Decisions, Diffusion of Innovation

Week 7: Opinion Leadership Types of Consumer Buying Behaviour, Black-Box Model, Modelling Buyer Behaviour-1, Modelling Buyer Behaviour-2

Week 8: Modelling Buyer Behaviour-3, Modelling Industrial buyer Behaviour-1, Modelling Industrial buyer Behaviour-2, Dimensions of Consumer Research, Course Wrap up



CONSUMER PSYCHOLOGY

PROF. NAVEEN KASHYAP

Department of Humanities and Social Sciences
IIT Guwahati

INTENDED AUDIENCE : UG / PG / PhD

COURSE OUTLINE :

Human beings have basic needs that they fulfill by making transactions in the market. Transactions mostly in the form of monetary exchange for goods and services are very basic for the survival of the human race. The present course is designed to study how consumers behave on the market and what the consequences of various behavior patterns. Additionally, the present course also looks at various psychological factors that shape the behavior and actions of the consumer in the global market.

ABOUT INSTRUCTOR :

Prof. Naveen Kashyap, Ph.D is an Associate Professor of Psychology at the Indian Institute of Technology Guwahati. His research interests are sleep and human cognitive processes. Dr Kashyap has been teaching courses like cognitive psychology, introduction to psychology, consumer psychology, advanced cognitive process and research methodology to UG and PG students of IITG for the past 10 years.

COURSE PLAN :

Week 1: Introduction to Consumer Psychology

Week 2: Overview of foundation of consumer behavior.

Week 3 : Consumer Decision Making

Week 4 : Purchase process and consumption; Consumer learning and brand loyalty

Week 5 : Low involvement decision making; Situational influences.

Week 6 : The Individual Consumer; Consumer perceptions; Consumer information processing and acquisition

Week 7 : Attitudes; Attitude reinforcement and change

Week 8 : Marketing Communications.



DATA ANALYSIS AND DECISION MAKING - I

PROF. RAGHU NANDAN SENGUPTA

Department of Management
IIT Kanpur

PRE-REQUISITES : Probability & Statistics, Operations Research

INTENDED AUDIENCE : Masters in Business Administration, Masters in Economics, Masters in Statistics/Mathematics, Masters in Industrial Engineering, Masters in Operations Research/Operations Management, Phd in related fields as mentioned above

INDUSTRIES APPLICABLE TO : Manufacturing industry, chemical industry, steel industry, cement industry, etc.

COURSE OUTLINE :

This is the first part of the three part course (DADM-I, DADM-II, DADM-III) which covers Operations Research and its tools with applications. In general Decision Analysis and Decision Making (DADM) covers three main areas which are: Multivariate Statistical Analysis with its applications, Other Decision Making Models like DEA, AHP, ANP, TOPSIS, etc., and Operations Research and its tools with applications. These three part DADM course will be more practical and application oriented rather than theoretical in nature.

ABOUT INSTRUCTOR :

Prof. Raghu Nandan Sengupta completed his bachelors in engineering in Mechanical Engineering from Birla Institute of Technology Mesra, Ranchi INDIA and his FPM (PhD) from Indian Institute of Management Calcutta, INDIA with specialization in Operations Management. His research interests are in Sequential Analysis, Statistical & Mathematical Reliability, Optimization and its use in Financial Optimization. His research work has been published in journals like Metrika, European Journal of Operational Research, Sequential Analysis, Computational Statistics & Data Analysis, Communications in Statistics: Simulation & Computation, Quantitative Finance, etc. At Indian Institute of Technology Kanpur, INDIA he is a Professor in the Industrial & Management Engineering department and teaches courses like Probability & Statistics, Stochastic Processes & their Applications, Management Decision Analysis, Financial Risk Management, etc. He is also the recipient of IUSSTF Fellowship 2008 and visited Operations Research & Financial Engineering department at Princeton University, USA, ERASMUS MUNDUS Fellowship 2011 to Warsaw University, POLAND, EU-NAMASTE Fellowship 2015 to IST, University of Lisboa, PORTUGAL, DAAD Fellowship 2015 to TU Dresden, GERMANY.

COURSE PLAN :

Week 1: Introduction to Multivariate Analysis

Week 2: Joint and marginal Distribution

Week 3: Multinomial, Multivariate Normal, Multivariate t, Wishart and other Distributions

Week 4: Multivariate Extreme Valued Distributions

Week 5: Copula Method

Week 6: Multiple Linear Regression, Multiple Non-Linear Regression, etc.

Week 7: Factor Analysis

Week 8: MANOVA, MANCOVA, etc.

Week 9: Conjoint Analysis

Week 10: Cluster Analysis

Week 11: Multiple Discriminant Analysis

Week 12: Multidimensional Scaling, Structural Equation Modeling



DATA ANALYTICS WITH PYTHON

PROF. A RAMESH

Department of Management Studies
IIT Roorkee

INTENDED AUDIENCE : Management, Industrial Engineering and Computer Science Engineering Students

INDUSTRIES APPLICABLE TO : Any analytics company

COURSE OUTLINE :

We are looking forward to sharing many exciting stories and examples of analytics with all of you using python programming language. This course includes examples of analytics in a wide variety of industries, and we hope that students will learn how you can use analytics in their career and life. One of the most important aspects of this course is that you, the student, are getting hands-on experience creating analytics models; we, the course team, urge you to participate in the discussion forums and to use all the tools available to you while you are in the course!

ABOUT INSTRUCTOR :

Prof. Ramesh Anbanandam graduated in Production Engineering from Madras University, Chennai. He did his post-graduation from National Institute of Technology, Trichy. He later earned his Ph.D. in Supply Chain Management from Indian Institute of Technology Delhi. His professional interest includes Humanitarian Supply Chain Management, Operations Management, Operations Research, Healthcare Waste Management, Sustainable Multi-model and Freight Transportation, Transportation Asset Management and Advanced Data Analytics using Python and R-programming. He has published various research articles in reputed journals. He was also awarded Emerald Literati Award for Excellence under "Highly Commended Research Paper in the Year 2011 and 2016" in the field of Supply Chain Management.

COURSE PLAN :

Week 1: Introduction to data analytics and Python fundamentals

Week 2: Introduction to probability

Week 3: Sampling and sampling distributions

Week 4: Hypothesis testing

Week 5: Two sample testing and introduction to ANOVA

Week 6: Two way ANOVA and linear regression

Week 7: Linear regression and multiple regression

Week 8: Concepts of MLE and Logistic regression

Week 9: ROC and Regression Analysis Model Building

Week 10: χ^2 Test and introduction to cluster analysis

Week 11: Clustering analysis

Week 12: Classification and Regression Trees (CART)



DATA BASE MANAGEMENT SYSTEM

PROF. PARTHA PRATIM DAS

Department of Computer Science and Engineering
IIT Kharagpur

PROF. SAMIRAN CHATTOPADHYAY

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Procedural and / or Object-Oriented Programming (C / C++ / Java / Python), Data Structures, Algorithms

INTENDED AUDIENCE : Students from all disciplines can enroll for this course.

INDUSTRIES APPLICABLE TO : DBMS is so fundamental that all companies dealing with systems as well as application development (including web, IoT, embedded systems, data mining, machine learning) have a need for the same. These include – Microsoft, Samsung, Xerox, Yahoo, Google, IBM, TCS, Infosys, Amazon, Flipkart, etc.

COURSE OUTLINE :

Databases form the backbone of all major applications today – tightly or loosely coupled, intranet or internet based, financial, social, administrative, and so on. Structured Database Management Systems (DBMS) based on relational and other models have long formed the basis for such databases. Consequently, Oracle, Microsoft SQL Server, Sybase etc. have emerged as leading commercial systems while MySQL, PostgreSQL etc. lead in open source and free domain.

While DBMS's differ in the details, they share a common set of models, design paradigms and a Structured Query Language (SQL). In this background the course examines data structures, file organizations, concepts and principles of DBMS's, data analysis, database design, data modeling, database management, data & query optimization, and database implementation. More specifically, the course introduces relational data models; entity-relationship modeling, SQL, data normalization, and database design. Further it introduces query coding practices using MySQL (or any other open system) through various assignments. Design of simple multi-tier client / server architectures based and Web-based database applications is also introduced.

ABOUT INSTRUCTOR :

Prof. Partha Pratim Das received his BTech, MTech and PhD degrees in 1984, 1985 and 1988 respectively from IIT Kharagpur. He served as a faculty in Department of Computer Science and Engineering, IIT Kharagpur from 1988 to 1998. In 1998, he joined Alumnus Software Ltd as a Business Development Manager. From 2001 to 2011, he worked for Interra Systems, Inc. as a Senior Director and headed its Kolkata Center. In 2011, he joined back to Department of Computer Science and Engineering, IIT Kharagpur as Professor. Prof. Das has also served as a Visiting Professor with Institute of Radio Physics and Electronics, Calcutta University from 2003 to 2013.

Prof. Das is currently the Head of Rajendra Mishra School of Engineering Entrepreneurship, the Professor-inCharge of the upcoming Research Park of IIT Kharagpur at Rajarhat, Kolkata, and the Joint Principal Investigator of National Digital Library of India project of MHRD.

Prof. Das has taught several courses in Computer Science including Software Engineering, Object-Oriented Systems, Programming and Data Structure, Compiler Design, Design and Analysis of Algorithms, Information System Design, Database Management Systems, Computational Geometry, Principles of Programming Languages, Embedded Systems, and Image Processing. Jointly with 2 others, he has also offered a course on Introduction to Design of Algorithms under the T10KT program of NME-ICT, MHRD (<https://www.facebook.com/t10kt.algorithms/>) to nearly 7000 teachers. Further, Dr. Das has been offering Programming in C++ and Object-Oriented Analysis and Design in NPTEL-NOC. Both courses are regularly attended by thousands of students.

Prof. Das has published over 40 technical papers in international journals in areas of Digital Geometry, Image Processing, Parallel Computing and Knowledge-based Systems. In 2013 he has co-authored a research monograph titled Digital Geometry in Image Processing (CRC Press). His current interests include Human-Computer Interactions, Computer Analysis of Indian Classical Dance, Object-Oriented Systems Analysis and Design, Software Engineering, Compiler Technology, and Technology Enabled Learning. Dr. Das is a member of Association of Computing Machinery (ACM), The Institute of Electrical and Electronics Engineers (IEEE), and Indian Unit for Pattern Recognition and Artificial Intelligence (IUPRAI).

Prof. Samiran Chattopadhyay obtained his B Tech and M Tech degree in 1987 and 1989 respectively from IIT Kharagpur. He obtained his PhD degree from Jadavpur University in 1993. He served as a faculty in the Department of Computer Science and Engineering, Jadavpur University from 1989 to 1993. In 1993, he moved to industry and joined back the same department in Jadavpur University as an Associate Professor in 1997. Since 2001, he is a Professor of Information Technology in Jadavpur University.

Prof. Chattopadhyay is also a visiting fellow of the University of Northumbria, Newcastle upon Tyne UK. He was an adjunct faculty at IIT Kharagpur for the Distributed Systems course and a visiting faculty member for the MTech course by IIT Kharagpur which was offered in distance learning mode.

Dr. Chattopadhyay has more than two decades of experience of serving reputed Industry houses including Mindware, Computer Associates TCG Software, Interra Systems India Ltd. He is also a project consultant of the prestigious National Digital Library Mission of Government of India.

Prof. Chattopadhyay has taught several courses in Computer Science including Software Engineering, Object-Oriented Systems, Programming and Data Structure, Compiler Design, Design and Analysis of Algorithms, Information System Design, Database Management Systems, Ad hoc Wireless Networks, Cloud Computing. Dr. Chattopadhyay has been a co-faculty in Database Management Systems in NPTEL-NOC.

Prof. Chattopadhyay has published over 60 technical papers in international journals in the areas of Wireless Networks, Network Security, Machine learning applications. He has co-authored a research monograph titled 'Digital Geometry in Image Processing', a textbook titled 'Data Structures through C' and 'Big Data in e-Healthcare'. His current research interests include Network Security, Machine learning, Wireless network and Pervasive computing.

COURSE PLAN :

Week 1: Course Overview, Introduction to RDBMS

Week 2: Structured Query Language (SQL)

Week 3: Relational Algebra, Entity-Relationship Model

Week 4: Relational Database Design

Week 5: Application Development, Case Studies, Storage and File Structure

Week 6: Indexing and Hashing, Query Processing

Week 7: Query Optimization, Transactions (Serializability and Recoverability)

Week 8: Concurrency Control, Recovery Systems, Course Summarization

SEA BASED VLSI DESIGN

Week-1: Introduction to Electronic Design Automation

Week-2: Introduction to C-based VLSI Design: Background

Week-3: Introduction to C-based VLSI Design: HLS Flow

Week-4: C-Based VLSI Design: Scheduling

Week-5: C-Based VLSI Design: Resource allocation and Binding, Data-path and Controller Generation

Week-6: Efficient Synthesis of C Code

Week-7: Hardware Efficient C Coding

Week-8: Impact of Compiler Optimizations in Hardware

Week-9: Verification of High-level Synthesis

Week-10: FPGA Technology Mapping

Week-11: Securing Design with High-level Synthesis

Week-12: Recent Advances in C-Based VLSI Design



DESCRIPTIVE STATISTICS WITH R SOFTWARE

Prof. Shalabh

Department of Mathematics
IITK

Prof. Prashant Jh

Department of Mathematics
NIT

INTENDED AUDIENCE: UG students of Science and Engineering. Students of humanities with basic mathematical and statistical background can also do it. Working professionals in analytics can also do it.

PRE-REQUISITES: Mathematics background up to class 12 is needed. Some minor statistics background is desirable

INDUSTRIES SUPPORT :All industries having R & D set up will use this course.

COURSE OUTLINE :

Any data analysis is incomplete without statistics. After getting the data, any statistical analysis starts with descriptive statistics which aims to extract the information hidden inside the data. The tools of descriptive statistics are based on mathematical and statistical functions which are to be evaluated using the software. The statistical software are paid as well as free. Most of the statistical software are paid software. A popular free statistical software is R. What are the basic tools of descriptive statistics and how to use the R software for descriptive statistical analysis is the objective of the course to be taught

ABOUT INSTRUCTOR :

Prof. Shalabh is a Professor of Statistics at IIT Kanpur. His research areas of interest are linear models, regression analysis and econometrics. He has more than 23 years of experience in teaching and research. He has developed several web based and MOOC courses in NPTEL including on regression analysis and has conducted several workshops on statistics for teachers, researchers and practitioners. He has received several national and international awards and fellowships. He has authored more than 75 research papers in national and international journals. He has written four books and one of the book on linear models is co- authored with Prof. C.R. Rao.

Prof. Prashant Jha is an Assistant Professor in the Department of Mathematics at NIT Sikkim. His research areas of interest are nonparametric regression, and shape restricted regression. He has recently completed his Ph.D. from the Department of Mathematics and Statistics, IIT Kanpur. He has worked as a Teaching Assistant in several MOOC courses in NPTEL including Introduction to R software and Descriptive statistics with R software. He has received NBHM Research Award, and CSIR fellowship for Research during his Ph.D.

COURSE PLAN :

Week 1: Calculations with R Software

Week 2: Introduction to Descriptive Statistics, frequency distribution

Week 3: Graphics and Plots

Week 4: Central Tendency of Data

Week 5: Variation in Data

Week 6: Moments, Association of Variables

Week 7: Association of Variables

Week 8: Association of Variables, Fitting of Linear Models



ELECTRICAL ENGINEERING

Design for Internet of Things

Type of Course	: New
Course Snapshot	: Elective / PG : Practicing professional, System Designers
Pre-requisites	: Computer Network Basics
Course Duration	: 20 hours / 8 weeks

COURSE OUTLINE:

A high level view of IOTs, design of smart objects that provide collaboration and ubiquitous services will be explored. Design for longevity/energy efficiency will be highlighted. Step by step system design will be introduced. Small video chips that will allow students to prototype will be displayed. At the end of the course, the student is expected to make the right choice of hardware, software and protocols for the proposed application

INSTRUCTOR:

Prof. T V Prabhakar
Department of Electronic Systems Engineering
IISc Bangalore



ABOUT INSTRUCTOR:

Prof. Prabhakar Venkata works as Principal Research Scientist in the Department of Electronic Systems Engg, IISc, Bangalore. His area of work is in Networked Embedded Systems. His research interest is in Energy Harvesting and Power Management Algorithms for sensor networks. The broad spectrum comprises of Modelling, Virtual Prototyping, System Building and Performance evaluation. His current work in LED based communication won the best demo award in COMSNETS 2014. He is currently working on energy harvesting technologies in chip design, indoor localization applications, and other battery less applications.

COURSE PLAN:

- Week 1 : Introduction to IOTs - Improving Quality of Life
- Week 2 : Challenges to solve in IOTs - Energy / Power, Data Explosion, Security
- Week 3 : System design of an IOT System - Power supply, Processor, Memory Sensor Interface
- Week 4 : Wireless Interfaces - LAN - BLE, Wi-Fi, RFID, LP WAN - LORA, LTE-M, Sigfox, NB-IOT
- Week 5 : Power supply design - LDOs, Switching regulators - BuckBoost Converters, Energy Measurements
- Week 6 : Energy harvesting and battery life calculation - PV, RF, Kinetic Energy, TEGs, aeroelastic flutter, Harvesting ICs in silicon
- Week 7 : Protocols - IoT MAC, REST based COAP, Publish subscribe- MQTT, AMQP, MDNS
- Week 8 : Building an IOT System - Case Studies -Joule Jotter, Chhaya.

Cloud computing

Week 1: Introduction to Cloud Computing

Week 2: Cloud Computing Architecture

Week 3: Service Management in Cloud Computing

Week 4: Data Management in Cloud Computing

Week 5: Resource Management in Cloud

Week 6: Cloud Security

Week 7: Open Source and Commercial Clouds, Cloud Simulator

Week 8: Research trend in Cloud Computing, Fog Computing

Week 9: VM Resource Allocation, Management and Monitoring

Week 10: Cloud-Fog-Edge enabled Analytics

Week 11: Serverless Computing and FaaS Model

Week 12: Case Studies and Recent Advancements



DEVELOPING SOFT SKILLS AND PERSONALITY

PROF. T. RAVICHANDRAN

Department of Humanities and Social Sciences
IIT Kanpur

INTENDED AUDIENCE : Students, Teachers, Professionals, Trainers, Leaders, Employers

INDUSTRIES APPLICABLE TO : All industries/companies/organisations will recognize and value this course and recommend this for their employees and trainee programs.

COURSE OUTLINE :

The course aims to cause a basic awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality. Hard or technical skills help securing a basic position in one's life and career. But only soft skills can ensure a person retain it, climb further, reach a pinnacle, achieve excellence, and derive fulfillment and supreme joy. Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills.

ABOUT INSTRUCTOR :

Prof. T. RAVICHANDRAN is presently a Professor of English in the Department of Humanities and Social Sciences at the Indian Institute of Technology Kanpur, Uttar Pradesh, India. He has written about fifty research articles/book chapters, supervised six doctoral theses, edited a special issue on Cyberpunk Literature for the Creative Forum Journal, and published a book on Postmodern Identity. He is a recipient of the Fulbright-Nehru Academic and Professional Excellence Fellowship (2014-15) for his research/teaching at Duke University, North Carolina, USA. He is honored with Champa Devi Gangwal Chair Professorship at IIT Kanpur. In his distinguished twenty-five years of teaching career, he has taught various courses in English Language and Literature. His NPTEL Video and Web courses on Communication Skills are well-acclaimed nationally and internationally. His NPTEL MOOC on Developing Soft Skills and Personality became hugely popular and well-received by about fifteen thousand participants from India and abroad

COURSE PLAN:

Week 1: Lecture 1: Introduction: A New Approach To Learning

Lecture 2: Planning And Goal-Setting

Lecture 3: Human Perceptions: Understanding People

Lecture 4: Types Of Soft Skills: Self-Management Skills

Lecture 5: Aiming For Excellence: Developing Potential And Self-Actualisation

Lecture 6: Need Achievement And Spiritual Intelligence

Week 2: Lecture 7: Conflict Resolution Skills: Seeking Win-Win Solution

Lecture 8: Inter-Personal Conflicts: Two Examples

Lecture 9: Inter-Personal Conflicts: Two Solutions

Lecture 10: Types Of Conflicts: Becoming A Conflict Resolution Expert

Lecture 11: Types Of Stress: Self-Awareness About Stress

Lecture 12: Regulating Stress: Making The Best Out Of Stress

- Week 3:** **Lecture 13:** Habits: Guiding Principles
Lecture 14: Habits: Identifying Good And Bad Habits
Lecture 15: Habits: Habit Cycle
Lecture 16: Breaking Bad Habits
Lecture 17: Using The Zeigarnik Effect For Productivity And Personal Growth
Lecture 18: Forming Habits Of Success
- Week 4:** **Lecture 19:** Communication: Significance Of Listening
Lecture 20: Communication: Active Listening
Lecture 21: Communication: Barriers To Active Listening
Lecture 22: Telephone Communication: Basic Telephone Skills
Lecture 23: Telephone Communication: Advanced Telephone Skills
Lecture 24: Telephone Communication: Essential Telephone Skills
- Week 5:** **Lecture 25:** Technology And Communication: Technological Personality
Lecture 26: Technology And Communication: Mobile Personality?
Lecture 27: Topic: Technology And Communication: E-Mail Principles
Lecture 28: Technology And Communication: How Not To Send E-Mails!
Lecture 29: Technology And Communication: Netiquette
Lecture 30: Technology And Communication: E-Mail Etiquette
- Week 6:** **Lecture 31:** Communication Skills: Effective Communication
Lecture 32: Barriers To Communication: Arising Out Of Sender/Receiver's Personality
Lecture 33: Barriers To Communication: Interpersonal Transactions
Lecture 34: Barriers To Communication: Miscommunication
Lecture 35: Non-Verbal Communication: Pre-Thinking Assessment-1
Lecture 36: Non-Verbal Communication: Pre-Thinking Assessment-2
- Week 7:** **Lecture 37:** Nonverbal Communication: Introduction And Importance
Lecture 38: Non-Verbal Communication: Issues And Types
Lecture 39: Non-Verbal Communication: Basics And Universals
Lecture 40: Non-Verbal Communication: Interpreting Non-Verbal Cues
Lecture 41: Body Language: For Interviews
Lecture 42: Body Language: For Group Discussions
- Week 8:** **Lecture 43:** Presentation Skills: Overcoming Fear
Lecture 44: Presentation Skills: Becoming A Professional
Lecture 45: Presentation Skills: The Role Of Body Language
Lecture 46: Presentation Skills: Using Visuals
Lecture 47: Reading Skills: Effective Reading
Lecture 48: Human Relations: Developing Trust And Integrity

Computational fluid dynamics

Week 1: Introduction to Computational Fluid Dynamics, classification of partial differential equations their physical behavior

Week 2: Fundamentals of discretization

Week 3: Finite Volume approach and discretization of unsteady-state problems

Week 4: Important consequences of discretization of time-dependent diffusion type problems

Week 5: Discretization of time-dependent diffusion type problems (contd.); finite volume discretization of 2-D unsteady state diffusion type problems

Week 6: Solution of systems of linear algebraic equations (Part I)

Week 7: Solution of systems of linear algebraic equations (Part II)

Week 8: Solution of systems of linear algebraic equations (Part III)

Week 9: Solution of systems of linear algebraic equations (Part IV); A finite volume discretization of convection-diffusion equations (Part I)

Week 10: A finite volume discretization of convection-diffusion equations (Part II)

Week 11: A finite volume discretization of convection-diffusion equations (Part III), Discretization of Navier-Stokes equations (Part I)

Week 12: Discretization of Navier-Stokes equations (Part II)



ELECTRIC VEHICLES - PART 1

PROF. AMIT JAIN

Department of Electrical Engineering
IIT Delhi

PRE-REQUISITES : BE (Electrical)

INTENDED AUDIENCE : Interested Students

COURSE OUTLINE :

This course will be a first level course on electric vehicle. Students will be able to understand the operation of battery driven electric vehicle. The course will start with introduction section which will enable the students to understand the focus areas that come under the umbrella of electric vehicles. Then the course will start covering this focus areas one by one such as vehicle dynamics, Motors, Power Electronics, Batteries, Charging etc. The most important part of this course will be that each topic will be analyzed and demonstrated through Matlab Simulink, so that the grip of the subject will be strong and the knowledge acquired will be useable in real time applications.

ABOUT INSTRUCTOR :

Prof. Amit Kumar Jain is presently working as Associate Professor in Department of ElectricalEngineering, IIT Delhi. He is done his Ph.D and M.S from Department of ElectricalEngineering, I.I.Sc, Bangalore and spend around two years in General Electric GlobalResearch Center before joining IIT Delhi in 2012. He expertise includes electric drives forrenewable and electric vehicle application. He has also started a course on ElectricVehicles in IIT Delhi which is now been converted to NPTEL video course.

COURSE PLAN :

Week 1: Introduction to Electric Vehicle

Week 2: Vehicle Dynamics: Modelling and Simulation

Week 3: Fundamental of Drives and DC Machine Modeling

Week 4: DC Machine Drives and Control of EV Using DC Machine



ELECTRONICS ENCLOSURES THERMAL ISSUES

PROF. N. V. CHALAPATHI RAO

Department of Electronic Systems Engineering
IISc Bangalore

PRE-REQUISITES :12th Standard

INTENDED AUDIENCE : Registrants to BSc, BE, B.Tech, MSc and ME, M.Tech courses, Product design engineers (in related industry) Product Managers

INDUSTRIES APPLICABLE TO : Electronics and Mechanical involved in enclosure Design

COURSE OUTLINE : Electronics Design is understood as analysis and implementation at various levels from large systems installation to chip design. One of the aspects is failure due to temperature effects is constantly under study. Theory of Heat transfer has been understood and explained way back in 1700. Rigor and precision has resulted in seemingly complicated 'equations'. In the design of enclosures, managing heat is (relatively) well understood. Empirical results can be used to optimise the layout and reduce failure. Practices in use of heat management hardware are available from specialist manufacturers and can be used. This course is an attempt to familiarise the participating registrants with heat related issues in Design of Electronic Product enclosures.

ABOUT INSTRUCTOR :

Prof. N.V.Chalapathi Rao has worked in Defense R & D for 8 years. Has been delivering lectures since 1984 on topics related to equipment design at CEDT, DESE and CPDM of IISc. Has guided and built more than 100 projects at M. Tech level

COURSE PLAN :

1. Introduction to Enclosures and thermal issues
2. Basics of conductive heat transfer
3. Radiation at normal ambient
4. Convection basics
5. Forced convection
6. Combined modes

7. Use of Conduction in enclosures
8. Radiation as a speciality
9. Convective cooling in small products
10. Forced cooling in medium and large systems
11. Liquid cooled high power modules
12. Novelty phase change and thermo electric
13. Refrigerated cabinets

14. Heat sinks practical application
15. Blowers, fans, ventilations of systems
16. Instrumentation for measurement
17. Effects on sealed enclosures

18. Integration of ID with the heat aspects
19. Case stories in biological instruments
20. Case study of select participants' work
21. Application of Thermal CAD and round up



EMOTIONAL INTELLIGENCE

PROF. RABINDRA KUMAR PRADHAN

Department of Humanities and Social Sciences
IIT Kharagpur

INTENDED AUDIENCE : Engineering, Management, Social Sciences and Law students

INDUSTRIES APPLICABLE TO : Human resource management division, training & development division of both manufacturing and service industries, MBA and HRM students

COURSE OUTLINE :

“Intelligence quotient (IQ) gets you hired but emotional quotient (EQ) gets you promoted”. This popular quote by Times magazine during late nineties has made the concept of emotional intelligence more popular among people by highlighting its multiple implications and applications. The uses and utility of emotional intelligence at home, school and workplace have benefited thousands in many disciplines. This course is designed to sensitize the participants about the concept, theory and applications of emotional intelligence. The participants will get to know the added advantage of EQ the software of the brain over the hardware (IQ). This programme will also explore how our hearts rule over our heads for creative creation. It will also focus on how various principles of emotional intelligence guide us in different contexts of life. The awareness about the credo of emotional intelligence will develop insights into self-regulation and realization of one’s optimum potentials for better performance. The participants will come to know about many unknowns of life, which will further help them to enhance their awareness to be effective on their roles. The course will offer useful lessons with the help of practical exercises, games, audio-visual instruments, case studies, classroom interaction to show the road map how to foster emotional intelligence in organisation for achieving health, happiness and optimal performance at work.

ABOUT INSTRUCTOR :

Prof. Rabindra Kumar Pradhan is currently working as associate professor in the department of humanities and social sciences, Indian Institute of Technology Kharagpur. He is currently working in diverse areas of behavioral sciences and human resource management. He is actively involved in teaching, training & research in the fields of positive psychology, industrial and organizational psychology, human resource development and management, and organizational behavior. He has 18 years of experience in teaching, research and training. He has published 02 books on emotional intelligence, 01 book on human resource management and 01 book on human development through training. He has also published more than 70 journal articles and 22 book chapters. His research papers/ articles have been published in international journal Emerald Insights, Inderscience Publishers, Sage, Springer, Taylor & Francis, etc. Recently, Dr. Pradhan has been awarded with the “best trainer award-2012” by ISTD, Hyderabad and “best teacher award-2013” by ISTD, Kolkata for outstanding contribution in training & HRD. Some of his research papers have been awarded as “best paper” in ICOM-2015, Abu Dhabi and IBRC-2015, India.

COURSE PLAN :

Week 1: Introduction to emotion, intelligence & wisdom

Week 2: Concept, theory, measurement and applications of intelligence

Week 3: Emotional intelligence: concept, theory and measurements

Week 4: Correlates of emotional intelligence

Week 5: Emotional intelligence, culture, schooling and happiness

Week 6: For enhancing emotional intelligence EQ mapping

Week 7: Managing stress, suicide prevention, through emotional intelligence, spirituality and meditation

Week 8: Application of emotional intelligence at family, school and workplace



ENHANCING SOFT SKILLS AND PERSONALITY

PROF.T. RAVICHANDRAN

Department of Humanities and Social Sciences
IIT Kanpur

INTENDED AUDIENCE : Students, Teachers, Professionals, Trainers, Leaders, Employers

INDUSTRIES APPLICABLE TO : All industry/companies/organisations will recognize and value this course and recommend this for their employees and trainee programs.

COURSE OUTLINE :

The course aims to cause an enhanced awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality. Hard or technical skills help securing a basic position in one's life and career. But only soft skills can ensure a person retain it, climb further, reach a pinnacle, achieve excellence, and derive fulfilment and supreme joy. Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills. The focus of this course is on interpersonal and management skills. It has been approved for "Faculty Development Programme" by AICTE.

ABOUT INSTRUCTOR :

Prof. T. Ravichandran is presently a Professor of English in the Department of Humanities and Social Sciences at the Indian Institute of Technology Kanpur, Uttar Pradesh, India. He has written about fifty research articles/book chapters, supervised six doctoral theses, edited a special issue on Cyberpunk Literature for the Creative Forum Journal, and published a book on Postmodern Identity. He is a recipient of the Fulbright-Nehru Academic and Professional Excellence Fellowship (2014-15) for his research/teaching at Duke University, North Carolina, USA. He is honored with Champa Devi Gangwal Chair Professorship at IIT Kanpur. In his distinguished twenty-five years of teaching career, he has taught various courses in English Language and Literature. His NPTEL Video and Web courses on Communication Skills are well-acclaimed nationally and internationally. His NPTEL MOOC on Developing Soft Skills and Personality became hugely popular and well-received by about fifteen thousand participants from India and abroad.

COURSE PLAN :

Week 1 : Highlights of Developing Soft Skills and Personality Course-1-24 ; Highlights of Developing Soft Skills and Personality Course-25-48 ; Definitions and Types of Mindset ; Learning Mindsets ; Secrets of Developing Growth Mindsets

Week 2 : Importance of Time and Understanding Perceptions of Time ; Using Time Efficiently ; Understanding Procrastination ; Overcoming Procrastination ; Don't Say "Yes" to Make Others Happy!

Week 3 : Types of People ; How to Say "No" ; Controlling Anger ; Gaining Power from Positive Thinking-1 ; Gaining Power from Positive Thinking-2

Week 4 : What Makes Others Dislike You? ; What Makes Others Like You?-1 ; What Makes Others Like You?-2 ; Being Attractive-1 ; Being Attractive-2

Week 5 : Common Errors-1 ; Common Errors-2 ; Common Errors-3 ; Common Errors-4 ; Common Errors-5

Week 6 : Humour in Communication ; Humour in the Workplace ; Function of Humour in the Workplace ; Money and Personality ; Managing Money

Week 7 : Health and Personality ; Managing Health-1: Importance of Exercise ; Managing Health-2: Diet and Sleep ; Love and Personality ; Managing Love

Week 8 : Ethics and Etiquette ; Business Etiquette ; Managing Mind and Memory ; Improving Memory ; Care for Environment ; Highlights of the Course

COURSE LAYOUT

Week 1 : Fundamentals of Image processing

Week 2 : 2-D Projective Geometry, homography, and Properties of homography

Week 3 : Camera geometry

Week 4 : Stereo geometry

Week 5 : Stereo geometry

Week 6 : Feature detection and description

Week 7 : Feature matching and model fitting

Week 8 : Color processing

Week 9 : Range image processing

Week 10 : Clustering and classification

Week 11 : Dimensionality reduction and sparse representation

Week 12 : Deep neural architecture and applications



FUNDAMENTALS OF ADDITIVE MANUFACTURING TECHNOLOGIES

PROF. SAJJAN KAPIL

Department of Mechanical Engineering
IIT Guwahati

INTENDED AUDIENCE : Bachelor/Master/PhD students having background in Mechanical Engineering/Production Engineering/Manufacturing Technology

COURSE OUTLINE :

The progress of additive manufacturing processes is ever increasing with the development of the digital platform in the manufacturing sector, which is essential for the growth of modern technologies. This course is primarily designed for fundamental understanding of different additive manufacturing technologies for realizing the metallic and non-metallic objects. The syllabus is oriented to cover from basic understanding to practical applications of this technology to develop the products. Therefore, the academic people, as well as the industrial practitioner both, will be benefitted from this course. The special emphasis is given to link computer interface with the digital manufacturing process and their demonstration using commercially available software. The modules cover almost all the direction of additive manufacturing technologies, and it is blended with fundamental development to the recent technologies. The audience will be able to develop a fundamental understanding of different perspectives and recent development in this field through the lectures, skill development through demonstration, and reinforce their knowledge by solving assignments. This course is presented in a lucid and simplified way to make it enjoyable to the beginners.

ABOUT INSTRUCTOR :

Prof. Sajjan Kapil completed his Bachelor's degree in Mechanical Engineering from G. B. Pant Engineering College Pauri, Master's degree in Computer Assisted Manufacturing from IIT Guwahati & University of Stuttgart and Ph.D. from IIT Bombay. After that, he joined the Department of Mechanical Engineering IIT Guwahati as an Assistant Professor. His areas of research include 3D printing, Manufacturing Automation, and CAD/CAM. At IIT Bombay, he had developed an Additive Manufacturing process called "Hybrid Layered Manufacturing". He had simplified the manufacturing process of complex geometries by generating both 3 and 5-axis metal deposition toolpaths. He has published his research work in 13 international journals, 7 Indian patents, and more than 20 conferences. He has developed a new elective course entitled as 'Additive Manufacturing Technologies' at IIT Guwahati. He is involved in teaching the subjects like 'Additive Manufacturing Technologies', 'Kinematics of Machinery', 'Engineering Drawing', and 'Manufacturing Laboratory', at IIT Guwahati.

COURSE PLAN :

- Week 1** : Introduction to Additive Manufacturing
- Week 2** : Computer Aided Process Planning for Additive Manufacturing
- Week 3** : Computer Aided Process Planning for Additive Manufacturing
- Week 4** : Liquid Additive Manufacturing
- Week 5** : Liquid Additive Manufacturing
- Week 6** : Sheet Additive Manufacturing
- Week 7** : Wire Additive Manufacturing
- Week 8** : Wire Additive Manufacturing
- Week 9** : Wire Additive Manufacturing
- Week 10** : Powder Additive Manufacturing
- Week 11** : Powder Additive Manufacturing
- Week 12** : Powder Additive Manufacturing

CYBER SECURITY AND PRIVACY

Week 1:

Introduction – Introduction to cyber security, Confidentiality, integrity, and availability.

R1. From information security to cyber security. Computers and Security, 2013, accessible at:

<https://www.sciencedirect.com/science/article/pii/S0167404813000801>

Week 2:

Foundations – Fundamental concepts, CIA, CIA triangle, data breach at target.

R2. Chapter 1- Text

R3. Why you should care about the Target data breach? Business Horizons, 2016, accessible at:

<https://www.sciencedirect.com/science/article/abs/pii/S0007681316000033>

Week 3:

Security management, Governance, risk, and compliance (GRC)- GRC framework, security standards.

R4. Text-Chapter 4 – Planning for security, pp. 171- 176

Week 4:

Contingency planning – Incidence response, Disaster Recovery, BCP.

R5. Text-Chapter 4 – Planning for security, pp. 214-251

Week 5:

Cyber security policy – ESSP, ISSP, SYSSP.

R6. Text-Chapter 4- Information security policy, pp. 177-213.

R7. Internet insecurity: The end of cyber security. HBR, 2018, accessible at: <https://hbr.org/2018/05/internet-insecurity>

Week 6:

Risk Management – Cyber Risk Identification, Assessment, and Control.

R8. Text-Chapter 5- Risk management: Identifying and assessing risk.

R9. Case Study- Protecting the Cheddar: The end of cyber security. HBR, 2018, accessible at: <https://hbr.org/2018/05/case-study-protecting-the-cheddar>

Week 7:

Cyber security: Industry perspective – Defense Technologies, Attack, Exploits

R10. Text-Chapter 6-7- Security technology

Week 8:

Cyber security technologies – Access control, Encryption, Standards.

R11. Text-Chapter 8- Cryptography

R12. Active defense and hacking back: A primer- The end of cyber security. HBR, 2018, accessible at: <https://hbr.org/2018/05/active-defense-and-hacking-back-a-primer?ab=seriesnav-bigidea>

Week 9:

Foundations of privacy – Information privacy, Measurement, Theories.

R13. Privacy, Stanford Encyclopedia of Philosophy, 2013, accessible at: <https://plato.stanford.edu/entries/privacy/>

R14. We Googled you. HBR Online, 2007, accessible at: <https://hbr.org/2007/06/we-googled-you-2>

Week 10:

Privacy regulation – Privacy, Anonymity, Regulation, Data Breach.

R15. Text-Chapter 3- Law and ethics

R16. UNCTAD. Data Protection and Privacy Legislation Worldwide, accessible at:

<https://unctad.org/page/data-protection-and-privacy-legislation-worldwide>

Week 11:

Privacy regulation in Europe, Privacy: The Indian Way – Data Protection, GDPR, DPDP, Aadhar.

R17. GDPR: General Data Protection Directive (<https://gdpr-info.eu>)

R18. Privacy and security of Aadhaar: A Computer Science perspective, IIT Delhi, accessible at: <https://www.jstor.org/stable/pdf/26697657.pdf>

R19. The digital personal data protection bill, 2023

<https://www.meity.gov.in/writereaddata/files/Digital%20Personal%20Data%20Protection%20Protection%202023.pdf>

Week 12:

Information privacy: Economics and strategy, Economic value of privacy, privacy valuation, WTA and WTC, Business strategy and privacy, espionage, Privacy vs safety. R20. The dark side of customer analytics. HBR Case, 2007, accessible at:

<https://www.pomsmeetings.org/ConfPapers/052/052-0002.pdf>

R21. Apple privacy vs safety issues: <https://hbswk.hbs.edu/item/cold-call-apples-dilemma-balancing-privacy-and-safety-responsibilities>



FUNDAMENTALS OF AUTOMOTIVE SYSTEMS

PROF. C. S. SHANKAR RAM

Department of Design Engineering
IIT Madras

PRE REQUISITES: Rigid Body Dynamics (done in 1st year BE), Thermodynamics, Fluid Mechanics

INTENDED AUDIENCE: 3rd/4th year undergraduate and 1st year M.Tech./M.S./Ph.D. students

COURSE OUTLINE :

The objective of this course is to provide a fundamental understanding of the various systems of a typical automobile.

Course Outcomes: At the end of this course, the participant should be able to:

1. acquire fundamental knowledge of the various systems of an automobile,
2. associate the functions of each system with its design and layout, depict the various systems using simple schematics, and apply concepts learnt in core undergraduate courses to synthesize mathematical models of the various systems.

ABOUT INSTRUCTOR :

Prof. C. S. Shankar Ram is currently a professor in the Department of Engineering Design, Indian Institute of Technology Madras, Chennai, India. He received his Bachelor of Engineering (B. E.) in Mechanical Engineering from Motilal Nehru Regional Engineering College, Allahabad, India, and his M. S. and Ph. D. from Texas A&M University, USA. His research interests are in the areas of dynamics and control with applications to automotive and transportation systems. He teaches courses on Control Systems, Fundamentals of Automotive Systems and Control of Automotive Systems at IIT Madras

COURSE PLAN :

Week 1 : Course Overview, Classification of Internal Combustion Engines, Engine Components, Operation of Four Stroke Engines

Week 2 : Two Stroke Engines, Engine Cycles

Week 3 : Engine Performance, Supercharging, Combustion in Spark Ignition Engines

Week 4 : Combustion in Compression Ignition Engines, Carburetion, Fuel Introduction Systems

Week 5 : Engine Emissions, Emission Control Systems, Automotive Powertrain

Week 6 : Automotive Clutch, Transmission, Powertrain Analysis

Week 7 : Transmission Matching and Introduction to Brake System

Week 8 : Components of Brake System, Hydraulic Brake

Week 9 : Air Brake, Antilock Brake System

Week 10 : Braking Analysis, Introduction to Steering System, Manual Steering System

Week 11 : Power Steering System, Wheel Alignment, Introduction to Suspension System

Week 12 : Components of Suspension System, Dependent and Independent Suspension, Introduction to Electric and Hybrid Powertrain, Tyres.



GERMAN - I

PROF. MILIND BRAHME

Department of Humanities and Social Sciences
IIT Madras

INTENDED AUDIENCE : Anyone interested in learning elementary German

INDUSTRIES APPLICABLE TO : Companies / Organisations / Individuals having business / work with Germany, Austria and/or Switzerland

COURSE OUTLINE :

German I is meant to be an introduction to the German language and a basic orientation towards Germany (and to some extent Austria and Switzerland). Learning to understand and articulate oneself in day to day real life situations, and to begin to make sense of Germany as a cultural space are the overall objectives of the course. Serious learners should be able to grasp the basic sentence structure and build a good foundational vocabulary through this course.

ABOUT INSTRUCTOR :

Prof. Milind Brahme has an MA, M Phil and a PhD in German language and literature from the Centre of German Studies, JNU. He has been on the faculty of IIT Madras since 2003, and has more than 25 years of experience of teaching German language and literature in diverse situations and contexts.

COURSE PLAN :

Week 1: Themes: Introducing oneself and others; Grammar: W questions, personal pronouns, simple sentence, verb conjugation

Week 2: Themes: hobbies, the week, numbers, the alphabet, months, seasons / Grammar : articles , plural, the verbs to have and to be

Week 3: Theme: In the city / naming places and buildings, means of transport, basic directions / Grammar : definite and indefinite articles; negation - kein and nicht; imperative

Week 4: Themes: food, drink, family / groceries and meals / Grammar : the accusative

Week 5: Theme: Everyday life, telling time, making appointments / Grammar : prepositions am, um, von..bis; modal verbs, possessive articles

Week 6: Leisure activity, celebrations / Grammar: separable verbs, the accusative, past tense of to have and to be

Week 7: Contacts, writing letters / Grammar: dative

Week 8: My apartment, rooms, furniture, colours / Grammar: changing prepositions

Week 9: Professions / Grammar : perfect tense

Week 10: Clothes / Grammar: perfect tense and dative

Week 11: Health and the body / Grammar: the imperative and modal verbs

Week 12: Holiday and weather

HEALTH RESEARCH FUNDAMENTALS

MULTI FACULTY

PRE-REQUISITES : Undergraduate students in medical/dental/nursing/AYUSH streams Graduate in any discipline

INTENDED AUDIENCE : Any current or potential health researcher

INDUSTRIES APPLICABLE TO : Government/ private sector, public health service institutions/ agencies, Post graduate institutions in biomedical and allied sciences, Medical colleges/ Universities, NGOs engaged in health research, Clinical research organizations, Pharma companies and marketing research organizations

COURSE OUTLINE :

ICMR - National Institute of Epidemiology is offering online programmes on conduct of human bio-medical research. The programme will be offered as NIE-ICMR e-Certificate – NIECer - Courses. The first in this series, NIECer 101:Health Research Fundamentals, is a basic level course in health research methods. It will explain the fundamental concepts in epidemiology and bio-statistics related to research methods. This course will provide an overview of steps and principles for designing bio-medical and health research studies among human participants. We expect this course to be useful for individuals interested in pursuing health research in the roles of study investigators, clinical/public health researchers (physicians, counselors, research associates, social scientists, nurses, pharmacists, technicians, data and quality managers etc.), scientists, ethics committee members and project managers.

ABOUT INSTRUCTOR :

Dr. Sanjay Mehendale, MD, MPH, FAMS, FIMSA, FACE
Ex - Additional Director General, ICMR

Dr. Manoj Murhekar, MD
Scientist 'G' & Director, ICMR - National Institute of Epidemiology

Dr. R Ramakrishnan, MAE, PhD
Formerly Scientist 'G', ICMR - National Institute of Epidemiology

Dr. Prabhdeep Kaur, MAE, DNB
Scientist 'E', ICMR - National Institute of Epidemiology

Dr. Tarun Bhatnagar, MD, PhD
Scientist 'E', ICMR - National Institute of Epidemiology

Dr. P. Manickam, BSMS, M.Sc., PhD
Scientist 'E', ICMR - National Institute of Epidemiology

Dr. P. GaneshKumar, MD
Scientist 'C', ICMR - National Institute of Epidemiology

All the instructors are faculty members for the two-year Master of Public Health [MPH] programme at the ICMR School of Public Health of the NIE, Chennai, India. The School is offering MSc (Biostatistics) from this July. Besides the Master's level programmes, the faculty members have been conducting PG diploma and various short-term training programmes in public health/epidemiology and biostatistics. Besides teaching, the faculty members have been conducting epidemiological/public health research.



INNOVATION BY DESIGN

PROF. B.K. CHAKRAVARTHY

Department of Design Engineering
IIT Bombay

INTENDED AUDIENCE : Open to all

COURSE OUTLINE :

In today's world, there are so many challenges and problems that need to be addressed. In this situation, innovation is what provides the solution that will benefit the maximum number of users. And such innovation is often enabled by design. This course familiarizes you with the concept of "innovation" and the journey of a design idea from the identification of a problem to a final solution that has a positive impact on a large community of users. Through case studies that focus on the "seven concerns of innovation", you learn how the innovation process requires empathy, meticulous effort, constant user interaction and effective collaboration.

ABOUT INSTRUCTOR :

Prof. B. K. Chakravarthy teaches Innovation by Design at the Industrial Design Centre (IDC), IIT Bombay. He has set up the Shenoy Innovation Studio at IITB, where students and young designers are given the opportunity to work on live projects and benefit from expertise in a range of interrelated fields. Prof. Chakravarthy works closely with other academics engaged in cutting-edge research at IIT Bombay and has played a key role in translating such research into products that reach the hands of users. A Collaborative Model for New Product Innovation, an outcome of Prof. Chakravarthy's doctoral research, has had wide application in the industry. Prof. Chakravarthy has also worked frequently with government departments and occupational communities engaged in essential services.

COURSE PLAN :

Week 1 :

- Module 1 – Introduction,
- Module 2 - First C: The Cause

Week 2 :

- Module 3 - Second C: The Context,
- Module 4 - Third C: The Comprehension

Week 3 :

- Module 5 - Fourth C: The Check,
- Module 6 - Fifth C: The Conception

Week 4 :

- Module 7 - Sixth C: The Crafting,
- Module 8 - Seventh C: The Connection



INTRODUCTION TO ABRASIVE MACHINING AND FINISHING PROCESSES

PROF. MAMILLA RAVI SANKAR

Department of Mechanical Engineering
IIT Tirupati

INTENDED AUDIENCE : BE/B.Tech, ME/ M.Tech, Ph. D (Mechanical Engineering, Production Engineering).
Faculty who teaches manufacturing.

INDUSTRIES APPLICABLE TO : Oil India Ltd., ONGC, TATA motors, ISRO, BARC, DRDL, NTPC,
CMTI, CMERI, CGCRI, Grind Master, NRL

COURSE OUTLINE :

This course will define the areas of application of traditional as well as non-traditional abrasive finishing processes in the manufacturing industry. The lectures will introduce the basic principles of material removal by use of abrasives particles and material removal mechanism of different abrasive process. The effects of various input parameters on the outputs as well as the use of cutting fluids in various finishing process will be discuss. A variety of numerical problems and MCQs, discussions will also be included.

ABOUT INSTRUCTOR :

Prof. Mamilla Ravi Sankar is currently an Assistant Professor in the Department of Mechanical Engineering, IIT Guwahati. He did his B.Tech from Sri Venkateswara University, Tirupati, and M.Tech as well as PhD from IIT Kanpur. His research group is focus on Sustainable Manufacturing, Eco-friendly Cutting fluids, Coatings, Advanced Manufacturing, Tribology and Rheology. MRS Lab also involves in development of lab scale Innovations to Commercial Manufacturing Products. He has published over 30 research articles in internationally reputed journals, 2 Patents, 2 Edited Books and 6 Book chapters. He is recipient of prestigious awards such as Institution of Engineers India (IEI) Young Engineers Award-2015 in Production Engineering, Indian Society for Advancement in Materials and Process Engineering (ISAMPE)-2011 and finalist of Indian National Academy of Engineering (INAE) Young Engineer Award-2014. Apart from academic awards, he is also received Institute Blues (Outstanding Sports Personality) of IIT Kanpur for the year 2009.

COURSE PLAN :

Week 1: Introduction conventional abrasive processes, Introduction to abrasive processes, Grinding Process

Week 2: Conventional abrasive finishing processes (CAFP): Honing & Wire Brushing, CAFP: Lapping, Buffing & Super finishing, Practical Conventional abrasive finishing processes

Week 3: Adv. abrasive machining processes (AAMP), AAMP

Week 4: Hybrid Adv. Abrasive Machining Processes, Advanced Finishing

Week 5: Adv. Finishing: Abrasive Flow Finishing

Week 6: Adv. Finishing: Magnetic Abrasive Finishing

Week 7: Adv. Finishing: Magnetic Rheological Finishing

Week 8: Hybrid abrasive finishing, Finishing of Advanced Materials



INTRODUCTION TO COGNITIVE PSYCHOLOGY

PROF. NAVEEN KASHYAP

Department of Humanities and Social Sciences
IIT Guwahati

INTENDED AUDIENCE : UG/PG/PhD students

COURSE OUTLINE :

One of the most puzzling fact for humans over the centuries has been the understanding of human behavior. Understanding and predicting human behavior will helps humans in exerting more control over situations. The bases of human behavior are the cognitive processes underlying them. The present course is an attempt to discuss and understand the basic cognitive processes that guide human behavior. The knowledge from the course will be useful in tackling everyday problems and attaining optimal solutions. Additionally, we can use knowledge about human cognitive systems in designing sophisticated Artificial Intelligence (AI) systems that learn from mistakes and make our lives a lot easier to live.

ABOUT INSTRUCTOR :

Prof. Naveen Kashyap, Ph.D is as Associate Professor of Psychology at the Indian Institute of Technology Guwahati. His research interests are sleep and human cognitive processes. Dr Kashyap has been teaching courses like cognitive psychology, introduction to psychology, consumer psychology, advance cognitive process and research methodology to UG and PG students of IITG Guwahati for the past 10 years.

COURSE PLAN :

Week 1: History, Theory and Research in Human Cognition

Week 2: Object Perception and Recognition

Week 3: Attentional Processes and cognition

Week 4: Memory Introduction

Week 5: Long Term Memory

Week 6: Memory of general knowledge

Week 7: Concept Formation

Week 8: Visual and Spatial Memory

Week 9: Human language skills

Week 10: Thought process and Problem Solving

Week 11: Reasoning

Week 12: Decision Making



INTRODUCTION TO INTERNET OF THINGS

PROF. SUDIP MISRA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Basic programming knowledge

INTENDED AUDIENCE : CSE, IT, ECE, EE, Instrumentation Engineering, Industrial Engineering

COURSE OUTLINE :

Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

ABOUT INSTRUCTOR :

Prof. Sudip Misra is a Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Kharagpur. Prior to this he was associated with Cornell University (USA), Yale University (USA), Nortel Networks (Canada) and the Government of Ontario (Canada). He received his Ph.D. degree in Computer Science from Carleton University, in Ottawa, Canada. He has several years of experience working in the academia, government, and the private sectors in research, teaching, consulting, project management, architecture, software design and product engineering roles. His current research interests include Wireless Ad Hoc and Sensor Networks, Internet of Things (IoT), Computer Networks, Learning Systems, and algorithm design for emerging communication networks. Dr. Misra is the author of over 260 scholarly research papers, including 140+ reputed journal papers. He has won seven research paper awards in different conferences. Recently, he and his students won Samsung Innovation Award and the IEEE ComSoc Student Competition. He was awarded the fellow of NASI. He was also awarded the IEEE ComSoc Asia Pacific Outstanding Young Researcher Award at IEEE GLOBECOM 2012, Anaheim, California, USA. He was also the recipient of several academic awards and fellowships such as the Young Scientist Award (National Academy of Sciences, India), Young Systems Scientist Award (Systems Society of India), Young Engineers Award (Institution of Engineers, India), (Canadian) Governor General's Academic Gold Medal at Carleton University, the University Outstanding Graduate Student Award in the Doctoral level at Carleton University and the National Academy of Sciences, India - Swarna Jayanti Puraskar (Golden Jubilee Award). Dr. Misra was also awarded the Canadian Government's prestigious NSERC Post-Doctoral Fellowship and the Humboldt Research Fellowship in Germany. Dr. Misra has been serving the editorial boards of distinguished journals such as the Transactions on Vehicular Technology, Transactions on Mobile Computing, International Journal of Communication Systems (Wiley) and the IET Wireless Sensor Systems (UK). In the past, he served as the Associate Editor/Editorial Board Member of the Telecommunication Systems Journal (Springer), Security and Communication Networks Journal (Wiley), and the EURASIP Journal of Wireless Communications and Networking, IET Communications Journal, and the Computers and Electrical Engineering Journal (Elsevier). Dr. Misra has published 10 books in the areas of wireless ad hoc networks, wireless sensor networks, wireless mesh networks, communication networks and distributed systems, network reliability and fault tolerance, and information and coding theory, published by reputed publishers such as Cambridge University Press, Springer, Wiley, and World Scientific.

COURSE PLAN :

Week 1: Introduction to IoT: Part I, Part II, Sensing, Actuation, Basics of Networking: Part-I

Week 2: Basics of Networking: Part-II, Part III, Part IV, Communication Protocols: Part I, Part II

Week 3: Communication Protocols: Part III, Part IV, Part V, Sensor Networks: Part I, Part II

Week 4: Sensor Networks: Part III, Part IV, Part V, Part VI, Machine-to-Machine Communications

Week 5: Interoperability in IoT, Introduction to Arduino Programming: Part I, Part II, Integration of Sensors and Actuators with Arduino: Part I, Part II

Week 6: Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi

Week 7: Implementation of IoT with Raspberry Pi (contd), Introduction to SDN, SDN for IoT

Week 8: SDN for IoT (contd), Data Handling and Analytics, Cloud Computing

Week 9: Cloud Computing(contd), Sensor-Cloud

Week 10: Fog Computing, Smart Cities and Smart Homes

Week 11: Connected Vehicles, Smart Grid, Industrial IoT

Week 12: Industrial IoT (contd), Case Study: Agriculture, Healthcare, Activity Monitoring



INTRODUCTION TO MACHINE LEARNING - IITKGP

PROF. SUDESHNA SARKAR

Department of Computer Science and Engineering
IIT Kharagpur

INTENDED AUDIENCE : Elective course for UG, PG, BE, ME, MS, M.Sc, PhD

PRE-REQUISITES : Basic programming skills (in Python), algorithm design, basics of probability & statistics

INDUSTRIES APPLICABLE TO : Data science companies and many other industries value machine learning skills.

COURSE OUTLINE :

This course provides a concise introduction to the fundamental concepts in machine learning and popular machine learning algorithms. We will cover the standard and most popular supervised learning algorithms including linear regression, logistic regression, decision trees, k-nearest neighbour, an introduction to Bayesian learning and the naïve Bayes algorithm, support vector machines and kernels and neural networks with an introduction to Deep Learning. We will also cover the basic clustering algorithms. Feature reduction methods will also be discussed. We will introduce the basics of computational learning theory. In the course we will discuss various issues related to the application of machine learning algorithms. We will discuss hypothesis space, overfitting, bias and variance, tradeoffs between representational power and learnability, evaluation strategies and cross-validation. The course will be accompanied by hands-on problem solving with programming in Python and some tutorial sessions.

ABOUT INSTRUCTOR :

Prof. Sudeshna Sarkar is a Professor and currently the Head of the Department of Computer Science and Engineering at IIT Kharagpur. She completed her B.Tech. in 1989 from IIT Kharagpur, MS from University of California, Berkeley, and PhD from IIT Kharagpur in 1995. She served briefly as faculty at IIT Guwahati and at IIT Kanpur before joining IIT Kharagpur in 1998. Her research interests are in Machine Learning, Natural Language Processing, Data and Text Mining.

COURSE PLAN :

Week 01 : Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation.

Week 02 : Linear regression, Decision trees, overfitting.

Week 03 : Instance based learning, Feature reduction, Collaborative filtering based recommendation.

Week 04 : Probability and Bayes learning

Week 05 : Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM.

Week 06 : Neural network: Perceptron, multilayer network, backpropagation, introduction to deep neural network.

Week 07 : Computational learning theory, PAC learning model, Sample complexity, VC Dimension, Ensemble learning.

Week 08 : Clustering: k-means, adaptive hierarchical clustering, Gaussian mixture model.



INTRODUCTION TO MACHINE LEARNING (TAMIL)

PROF. ARUN RAJKUMAR

Department of Computer Science
IIT Madras

INTENDED AUDIENCE: Native Tamil speaking audience (Teachers/ Undergraduate Students)

PREREQUISITES: A basic course in linear algebra/probability/programming/algorithms would be a big plus. These are not strong pre-requisites.

INDUSTRY SUPPORT: All Data centric companies including those that have core business in search/e-commerce/social-media

COURSE OUTLINE:

A short course introducing the main ideas and algorithms of Machine Learning. The goal of the course is to cover the topics at a high level so that it would act as a first course for a full fledged Machine Learning course. The course will be delivered in spoken Tamil while the technical terms discussed/exams/assignments will be in English.

ABOUT INSTRUCTOR:

Prof.Arun Rajkumar is currently an assistant professor in the department of CSE at IIT Madras. His PhD thesis was in the area of Machine Learning and his broad research interests are in the areas of Machine Learning, sequential decision making.

COURSE PLAN:

Week 1: Basics of Linear Algebra, Probability, Optimization

Week 2: Introduction to Supervised Learning - Regression; Topics - Linear Regression; Ridge Regression; LASSO

Week 3: Supervised Learning - Classification; Topics: K-NN, Decision Tree.

Week 4: Supervised Learning - Classification; Topics: Naive Bayes.

Week 5: Supervised Learning - Logistic Regression ,Perceptron.

Week 6: Supervised Learning - Support Vector Machines

Week 7: Supervised Learning - Ensemble Methods

Week 8: Unsupervised Learning - K-means Clustering, PCA



INTRODUCTION TO MULTIMODAL URBAN TRANSPORTATION SYSTEMS (MUTS)

PROF. ARKOPAL KISHORE GOSWAMI

Department of RCG School of Infrastructure Design Management
IIT Kharagpur

INTENDED AUDIENCE : UG Civil Engineering, PG Civil Engineering (Transportation), UG Urban Planning, PG Urban Planning

INDUSTRY SUPPORT: Urban Local Bodies, Transport Network Companies (TNCs), Public transportation operating companies and administrators

COURSE OUTLINE :

This course is refined version of the Post-Graduate course (ID6004) "Planning, Operation and Management of Transportation Facilities" which is being currently taught to the students of Infrastructure Design and Management at IIT Kharagpur. The course's primary objectives are to:

1. Identify the sustainability principles in transportation
2. Introduce the concept of Travel Demand Management (TDM)
3. Disseminate the techniques of urban public transit planning, operations and management
4. Imbibe the concepts of non-motorized urban transport
5. Demonstrate the applications in intelligent transportation systems (ITS)

ABOUT INSTRUCTOR :

Prof. Arkopal K. Goswami is currently a faculty member in the Ranbir and Chitra Gupta School of Infrastructure Design and Management, IIT Kharagpur, where he specializes in Transportation Infrastructure. He earned his Bachelor's in Civil Engineering from NIT Jamshedpur, after which he was awarded a full academic scholarship, along with a research assistantship (RA), to pursue his high studies from the University of Virginia (UVa). He graduated with a Doctorate in Civil Engineering from UVa in the year 2008, under the tutelage of Professor (Emeritus) Dr. Lester A. Hoel. Dr. Goswami specializes in the field of sustainable urban transport, having over 13 years of experience in consulting, public sector, and academia, both in India and United States of America (USA). He is currently a Principal Investigator (PI) of multiple projects that aim to enhance urban transport sustainability in India. To further the cause, Dr. Goswami is collaborating with researchers from around the globe, including Japan, Germany, United Kingdom (UK), and USA. His work has been recognized worldwide, where he has received the Jack H. Dillard best research paper award, and has published in reputed peer reviewed journals including the ASCE Journal of Transportation Engineering, Transport Reviews, and Energy. He has also presented his work at national and international conferences, including the Annual Conference of the Transportation Research Board (TRB), and the World Conference on Transport Research Society (WCTRS). He is a member of the Transportation Research Group (TRG), India; and Eastern Asian Society for Transportation Studies (EASTS). He is currently leading a group of researchers that include 7 PhD students, 8 Masters' students, as well as multiple project personnel. Arkopal loves travelling and is an avid sports enthusiast, where he follows cricket, tennis and basketball.

COURSE PLAN :

Week 1:

Module 1: Overview of urban transportation

- Lec. 1: Urbanization and Transport(0.5 hr.)
- Lec. 2: Key issues in urban transportation (0.5 hr.)
- Lec. 3: Challenges in urban transportation(0.5 hr.)
- Lec. 4: Travel demand modelling overview (0.5 hr.)
- Lec. 5: Vehicular Level of Service (LOS) overview (0.5 hr.)

Week 2:

Module 2: Public Transportation

- Lec. 6: Introduction to public transportation (0.5 hr.)
- Lec. 7: Basic operating elements of public transportation (0.5 hr.)
- Lec. 8: Basic operating elements of public transportation (contd.) (0.5 hr.)
- Lec. 9: Bus Transportation (0.5 hr.)
- Lec. 10: Bus Transportation (contd.) (0.5 hr.)

Week 3:

Module 2: Public Transportation

- Lec. 11: Financing public transportation (0.5 hr.)
- Lec. 12: Transit marketing (0.5 hr.)
- Lec. 13: Rail transportation (0.5 hr.)
- Lec. 14: Intermediate Public Transportation (0.5 hr.)
- Lec. 15: Measuring performance of transit systems (0.5 hr.)

Week 4:

Module 2: Public Transportation

- Lec. 16: Advanced operation concepts of public transportation (0.5 hr.)
- Lec. 17: Bus & Rail Transit Capacity (0.5 hr.)
- Lec. 18: Bus & Rail Transit Capacity (contd.) (0.5 hr.)
- Lec. 19: Station Capacity (0.5 hr.)
- Lec. 20: Transit Stop Location (0.5 hr.)

Week 5:

Module 3: Non-Motorised Transportation (NMT) Planning

- Lec. 21: Introduction to NMT Systems (0.5 hr.)
- Lec. 22: Assessing existing NMT scenario (0.5 hr.)
- Lec. 23: Data collection and analysis in NMT Planning (0.5 hr.)
- Lec. 24: Complementarity and Selection of Interventions (0.5 hr.)
- Lec. 25: Alternative Selection through Economic & Financial Analysis (0.5 hr.)

Week 6:

Module 3: Non-Motorised Transportation (NMT) Planning

- Lec. 26: Introduction to NMT systems (0.5 hr.)
- Lec. 27: Basic NMT Characteristics (0.5 hr.)
- Lec. 28: Pedestrian Data Collection and Flow Characteristics (0.5 hr.)
- Lec. 29: PTS Case Studies Pedestrian flow characteristics on facilities (0.5 hr.)
- Lec. 30: Pedestrian Level of Service (PLOS) based on Flow models (0.5 hr.)

Week 7:

Module 3: Non-Motorised Transportation (NMT) Planning

- Lec. 31: Other types of Pedestrian Level of Service (PLOS) (0.5 hr.)
- Lec. 32: HCM 2010 Methodology for PLOS (0.5 hr.)
- Lec. 33: HCM 2010 Methodology for PLOS (contd.) (0.5 hr.)
- Lec. 34: Bicycle Facilities and Level of Service (BLOS) (0.5 hr.)
- Lec. 35: BLOS and Bicycle Compatibility Index (BCI) (0.5 hr.)

Week 8:

Module 3: Non-Motorised Transportation (NMT) Planning

- Lec. 36: NMT Design Principles (0.5 hr.)
- Lec. 37: Design of Pedestrian Infrastructure (0.5 hr.)
- Lec. 38: Design of Pedestrian Infrastructure (contd.) (0.5 hr.)
- Lec. 39: Design of Cycling Infrastructure (0.5 hr.)
- Lec. 40: Design of Cycling Infrastructure (contd.) (0.5 hr.)

Week 9:

Module 4: Urban Transport & Sustainability

- Lec. 41: Travel Demand Management (TDM) overview (0.5 hr.)
- Lec. 42: Push measures cases (0.5 hr.)
- Lec. 43: Pull measure cases (0.5 hr.)
- Lec. 44: Parking Studies (0.5 hr.)
- Lec. 45: Transit Oriented Development (TOD) (0.5 hr.)

Week 10:

Module 4: Urban Transport & Sustainability

- Lec. 46: Introduction to Intelligent Transportation Systems (ITS) (0.5 hr.)
- Lec 47: ITS components, applications and communication (0.5 hr.)
- Lec. 48: ITS Architecture (0.5 hr.)
- Lec. 49: Electronic Toll Collection (ETC) (0.5 hr.)
- Lec. 50: Public Bicycle Sharing (PBS) System with ITS (0.5 hr.)

Week 11:

Module 4: Urban Transport & Sustainability

- Lec. 51: Multimodal transportation (MMT) environment (0.5 hr.)
- Lec. 52: Multimodal Level of Service (MMLOS) (0.5 hr.)
- Lec. 53: Multimodal Level of Service (MMLOS) (contd.) (0.5 hr.)
- Lec. 54: Design of multimodal transfer facilities (0.5 hr.)
- Lec. 55: Park & Ride (P&R) Facility Planning (0.5 hr.)

Week 12:

Module 4: Urban Transport & Sustainability

- Lec. 56: An Introduction to Pedestrian Road Safety and associated Risk Factors (0.5 hr.)
- Lec. 57: Road crash estimation and elements of predictive methods (0.5 hr.)
- Lec. 58: Predicting Vehicle-Pedestrian and Vehicle-Bicycle conflicts (0.5 hr.)
- Lec. 59: Environmental Concerns of Urban Transport (0.5 hr.)
- Lec. 60: Sustainable strategies for Urban Transportation (0.5 hr.)



INTRODUCTION TO PSYCHOLOGY

PROF. BRAJ BHUSHAN

Department of Humanities and Social Sciences

IIT Kanpur

INTENDED AUDIENCE : Elective UG, BE, BSc

INDUSTRIES APPLICABLE TO : HR section the companies

COURSE OUTLINE :

This course is designed for better understanding of the self and others. It will help you understand the how and why of thinking, feeling, and action. This introductory psychology course will cover the major psychological constructs and principles, primarily focusing on the perceptual processes, learning, memory, emotions, genetic and environmental determinants of behavior and personality. In the last week it will also demonstrate some lab sessions whereby the relevant construct and phenomena can be empirically tested.

ABOUT INSTRUCTOR :

Prof. Braj Bhushan is a professor of psychology at IIT Kanpur.

COURSE PLAN :

Week 1: Why Psychology? Major milestones in psychology, Major areas of psychology, Major methods used in psychology, Redefining boundaries of the discipline

Week 2: Perception

Week 3: Learning

Week 4: Memory

Week 5: Emotion

Week 6: Genetic and Environmental bases of behaviour

Week 7: Personality

Week 8: Lab session: Perception



KINEMATICS OF MECHANISMS AND MACHINES

PROF. ANIRVAN DASGUPTA

Department of Mechanical Engineering
IIT Kharagpur

PRE-REQUISITES : Engineering Mechanics, Undergraduate Mathematics

INTENDED AUDIENCE : Mechanical, Electrical, Aerospace and Bio-Medical Engineering students

INDUSTRIES APPLICABLE TO : Automobile and Aerospace industries, Automation and robotic device manufacturers, Bio-Medical device manufacturers

COURSE OUTLINE :

This course will deal with kinematic analysis of mechanisms and machines. It will include motion and force transmission analysis of linkage mechanisms, open and closed-chain planar robots, and geared transmission. The discussion will start with an introduction to the subject matter and nomenclature, and will cover direct and inverse kinematics, velocity and acceleration analysis, kinematic path generation for robots, singularities in kinematic chains, principle of virtual work and force analysis, and kinematic analysis of gear transmission. The course will demonstrate various concepts by working out problems relevant to real life applications of mechanisms. The course is expected to help students in their basic understanding and use of kinematic analysis.

ABOUT INSTRUCTOR :

Prof. Anirvan DasGupta is a faculty in Mechanical Engineering at IIT Kharagpur since 1999. His interests are in the mechanics of discrete and continuous systems. He has extensively taught courses at undergraduate and postgraduate levels like Mechanics, Kinematics of Machines, Dynamics, Dynamics of Machines, Vibration Analysis, Wave Propagation in Continuous Media, and Rail Vehicle Dynamics.

COURSE PLAN :

Week 1 : Introduction to Mechanisms (1.5 hr), Mobility Analysis (1.5 hr)

Week 2 : Mobility Analysis (1.5 hr), Displacement Analysis (1 hr)

Week 3 : Displacement Analysis (2.5 hr)

Week 4 : Velocity Analysis (2.5 hr)

Week 5 : Velocity Analysis (2.5 hr)

Week 6 : Velocity Analysis (1.0 hr), Acceleration Analysis (1.5 hr)

Week 7 : Force Analysis (1.5 hr), Introduction to geared transmission (1.0 hr)

Week 8 : Analysis of gear trains (2.0 hr).



MECHATRONICS

PROF. PUSHPARAJ MANI PATHAK

Department of Mechanical Engineering
IIT Roorkee

INTENDED AUDIENCE : Mechanical/Electrical/Electronic under graduate and post graduate students

INDUSTRIES APPLICABLE TO : Automobile, DRDO, Railways

COURSE OUTLINE :

The word mechatronics is composed of "mecha" from mechanism and the "tronics" from electronics. It is the synergistic integration of mechanical engineering, with electronics and intelligent computer control in the design and manufacturing of industrial products and processes. Mechatronics generally involves (i) implementing electronics control in a mechanical system (ii) enhancing existing mechanical design with intelligent control and (iii) replacing mechanical component with an electronic solution. This course will cover all aspects related with mechatronics such as sensors and transducers, actuators and mechanisms, signal conditioning, microprocessors and microcontrollers, modeling & system response and design and mechatronics.

ABOUT INSTRUCTOR :

Prof. Pushparaj Mani Pathak is currently a Professor at IIT Roorkee. He was graduated from N.I.T., Calicut in 1988 in Mechanical Engineering. He completed his M. Tech in Solid Mechanics and Design from IIT Kanpur in 1998. Later he was awarded the PhD degree from IIT Kharagpur in 2005. His areas of research are Robotics, Dynamics, Control, and Bond Graph Modelling. He has served in different industries from 1989 to 1994. He is in teaching profession since 1994. He is serving in Mechanical and Industrial Engineering Department, IIT Roorkee since 2006. He has co-authored one book on Intelligent Mechatronic Systems: Modeling, Control and Diagnosis published by Springer, London and has published more than 40 papers in International Journals in the field of Robotics and Control. He has supervised 34 M. Tech theses and 7 PhD theses in different areas.

COURSE PLAN :

Week 1: Introduction to mechatronics : Introduction, Examples of Mechatronic systems, Electric circuits and components, Semiconductor Electronics, Transistor Applications

Week 2: Electric Circuits and Semiconductor Electronics : Performance terminology of sensors, Displacement, Position & Proximity Sensors-I, Displacement, Position & Proximity Sensors-II, Force, Fluid pressure, Liquid flow sensors, temperature, light sensor, Acceleration and Vibration measurement, Semiconductor sensor and MEM, SAW

Week 3: Sensors and transducers : Mechanical Actuation System, Hydraulic & Pneumatic Actuation System, Electrical Actuation System-I, Electrical Actuation System-II, Data Presentation system

Week 4: Actuators and mechanisms: Introduction to signal processing & Op-Amp, Op-Amp as signal conditioner, Analogue to Digital Converter, Digital to Analogue Converter, Artificial intelligence

Week 5: Signal conditioning: Digital circuits-I, Digital circuits-II, Microprocessor Micro Controller, Programming of Microcontrollers

Week 6: Microprocessors and microcontrollers: Mechanical system model, Electrical system model, Fluid system model, Dynamic response of systems, Transfer function and frequency response.

Week 7: Modeling and system response: P,I, PID Controllers, Digital Controllers, Program Logic Controllers, Input/output & Communication systems, Fault findings

Week 8: Design and mechatronics: Project using Microcontroller-Atmega 16, Myoelectrically Controlled, Robotic Arm, Robocon-Part I, Robocon-Part II, Design of a Legged Robot



MODELLING AND ANALYTICS FOR SUPPLY CHAIN MANAGEMENT

PROF. KUNAL KANTI GHOSH

Department of Management
IIT Kharagpur

PROF. ANUPAM GHOSH

Department of Management
IIT Kharagpur

INTENDED AUDIENCE : Students from Management, Industrial and Systems Engineering, Mechanical Engineering, and related disciplines.

INDUSTRIES APPLICABLE TO : Tata Group of Industries, Multinationals, L&T, and similar manufacturing and service organizations including IT companies

COURSE OUTLINE :

This course focuses on the application of analytical techniques for determining effective solutions to problems associated with supply networks considering the constraints of demand and supply. The objectives of the course are to understand the nature of supply networks, goal of supply networks and explain the impact of analytics based supply chain decisions on the success of a firm. The coverage includes key metrics that track the performance of the supply network in terms of each driver, identification of the key factors to be considered when designing a distribution network and use of analytical techniques for developing a framework for network design. Emphasis is laid on the use of optimization techniques for facility location, capacity allocation and evaluation of supply chain design decisions under uncertainty. Along with these objectives, this course is also aimed at understanding the concepts of multi-criterion decision making in supplier selection and rating, inventory management techniques under uncertain demand and supply environment, mathematical models for design of transportation networks, and the role of soft computing techniques for matching supply with demand.

ABOUT INSTRUCTOR :

Prof. Kunal Kanti Ghosh has over three decades of experience at various levels in the automobile industry. He was the "Corporate Initiatives Head" of Tata Technologies Ltd and was adjudged the "Best Young Materials Manager" by the Indian Institute of Materials Management in 1986. He also received the "Best young Manager's Award" from All India Management Association in 1990. He was the prime architect of "Parts Supply Management System" for Nissan Plant in Australia, Melbourne. He was the project manager in charge of installation and commissioning of semi-automated (Kurimoto Presses) in Jamshedpur plant of Tata Motors in 1988. He holds B Tech (Mechanical Engineering), M Tech (IE & OR), and PhD (Automotive Design). He is a fellow member of the Institution of Engineers (India).

Prof. Anupam Ghosh obtained Masters Degrees with specializations in Supply Chain Management, Accounting, and Commerce. His PhD is on Information Visibility in Supply Chain. He has about 13 years of teaching experience in Supply Chain Management, Supply Chain Analytics, and International Marketing. He was a Visiting Scholar to Bentley University, Waltham, MA, USA during 2004-05. He has worked on projects on Healthcare Information Systems in USA, Fixing Transportation Fares for Public Transportation Systems in India, and has conducted various Management Development Programs on Supply Chain Management and Materials Management.

COURSE PLAN:

Week 1 : Introduction to Modeling and Analytics in Supply Networks:

Introduction to Supply Network, Performance Measures for Efficiency and Effectiveness, SCOR model, Strategic Fit and Scope, Types of Distribution Networks, Analytics in Management, Design of Distribution Networks

Week 2 : Supplier Selection Analytics:

Linear Programming, Rating method, Ranking method, Borda Count, Clustering, Goal Programming and related multi-criterion decision making (MCDM) techniques

Week 3 : Transportation Modeling and Analytics:

Transportation models, Route planning, Transshipment, Shipment schedule, Flow path optimization.

Week 4 : Warehousing Modeling and Analytics:

Warehouse location problem, MILP formulation, Location with foreign exchange risks, space calculation for warehouse, Non-linear optimization for warehouse space allocation

Week 5 : Strategic Performance Improvement:

Data Envelopment Analysis for competitive comparisons among multiple warehouses and service units and formulation of strategic action plans for improving the efficiencies of non-performing DMUs, Stochastic Frontier Analysis.

Week 6 : Inventory Analytics - I:

Elementary Concepts related to Inventory Management, Economic Order Quantity (Instantaneous Replenishment), Economic Production Lot Size, Inventory Model with Planned Shortages (Back-Orders), Inventory Management under Uncertainty – Concept of Safety Stock, Continuous Review System, Periodic Review System

Week 7 : Inventory Analytics - II:

Newsvendor Model, Performance Measures: Expected Lost Sales, Expected Sales, Expected Leftover Inventory, Expected Profit, Fill Rate, In-Stock Probability, and Stock-Out Probability

Week 8 : Inventory Analytics - III:

Choosing an Order-up-to Level to Meet a Target Service Level, In-Stock Probability, and Desired Fill-Rate

Week 9 : Inventory Analytics - IV:

Assemble-to-Order, Make-to-Order and Quick Response with Reactive Capacity, Reducing Mismatch Costs with Make-To-Order

Week 10 : Modeling Coordination in Supply Chains:

Information Distortion in Supply Network and Bull-Whip Effect, Coordination and collaboration modeling in supply networks.

Week 11 : Risk Analytics in Supply Network Design:

Mapping the riskiness profile of a country, taxation, Mapping the riskiness profile of possible international routes and Designing the route plan based on riskiness profile

Week 12 : Design and Modeling the global supply chain:

Design and optimization of global supply chain networks, Multi-period supply chain network design



MUNICIPAL SOLID WASTE MANAGEMENT

PROF. AJAY KALAMDHAD

Department of Civil Engineering
IIT Guwahati

INTENDED AUDIENCE : PG Level course for Environmental Engineering and UG level for Civil Engineering

INDUSTRY SUPPORT : Synergy waste management Pvt Ltd, UPL Environmental Engineers Pvt Ltd, Green power systems, A2Z group, Timarpu-Okhla waste management pvt ltd, Ramky Enviro Engineers Limited

COURSE OUTLINE :

The problems affiliated with solid waste management (SWM) in today's sprawling civilized and urbanized society are intricate because of the quantity and varied nature of wastes, the funding restriction for public disposal, interference of technology (energy and raw materials), and complex infrastructure development network in urban cities. As a result, if SWM is to achieve in consummate approach, the fundamentals aspects need to be identified. Thus, there is dire need to group the activities from the generation to the disposal point. The six different functional elements (generation, handing and separations, storage and processing at source, collection, the transformation of wastes, transfer and transport, and final disposal) for the engineering comparison and treatment need to be understood in detail. The understanding of the functional element is important because it helps in evaluating the impacts of projected changes and technological developments. Solid waste management is an essential part of every society, but it is also one of the most neglected one. An in-depth understanding of the subject is required to tackle the current solid waste management crisis effectively. This course attempts to familiarize various steps involved in solid waste management.

ABOUT INSTRUCTOR :

Prof. Ajay Kalamdhad is a Professor in the Department of Civil Engineering, Indian Institute of Technology Guwahati. He received his PhD from Indian Institute of Technology Roorkee in the year of 2008 and started working as a Lecturer in Visvesvaraya National Institute of Technology from September 2008. He joined Indian Institute of Technology Guwahati in June 2009 as an Assistant Professor. His research interests include Solid waste management, Mechanical composting and vermicomposting, Anaerobic digestion, Analysis of solid wastes, Microbiology of composting, Biosorption and Water & Wastewater Treatment. He has published numerous papers in various reputed journals. He is also the head of Waste Management Research Group (WMRG), a group that focuses on the biological treatment of various wastes.

COURSE PLAN :

- Week 1:** Evolution of Solid Waste Management
- Week 2:** Sources/Types and Characteristics of Solid Waste
- Week 3:** Generation of Solid Waste
- Week 4:** Waste Handling, Separation, storage, and Processing
- Week 5:** Collection of Solid Waste
- Week 6:** Transfer and Transport
- Week 7:** Separation and processing of Solid Waste
- Week 8:** Chemical Transformation (combustion/incineration)
- Week 9:** Biological Treatment (Composting)
- Week 10:** Biological Treatment (Anaerobic Digestion)
- Week 11:** Disposal of Solid Waste
- Week 12:** ISWM and legislation



APPLIED NATURAL LANGUAGE PROCESSING

PROF. RAMASESHAN R

Department of Computer Science and Engineering
Chennai Mathematical Institute

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (20 Jul'20 - 9 Oct'20)

EXAM DATE : 17 Oct 2020

PRE-REQUISITES : Essential – Algorithms, Python Proficiency, Elementary probability and statistics, Linear Algebra, basic understanding of machine learning

COURSE OUTLINE :

A major portion of communication now is through text and any organization has more than 90% of its content in the unstructured form. Natural Language Processing (NLP), an important part in Artificial Intelligence, is one of the important technologies that would help in activities such as classification, retrieving and extraction of information, identifying important documents, etc. Students will gather knowledge in the fundamentals of NLP, methods and techniques and gain skills to use them in practical situations.

ABOUT INSTRUCTOR :

Prof. Rameseshan R is currently working as a Visiting faculty at Chennai Mathematical Institute and teaches this course to the students there. He has more than 30 years of experience in Research and Development, Teaching, Product Development, Information Technology, Innovation and Convergence.

COURSE PLAN :

Week 1: Introduction to language processing – tokens, sentences, paragraphs

Week 2: Regular expressions - extraction of information using Regex

Week 3: Document Similarity measures - Cosine and cluster measures

Week 4: Spelling correction - Edit distance

Week 5: Information retrieval, extraction

Week 6: Document Classification, Clustering, topic modeling techniques

Week 7: Vector Space Model - word vectors, GloVe/Word2Vec model, word embedding

Week 8: Text Classification, Clustering, and Summarization

Week 9: Machine Learning, Perceptron

Week 10: Back Propagation, Recurrent Neural network relevant to NLP

Week 11: Machine Translation, Language Generation

Week 12: Applications – Sentiment Analysis, Spam Detection, Resume Mining, Alnstein



NATURE AND PROPERTIES OF MATERIALS

PROF. BISAKH BHATTACHARYA

Department of Mechanical Engineering
IIT Kanpur

PRE-REQUISITES : Basic Physics and Mathematics Courses at the First Year Level, added with thirst for learning.

INTENDED AUDIENCE : Students of BE/B.Tech stream

INDUSTRIES APPLICABLE TO : Every industry recommends to have a basic knowledge about various materials and truth behind their properties

COURSE OUTLINE :

This course introduces to the basics of metals and metallic alloys, polymers, composites and smart materials which have extensively broadened the scope of engineering design in the fields of Civil, Mechanical, Aerospace and other structural applications. After learning this course, students will be well-versed with the underlying principle governing the material properties and should be able to select proper material for their application.

ABOUT INSTRUCTOR :

Prof. Bishakh Bhattacharya is Professor at the Department of Mechanical Engineering and currently heading the Cognitive Science programme, IIT Kanpur. His research interest primarily lies in vibration control, structural health monitoring, energy harvesting system, intelligent system design and Child-Reconfigurable Robot Interaction.

COURSE PLAN :

Week 1: Introduction to Engineering materials & Mechanical properties

Week 2: Atomic bonding and crystal structure

Week 3: Metals and Ceramics

Week 4: Polymers

Week 5: Composite Materials

Week 6: Smart Materials

Week 7: Materials selection in Engineering design

Week 8: Non-mechanical properties and Laboratory demonstration



NON-CONVENTIONAL ENERGY RESOURCES

PROF. PRATHAP HARIDOSS

Department of Multidisciplinary
IIT Madras

PRE-REQUISITES : Course will be accessible to most students who have completed their first two years of study at an Undergraduate level.

INTENDED AUDIENCE : Interested students

COURSE OUTLINE :

This course looks at the operating principle of a range of non-conventional energy resources, materials used, characterization, and key performance characteristics. The technologies looked at will include, Solar energy, Wind, Batteries, Fuel cells, and Geothermal conversion. The advantages and limitations of these technologies in comparison to conventional sources of energy will also be examined.

ABOUT INSTRUCTOR :

Prof. Prathap Haridoss is a Professor in the Department of Metallurgical and Materials Engineering at IIT Madras. He works in the areas of Fuel Cell and Carbon nanomaterials. He has a B.Tech in Metallurgical Engineering from IIT Madras, and a PhD in Materials Science and Engineering from the University of Wisconsin-Madison, USA. Before he joined as a faculty at IIT Madras, he served as a Senior Scientist at Plug Power, a Fuel Cell company in New York. He has 3 US patents, several International Journal publications, and has published a book titled "Physics of Materials, Essential Concepts of Solid State Physics".

COURSE PLAN :

Week 1: Scale of quantities, Impact of current energy usage, Conventional sources of energy

Week 2: Overview of non-conventional energy resources, Consumption by sector

Week 3: Solar energy incident on earth, solar spectrum

Week 4: Overview of solar energy technologies, Solar Thermal devices

Week 5: Solar Photo-voltaic devices, Performance and durability of solar devices

Week 6: Wind energy, technology and geographical aspects

Week 7: Geothermal and Biomass

Week 8: Battery basics, types

Week 9: Testing, performance of batteries

Week 10: Fuel cell types, Fuel processing, concept to product.

Week 11: Characterization and durability of fuel cells

Week 12: Flywheels and super capacitors



PROBLEM SOLVING THROUGH PROGRAMMING IN C

PROF. ANUPAM BASU

Department of Computer Science and Engineering
IIT Kharagpur

INTENDED AUDIENCE : BE/BTech in all disciplines BCA/MCA/M. Sc

INDUSTRIES APPLICABLE TO : All IT Industries

COURSE OUTLINE : This course is aimed at enabling the students to

- Formulate simple algorithms for arithmetic and logical problems
- Translate the algorithms to programs (in C language)
- Test and execute the programs and correct syntax and logical errors
- Implement conditional branching, iteration and recursion
- Decompose a problem into functions and synthesize a complete program using divide and conquer approach
- Use arrays, pointers and structures to formulate algorithms and programs
- Apply programming to solve matrix addition and multiplication problems and searching and sorting problems
- Apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration

ABOUT INSTRUCTOR :

Prof. Anupam Basu is Professor in the Dept. of Computer Science Engineering, IIT Kharagpur, and has been an active researcher in the areas of Cognitive and Intelligent Systems, Embedded Systems and Language Processing, Presently he is acting as the Chairman and Head of the Center for Educational Technology, IIT Kharagpur. He has developed several embedded system based tools empowering the physically challenged and has led several national projects in the area. He has taught at the University of California, Irvine at the Center for Embedded Systems. He is an Alexander von Humboldt Fellow and a Fellow of the Indian National Academy of Engineering. The awards won by him include the State Award for the Best Contribution to the Cause of Empowerment of the Disabled (2014), Universal Design Award 2011, for contributions in design for the disabled, by National Council for Promotion of Employment of Disabled Persons, India, the National Award for the Best Technology Innovation for the Physically Disabled (2007) and the Da-Vinci Award 2004 from the Engineering Society of Detroit.

COURSE PLAN :

Week 1: Introduction to Problem Solving through programs, Flowcharts/Pseudo codes, the compilation process, Syntax and Semantic errors, Variables and Data Types

Week 2: Arithmetic expressions, Relational Operations, Logical expressions; Introduction to Conditional Branching

Week 3: Conditional Branching and Iterative Loops

Week 4: Arranging things : Arrays

Week 5: 2-D arrays, Character Arrays and Strings

Week 6: Basic Algorithms including Numerical Algorithms

Week 7: Functions and Parameter Passing by Value

Week 8: Passing Arrays to Functions, Call by Reference

Week 9: Recursion

Week 10: Structures and Pointers

Week 11: Self-Referential Structures and Introduction to Lists

Week 12: Advanced Topics

Product design and development.

COURSE LAYOUT

Week1: Introduction to course, Product life-cycle, Product policy of an organization. Selection of a profitable product, Product design process, Product analysis.

Week 2: Value engineering in product design; Advantages, Applications in product design, Problem identification and selection, Analysis of functions, Anatomy of function. Primary versus secondary versus tertiary/unnecessary functions, Functional analysis: Functional Analysis System Technique (FAST), Case studies.

Week 3: Introduction to product design tools, QFD, Computer Aided Design, Robust design, DFX, DFM, DFA, Ergonomics in product design,.

Week 4: DFMA guidelines, Product design for manual assembly, Design guidelines for metallic and non-metallic products to be manufactured by different processes such as casting, machining, injection molding etc., Rapid prototyping, needs, advantages, working principle of SLA, LOM and SLS



PRODUCT DESIGN AND MANUFACTURING

PROF. J. RAMKUMAR

Department of Mechanical Engineering
IIT Kanpur

PROF. AMANDEEP SINGH

Department of Mechanical Engineering
IIT Kanpur

PRE-REQUISITES : The student should have completed two semesters of UG Engineering or Science program.

INTENDED AUDIENCE : Students of all Engineering and Science disciplines.

INDUSTRIES APPLICABLE TO : HAL, NAL, SAIL, ISRO

COURSE OUTLINE :

Innovation, better management, throughput improvements, and expansion of new technologies have led Product Design and Manufacturing as a compelling field for the students. Managing the product development process, right from idea generation to final product manufacturing has to be systematic and effective to meet the customer needs, while incorporating the time-to-market constraint as well. This course presents an overview of the product design and development process, along with the manufacturing systems aspects. The concepts Design for Manufacturing, Assembly, and Environment, and analytical tools for development, costing and manufacturing would help the students and practitioners learn to conceptualize, design, and manufacture competitively-priced quality products. Reverse Engineering, Prototyping and Simulation using soft tools are also incorporated make the students learn the advanced methods in manufacturing.

ABOUT INSTRUCTOR :

Prof. Janakarajan Ramkumar is Professor of Mechanical Engineering Department, and Design Program, at Indian Institute of Technology, Kanpur. He teaches manufacturing science, micro/nano technology, new product development. He has a bachelors in Production Engineering with his doctorate in Defect quantification in drilling of composites from IIT Madras, India with a best thesis award. Over the years his contribution in teaching and research is remarkable. He has worked for BOSCH group and improved the productivity of the company. His research and teaching focus is on nano technology and inclusive design. He has several international and national patents in his credit and has published more than 100 journal papers

Prof. Amandeep Singh is working as Research Scientist in the Mechanical Engineering Department, and Design Program, Indian Institute of Technology, Kanpur, India. He holds PhD degree from Indian Institute of Technology Kanpur, India, and a bachelor degree in Production Engineering. Dr. Singh has ten years of industrial and academic experience. His research interests are Sustainable Manufacturing Processes and Systems, Simulation of Manufacturing Systems, Product Design and Manufacturing, Applied Ergonomics and Engineering Metrology. He has traveled in countries like US, Canada, and Australia to present his research in various international conferences organized by reputed bodies like CIRP and IEOM. His research is also published in various international reputed journals.

COURSE PLAN :

- Week 1:** Introduction to product design and manufacturing
- Week 2:** Product design morphology
- Week 3:** Visual Design, and Quality Function Deployment (QFD)
- Week 4:** Value Engineering
- Week 5:** Material, and Manufacturing process selection
- Week 6:** Design for Manufacturing, Assembly, and Maintenance
- Week 7:** Design for Environment, and Quality Control
- Week 8:** Patenting, and Creativity
- Week 9:** Rapid Prototyping
- Week 10:** Plant Layout Design
- Week 11:** Computer Integrated Manufacturing
- Week 12:** Reverse Engineering, and Managing Competitiveness



PRODUCTION AND OPERATION MANAGEMENT

PROF. RAJAT AGRAWAL

Department of Management
IIT Roorkee

INTENDED AUDIENCE : Management & Science students

INDUSTRIES APPLICABLE TO : BHEL, THDC, Hero Motocorp, UJVNL, Maruti, etc.

COURSE OUTLINE :

Production and operations Management will introduce students to the many operations topics and issues faced by leading organizations, both in service and in manufacturing. The goal of this course is to help students gain an understanding of what operations management involves, how it relates to other functional areas in an organization, the types of problems that are faced by operations managers, and common decision-making approaches.

ABOUT INSTRUCTOR :

Prof. Rajat Agrawal is a member of faculty (Associate Professor) at Department of Management Studies, Indian Institute of Technology Roorkee. He is also associate faculty member at Center of Excellence for Disaster Mitigation and Management and Center of Excellence for Transportation Management, IIT Roorkee. He administers various initiatives of IIT Roorkee in the field of IPR, incubation and entrepreneurship in different capacities. He initiated the incubation centre at IIT Roorkee. He is cocordinator of Design innovation centre at IIT Roorkee and is also the IPR Chair Coordinator there.

COURSE PLAN :

Week 1: Introduction to Operations Management

Week 2: Introduction to Forecasting

Week 3: Causal Methods of forecasting

Week 4: Various variations of EOQ

Week 5: Aggregate Sales and Operations Planning

Week 6: Nature of Quality

Week 7: Acceptance Sampling

Week 8: Facility Capacity

Week 9: Service Facility Layout

Week 10: Maintenance Management

Week 11: Process Analysis

Week 12: Supply Chain Strategy



PROGRAMMING IN JAVA

PROF. DEBASIS SAMANTA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : This course requires that the students are familiar with programming language such as C/C++ and data structures, algorithms.

INTENDED AUDIENCE : The undergraduate students from the engineering disciplines namely CSE, IT, EE, ECE, etc. might be interested for this course.

INDUSTRIES APPLICABLE TO : All IT companies.

COURSE OUTLINE :

With the growth of Information and Communication Technology, there is a need to develop large and complex software. Further, those software should be platform independent, Internet enabled, easy to modify, secure, and robust. To meet this requirement object-oriented paradigm has been developed and based on this paradigm the Java programming language emerges as the best programming environment. Now, Java programming language is being used for mobile programming, Internet programming, and many other applications compatible to distributed systems. This course aims to cover the essential topics of Java programming so that the participants can improve their skills to cope with the current demand of IT industries and solve many problems in their own field of studies.

ABOUT INSTRUCTOR :

Prof. Debasis Samanta holds a Ph.D. in Computer Science and Engineering from Indian Institute of Technology Kharagpur. His research interests and work experience spans the areas of Computational Intelligence, Data Analytics, Human Computer Interaction, Brain Computing and Biometric Systems. Prof. Samanta currently works as a faculty member at the Department of Computer Science Engineering at IIT Kharagpur.

COURSE PLAN :

Week 1: Overview of Object-Oriented Programming and Java

Week 2: Java Programming Elements

Week 3: Input-Output Handling in Java

Week 4: Encapsulation

Week 5: Inheritance

Week 6: Exception Handling

Week 7: Multithreaded Programming

Week 8: Java Applets and Servlets

Week 9: Java Swing and Abstract Windowing Toolkit (AWT)

Week 10: Networking with Java

Week 11: Java Object Database Connectivity (ODBC)

Week 12: Interface and Packages for Software Development



PROGRAMMING, DATA STRUCTURES AND ALGORITHMS USING PYTHON

PROF. MADHAVAN MUKUND

Department of Computer Science and Engineering
Chennai Mathematical Institute

INTENDED AUDIENCE : Students in any branch of mathematics/science/engineering, 1st year

PRE-REQUISITES : School level mathematics.

INDUSTRIES APPLICABLE TO : This course should be of value to any company requiring programming skills.

COURSE OUTLINE :

This course is an introduction to programming and problem solving in Python. It does not assume any prior knowledge of programming. Using some motivating examples, the course quickly builds up basic concepts such as conditionals, loops, functions, lists, strings and tuples. It goes on to cover searching and sorting algorithms, dynamic programming and backtracking, as well as topics such as exception handling and using files. As far as data structures are concerned, the course covers Python dictionaries as well as classes and objects for defining user defined datatypes such as linked lists and binary search trees.

ABOUT INSTRUCTOR :

Prof. Madhavan Mukund studied at IIT Bombay (BTech) and Aarhus University (PhD). He has been a faculty member at Chennai Mathematical Institute since 1992, where he is presently Professor and Director. His main research area is formal verification. He has active research collaborations within and outside India and serves on international conference programme committees and editorial boards of journals.

He has served as President of both the Indian Association for Research in Computing Science (IARCS) (2011-2017) and the ACM India Council (2016-2018). He has been the National Coordinator of the Indian Computing Olympiad since 2002. He served as the Executive Director of the International Olympiad in Informatics from 2011-2014.

In addition to the NPTEL MOOC programme, he has been involved in organizing IARCS Instructional Courses for college teachers. He is a member of ACM India's Education Committee. He has contributed lectures on algorithms to the Massively Empowered Classroom (MEC) project of Microsoft Research and the QEEE programme of MHRD

COURSE PLAN:

Week 1:

Informal introduction to programming, algorithms and data structures
Downloading and installing Python
gcd in Python: variables, operations, control flow - assignments, condition-als, loops, functions

Week 2:

Python: types, expressions, strings, lists, tuples
Python memory model: names, mutable and immutable values
List operations: slices etc
Binary search
Inductive function definitions: numerical and structural induction
Elementary inductive sorting: selection and insertion sort
In-place sorting

Week 3:

Basic algorithmic analysis: input size, asymptotic complexity, $O()$ notation
Arrays vs lists
Merge sort
Quicksort
Stable sorting

Week 4:

Dictionaries
More on Python functions: optional arguments, default values
Passing functions as arguments
Higher order functions on lists: map, lter, list comprehension

Week 5:

Exception handling
Basic input/output
Handling files
String processing

Week 6:

Backtracking: N Queens, recording all solutions
Scope in Python: local, global, nonlocal names
Nested functions
Data structures: stack, queue
Heaps

Week 7:

Abstract datatypes
Classes and objects in Python
"Linked" lists: find, insert, delete
Binary search trees: find, insert, delete
Height-balanced binary search trees

Week 8:

Efficient evaluation of recursive definitions: memoization
Dynamic programming: examples
Other programming languages: C and manual memory management
Other programming paradigms: functional programming



PROJECT PLANNING & CONTROL

PROF. KOSHY VARGHESE

Department of Civil Engineering
IIT Madras

INTENDED AUDIENCE : UG/PG/Industry Participants

PRE-REQUISITES : Basic Mathematics with Probability & Statistics

INDUSTRIES APPLICABLE TO : All leading construction companies.

COURSE OUTLINE :

This course will cover the basic concepts in Project Planning and Control with a focus on construction projects. The course is relevant to Civil Engineering senior level undergraduate as well as post-graduate students in the area of construction management. Practicing engineers who are part of the planning team on construction projects will also benefit from the concepts covered in the course.

ABOUT INSTRUCTOR :

Prof. Koshy Varghese is a Professor with the Building Technology & Construction Management Division of Department of Civil Engineering, Indian Institute of Technology Madras (IITM). Prof. Varghese earned his Doctoral Degree at the University of Texas at Austin in 1992 and worked as a Post-Doctoral Fellow for a year after which he joined IIT Madras. Prof. Varghese is a pioneer in construction management education and research in India and He has received numerous academic honors, and he is on the editorial-board of several international journals. He is also a Member of the Board of Directors of ILCE (Institute for Lean Construction Excellence).

COURSE PLAN :

Week 01 : Introduction, Course Context, Construction Project Management

Week 02 : Time Management, Work Breakdown Structure (WBS), Gantt Charts

Week 03 : Duration Estimation, Network Representation & Analysis -1

Week 04 : Network Representation & Analysis -2; Two-Span Bridge: Scheduling, Network Analysis and Application

Week 05 : Time-Cost Trade-off (Crashing)

Week 06 : Resource Scheduling

Week 07 : Precedence Diagramming Method (PDM), Project Monitoring & Control

Week 08 : Project Monitoring & Control (Earned Value Concepts), Uncertainty in Project Schedules (PERT), Course Summary



PSYCHOLOGY OF EVERYDAY

PROF. BRAJ BHUSHAN

Department of Humanities and Social Sciences
IIT Kanpur

PROF. ALOK BAJPAI

Department of Humanities and Social Sciences
IIT Kanpur

PRE-REQUISITES : Pursuing UG/PG in Psychology, Psychiatry, Psychiatric Social Work, Psychiatric Nursing, etc.

INTENDED AUDIENCE : Anyone interested in mental health issues

INDUSTRIES APPLICABLE TO : Institutions offering MA/MSc/MPhil in clinical/ guidance&counseling/ mental health programmes

COURSE OUTLINE :

This course picks-up threads from the basic observed behavior in everyday life and enters into a dialogue facilitating self-reflection and thus better self-understanding. The emphasis is on what a common man observes and how the knowledge of psychology and psychiatry can be applied to it for better clarity.

ABOUT INSTRUCTOR :

Prof. Braj Bhushan is a professor of psychology at IIT Kanpur. His research interest lies in Cognitive Neuropsychology, Cognitive Factors in Design, Trauma Psychology. He has been awarded with many laurels some being "Our Common Future Fellowship (2010), Volkswagen Stiftung, Germany", "Abstract Award (2008), International Association for Suicide Prevention, 3rd Asia Pacific Regional Conference of IASP, Hong Kong", "In Search of Excellence' Award (2004), IAAP and NAOP-I", "Young Scientist Award (2002), Indian Science Congress Association", "B.H.U. Merit and Prize Award (1991), Banaras Hindu University".

Prof. Alok Bajpai has been trained in Psychiatry at National Institute of Mental health and NeuroSciences (NIMHANS) Bangalore. He did his DPM, MD and is currently practicing at Kanpur and is also the Psychiatrist with Counselling cell, IIT Kanpur. His research interest are in Physics of Brain, Sleep and EEG.

COURSE PLAN :

Week 1:

- Introduction to clinical psychology
- Introduction to psychiatry
- Understanding behaviour- I
- Understanding behaviour- II
- Revisiting normal-abnormal dilemma- I

Week 2:

- Revisiting normal-abnormal dilemma- II
- Revisiting normal-abnormal dilemma- III
- Revisiting normal-abnormal dilemma- IV
- Issues confronting the young adults- I
- Issues confronting the young adults- II

Week 3:

- Issues confronting the young adults- III
- Issues confronting the young adults- IV
- Mental health issues of adults- I
- Mental health issues of adults- II
- Mental health issues of adults- III

Week 4:

- Mental health issues of adults- IV
- Mental health issues of child & adolescents- I
- Mental health issues of child & adolescents - II
- Mental health issues of child & adolescents - III
- Mental health issues of child & adolescents - IV

Week 1:

BASICS OF PYTHON SPYDER (TOOL)

- Introduction Spyder
- Setting working Directory
- Creating and saving a script file
- File execution, clearing console, removing variables from environment, clearing environment
- Commenting script files
- Variable creation
- Arithmetic and logical operators
- Data types and associated operations

Week 2:

Sequence data types and associated operations

- Strings
- Lists
- Arrays
- Tuples
- Dictionary
- Sets
- Range

NumPy

- ndarray

Week 3:

Pandas dataframe and dataframe related operations on Toyota Corolla dataset

1. Reading files
2. Exploratory data analysis
3. Data preparation and preprocessing

Data visualization on Toyoto Corolla dataset using matplotlib and seaborn libraries

1. Scatter plot
2. Line plot
3. Bar plot
4. Histogram
5. Box plot
6. Pair plot

Control structures using Toyota Corolla dataset

1. if-else family
2. for loop
3. for loop with if break
4. while loop

Week 4: CASE STUDY

Regression

1. Predicting price of pre-owned cars

Classification

1. Classifying personal income



RAPID MANUFACTURING

PROF. JANAKARAJAN RAMKUMAR

Department of Mechanical Engineering
IIT Kanpur

PROF. AMANDEEP SINGH OBEROI

Department of Mechanical Engineering
IIT Kanpur

PRE-REQUISITES : The student should have completed two semesters of UG Engineering or Science program

INTENDED AUDIENCE : Students of all Engineering and Science disciplines

INDUSTRIES APPLICABLE TO : HAL, NAL, SAIL, ISRO

COURSE OUTLINE :

In the contemporary dynamic manufacturing era, to produce products that can be easily made and can offer typical competences is of utmost importance. Besides basic manufacturing processes, engineering students and manufacturers needs to bolster their skills in advanced technologies. This course is a step in this direction to make the students to learn design, development, and manufacturing using Rapid Manufacturing technologies. Along with specific Rapid Prototyping techniques, manufacturing concerns such as geometric modelling, design for manufacturing and assembly, developing modular designs, group technology, et cetera are included. Laboratory demonstrations are also induced for practical experience. In the end of this course, students should be able to identify the methods and techniques required to manufacture any model.

ABOUT INSTRUCTOR :

Prof. Janakarajan Ramkumar is Professor of Mechanical Engineering Department, and Design Program, at Indian Institute of Technology, Kanpur. He teaches manufacturing science, micro/nano technology, new product development. He has a bachelors in Production Engineering with his doctorate in Defect quantification in drilling of composites from IIT Madras, India with a best thesis award. Over the years his contribution in teaching and research is remarkable. He has worked for BOSCH group and improved the productivity of the company. His research and teaching focus is on nano technology and inclusive design. He has several international and national patents in his credit and has published more than 100 journal papers.

Prof. Amandeep Singh Oberoi is a Faculty for online courses and shoulders the position of Senior Research Establishment Officer at the prestigious Indian Institute of Technology (IIT) Kanpur, India. Under the role, he is entrusted with the responsibility to manage Imagineering Laboratory, where the emphasis is principally given to providing novel product development and fostering services in defense, Agritech, and Medtech. Dr. Oberoi has accumulated an experience of over two decades: industrial and academic combined; his research interests include the things he values such as Sustainable Manufacturing Processes and Systems, along with areas such as Additive Manufacturing; Simulation of Manufacturing Systems; Product Design and Manufacturing. He has fetched grants and has holds projects from various national and international funding agencies such as DST, MoT, BIRAC, DRDO, SIDBI, CoL. His MOOCs courses in NPTEL and agMOOC are well-received, gaining favour with the audience and receiving positive feedback. Furthermore, he has visited countries like the USA, Canada, Australia, and Egypt to speak at various international symposiums organised by renowned bodies such as AARDO, CIRP, IEOM.

COURSE PLAN :

Week 1 : Introduction to Rapid Manufacturing (RM)

Week 2 : Product Design Process

Week 3 : Design for Modularity

Week 4 : Reverse Engineering

Week 5 : 3D measurement: laboratory demonstration

Week 6 : Polymerization, and Powder based RM processes

Week 7 : Liquid based, and Sheet stacking RM processes

Week 8 : 3D printing RM processes and laboratory demonstration

Week 9 : Beam Deposition RM processes, and materials in RM

Week 10 : Post-processing and costing in RM

Week 11 : Rapid Product Development (CAD/CAE/CIM)

Week 12 : Rapid Product Development (Software demonstration), and case studies on RM



RECENT ADVANCES IN TRANSMISSION INSULATOR

PROF. SUBBA REDDY

Department of Electrical Engineering
IISc Bangalore

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 4 weeks (24 Jan' 22 - 18 Feb' 22)

EXAM DATE : 27 Mar 2022

PRE-REQUISITES : Basic knowledge of Electrical Engineering.

INTENDED AUDIENCE : 3rd or 4th year UG, 1st year masters and research students UG/PG course, industry/utility participants can also register.

COURSE OUTLINE :

This course introduces the recent advances in EHV/UHV transmission Insulators. The course emphasizes learning and understanding the newer design criteria for the UHV transmission insulation. The course starts with an introduction to the importance of EHV /UHV transmission, its present and future growth. The discussion on the various components used for UHV transmission, design considerations etc are strengthened with the aid of lectures, practical video demonstrations and assignment exercises.

ABOUT INSTRUCTOR :

Prof. Subba Reddy B is a Principal Research Scientist at the High Voltage Laboratory, Dept. of Electrical Engineering, Indian Institute of Science, Bangalore, India. He received Bachelor in Electrical Engineering degree from Karnatak university, Dharwad, and MSc(Engg) and PhD from Indian Institute of Science, Bangalore, India.

His research interests are high voltage engineering, transmission line insulators, numerical techniques for high voltage applications, condition monitoring and diagnostics of HV equipment, surge arresters, renewable energy systems etc. He has received national and international recognition for his research work. He is a Fellow of Institution of Engineers (India), Fellow, Society of Power Engineers (India) and Senior member IEEE

COURSE PLAN :

Week 1: Introduction, Important components of transmission system, Insulation coordination

Week 2: Non ceramic insulators performance-service experience, Pollution/contamination flashover phenomena modelling etc , Failures, importance of reliability and testing

Week 3: High Voltage testing and techniques employed, HV testing techniques for Ceramic / Glass Insulators

Week 4: Surface degradation studies on composite insulators , Recent studies on composite insulators \ Summary



REMOTE SENSING AND GIS

PROF. RISHIKESH BHARTI

Department of Civil Engineering
IIT Guwahati

INTENDED AUDIENCE : UG, PG and PhD Students

INDUSTRIES APPLICABLE TO : Esri, Rolta India, RMSI Private Limited, ArcGeosystems

COURSE OUTLINE :

This course will introduce the students to the state-of-the-art concepts and practices of remote sensing and GIS. It starts with the fundamentals of remote sensing and GIS and subsequently advanced methods will be covered. This course is designed to give comprehensive understanding on the application of remote sensing and GIS in solving the research problems. Upon completion, the participants should be able to use remote sensing (Satellite images and Field data) and GIS in their future research work.

ABOUT INSTRUCTOR :

Prof. Rishikesh Bharti is a faculty member at the Department of Civil Engineering, Indian Institute of Technology Guwahati. He has been teaching Advanced Remote Sensing, Geohazard Science and Engineering, Advanced Techniques in Geoscience, Engineering Geology to the B.Tech, M.Tech and PhD students at IIT Guwahati. Hydrogeomorphology, Geospatial modelling, Snow and Glacier Studies, Spectroscopy of natural and man-made materials and Advance remote sensing (Hyperspectral and thermal) for the earth and planetary exploration are his major research interests. He hopes participants will enjoy and learn the proposed course. The details of his research can be found at Website: <http://www.iitg.ac.in/rbharti/>

COURSE PLAN :

Week 1: Remote Sensing Data and Corrections

Week 2: Satellite Image Corrections

Week 3: Digital Image Processing-I

Week 4: Digital Image Processing-II

Week 5: Thermal and Microwave

Week 6: Imaging Spectroscopy-I

Week 7: Imaging Spectroscopy-II & GIS-I

Week 8: GIS-II and Application



ROBOTICS AND CONTROL: THEORY AND PRACTICE

PROF. N. SUKAVANAM

Department of Mathematics
IIT Roorkee

PROF .M. FELIX ORLANDO

Department of Electrical Engineering
IIT Roorkee

PRE-REQUISITES : Basic Mathematics

INTENDED AUDIENCE : Electrical Engineering, Computer Science Engineering, Mechanical Engineering, Electronics and Communication Engineering, Mathematics students

COURSE OUTLINE :

Robotics has stimulated an growing interest among a wide range of scholars, researchers and students due to its interdisciplinary characteristics. The development of this field of science is boosted by various domains which are not limited to Cybernetics, Controls, Computers, Mechanics, Bio-Engineering, and Electronics. Among these areas, modelling, control, planning play a fundamental role not only in the growth of industrial robotics, but also towards the advanced fields including healthcare and field robotics.

Through this course the participants will acquire the ability to conduct research, develop innovative designs in the field of systems engineering and control of robots and to direct the development of engineering solutions in new or unfamiliar environments by linking creativity, innovation and transfer of technology.

ABOUT INSTRUCTOR :

Prof. N. Sukavanam received his Ph. D from the Indian Institute of Science, Bangalore in 1985. He served as a Scientist-B at Naval Science and Technological Laboratory, DRDO for two years (1984-86). Then joined as a Research Scientist in the Department of Mathematics, IIT Bombay (1987-90). Worked as a Lecturer at BITS Pilani from 1990 to 1996. Currently he is a Professor in the Department of Mathematics IIT Roorkee and heads the department.

Prof. M. Felix Orlando received his Ph.D. from Electrical Engineering Department at Indian Institute of Technology Kanpur (IITK) in 2013. In 2015, he completed his post doctoral fellowship at Case Western Reserve University, USA on Medical robotics. Dr. Felix Orlando has been working as an Assistant Professor in the Department of Electrical Engineering at the Indian Institute of Technology Roorkee (IITR) from November 2015 onwards.

COURSE PLAN :

Week 1: Simple manipulators: Two /three arm manipulators and their kinematics equations, Work space Homogeneous Transformation: Rotation, Translation, Composition of homogeneous transformations

Week 2: Denavit-Hartenberg Algorithm: D-H procedure for fixing joint coordinate frames, Robot parameters, Arm matrix, Inverse Kinematics for PUMA, SCARA manipulators.

Week 3: Introduction to Robotic Exoskeletons ,Optimal Design of a Three Finger Exoskeleton for Rehabilitation Purpose

Week 4: Differential transformation and velocity of a frame: Derivative of a frame, Velocity, Jacobian, Inverse Jacobian, Trajectory Planning: Polynomial trajectory, Biped trajectory

Week 5: Dynamics: Lagrangian method, Robot dynamics equation, Control: Robot dynamics equation as a control system, Trajectory tracking control, PD controller, Neural network control design

Week 6: Redundancy Resolution of Human Fingers using Robotic Principles ,Manipulability Analysis of Human Fingers during Coordinated Object Rotation ,Kinematics of Flexible Link Robots

Week 7: Robot Assisted Needling System for Percutaneous Intervention-An Introduction ,Smart Robotic Needles for Percutaneous Cancerous Interventions

Week 8: Robust Force Control of a Two Finger Exoskeleton during Grasping ,Neural Control of an Index Finger Exoskeleton



SMART MATERIALS AND INTELLIGENT SYSTEM DESIGN

PROF. BISHAKH BHATTACHARYA

Department of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 4 weeks (21 Feb'22 - 18 Mar'22)

EXAM DATE : 24 Apr 2021

INTENDED AUDIENCE : People aiming to explore advance areas.

PRE-REQUISITES : Basics of Nature and Properties of Materials, Linear algebra

INDUSTRIES APPLICABLE TO : Aerospace, Automobile, Manufacturing industries

COURSE OUTLINE :

Smart Structures and Intelligent System are becoming an integral part of new aerospace and automobile systems due to high performance and fast response potential. Knowledge in this field is multi-disciplinary in nature involving materials, composites, basic electronics, control system and informatics. In this short course, I intend to convey the core flavor of the field by introducing the basic concepts behind such system along with some industrial applications developed in the SMSS laboratory of IIT Kanpur.

ABOUT INSTRUCTOR :

Prof. Bishakh Bhattacharya is currently Dr. Gurumukh D. Mehta and Veena M. Mehta Chair Professor at the Department of Mechanical Engineering and joint faculty at Cognitive Science and Technology, IIT Kanpur. His research interest primarily lies in vibration control, structural health monitoring, energy harvesting system, intelligent system design and Child-Reconfigurable Robot Interaction. He is the coordinator of Space Technology Cell, IIT Kanpur and head of the SMSS (Smart Materials, Structures and Systems) Laboratory.

<http://home.iitk.ac.in/~bishakh/>

COURSE PLAN :

Week 01 : Introduction to Smart Materials

Week 02 : Mechanics of Composite Materials

Week 03 : Induced Strain Actuation Mechanisms

Week 04 : Intelligent System Design



STRATEGY: AN INTRODUCTION TO GAME THEORY

PROF. ADITYA K JAGANNATHAM

Department of Electrical Engineering
IIT Kanpur

PROF. VIMAL KUMAR

Department of Economic Sciences
IIT Kanpur

INTENDED AUDIENCE : Students: Engineering, Management, Economics, Mathematics Professionals: Engineers, Scientists, Managers, Economists, Academicians, Policy Makers

INDUSTRIES APPLICABLE TO : This is an undergraduate core course required as a foundation to other courses in Microwave, Optical, and Antenna engineering.

COURSE OUTLINE :

Games or 'Strategic Interactions' can be found in all walks of life. Examples of such scenarios are two firms competing for market share, politicians contesting elections, different bidders participating in an auction for wireless spectrum, coal blocks etc. Game theory provides a convenient framework to model and interpret the behaviour of participants in such strategic interactions. Hence it can be applied to solve a wide variety of problems involving diverse areas such as Markets, Auctions, Online Retail, Cold War, Paying Taxes, Bargaining, Elections, Portfolio Management etc. Therefore, both undergraduate and postgraduate students and professionals from diverse backgrounds such as Scientists, Engineers, Managers, Politicians and Political Scientists, Economists, Mathematicians etc will find the course content useful. Examples and exercises will be motivated by problems close to real life scenarios.

ABOUT INSTRUCTOR :

Prof. Aditya K. Jagannatham received his Bachelors degree from the Indian Institute of Technology, Bombay and M.S. and Ph.D. degrees from the University of California, San Diego, U.S.A. From April '07 to May'09 he was employed as a senior wireless systems engineer at Qualcomm Inc., San Diego, California, where he was a part of the Qualcomm CDMA technologies (QCT) division. His research interests are in the area of next-generation wireless cellular and WiFi networks, with special emphasis on various 5G technologies such as massive MIMO, mmWave MIMO, FBMC, NOMA, Full Duplex and others. He has contributed to the 802.11n high throughput wireless LAN standard and has published extensively in leading international journals and conferences. He was awarded the CAL(IT)2 fellowship at the University of California San Diego and the Upendra Patel Achievement Award at Qualcomm. He is currently a Professor in the Electrical Engineering department at IIT Kanpur, where he holds the Arun Kumar Chair Professorship, and is also associated with the BSNL-IITK Telecom Center of Excellence (BITCOE). He has been twice awarded the P.K. Kelkar Young Faculty Research Fellowship for excellence in research, the Qualcomm Innovation Fellowship (QInF) and the IIT Kanpur Excellence in Teaching Award. His popular video lectures for the NPTEL (National Programme on Technology Enhanced Learning) course on Advanced 3G and 4G Wireless Mobile Communications can be found at the following YouTube link (NPTEL 3G/4G). He has also successfully conducted several Massive Open Online Courses (MOOCs) on various topics such as Applied Game Theory, MIMO OFDM Wireless Systems, Probability and Random Processes, Signals and Systems, Principles of Communication Systems, which have been widely adopted and appreciated. A book authored by him titled Principles of Modern Wireless Communications Systems has been published by McGraw Hill Education and comprehensively covers several key aspects of modern wireless technologies.

Prof. Vimal Kumar received his Ph.D. in Economics from the University of California Irvine in 2008 and B. Tech. in Mechanical Engineering and M. Tech in Thermal Fluid Engineering under a dual degree program from the Indian Institute of Technology Bombay in 2003. After finishing his Ph.D. program in July 2008, he joined the Delhi office of Watson Wyatt Worldwide, a multinational consultancy organization. He worked for one year as a Consultant/Economist in the Global Research Division of the firm. In June 2009, he joined the Indian Institute of Technology (IIT) Kanpur as Assistant Professor. In June 2015, he became Associate Professor, and in December 2019, he became a Professor. Currently, he is the head of the Department of Economic Sciences at IIT Kanpur. He is also a coordinator for NPTEL program at IIT Kanpur.

He is the recipient of several awards and fellowships, including the class of 1982 research fellowship given by IIT Kanpur, the best research paper award for the year 2011 by the American Political Science Association, the Social Science Merit fellowship from the University of California Irvine for years 2003 to 2008, and National Talent Search Scholarship (NTSE) from NCERT, India.

He has participated in 5 sponsored research grants and organized more than 15 workshops in Game Theory and Power System Economics. He has delivered more than 25 guest lectures.

COURSE PLAN :

Week 1: Normal Games and Nash Equilibrium.

Week 2: Mixed Strategies.

Week 3: Sequential Games.

Week 4: Games with Incomplete Information.

Week 5: Auctions

Week 6: Repeated Games

Week 7: Cooperative Games

Week 8: Bargaining and Negotiation



Sustainable Engineering Concepts and Life Cycle Analysis

Prof. Brajesh Kumar Dubey

Department of Civil Engineering
IIT Kharagpur

INTENDED AUDIENCE: Any interested learners.

PRE-REQUISITES : Environmental Sciences, Introduction to Environmental Engineering

INDUSTRIES APPLICABLE TO : list of companies/industry that will recognize/value this online course, Larsen and Turbo, Tata Group of Industries.

COURSE OUTLINE :

This course will introduce students to the fundamental concepts related to interaction of industrial and environmental/ecological systems, sustainability challenges facing the current generation, and systems-based approaches required to create sustainable solutions for society. Students will understand the concepts and the scientific method as it applies to a systems-based, trans-disciplinary approach to sustainability, and will be prepared to identify problems in sustainability and formulate appropriate solutions based on scientific research, applied science, social and economic issues. The basic concepts of life cycle assessment (LCA) will be discussed, along with life cycle inventory (LCI) and life cycle impact assessment (LCIA) including the social and economic dimensions. The application of life cycle assessment methodology using appropriate case studies will be presented.

ABOUT INSTRUCTOR :

Prof. Brajesh Kr. Dubey has his bachelors degree in Civil Engineering (Hons) from Indian Institute of Technology (IIT) Kharagpur, India and PhD in Environmental Engineering Sciences, University of Florida, Gainesville, Florida, USA. He is presently Associate Professor (Integrated Waste Management and Sustainable Engineering) in the Division of Environmental Engineering and Management at Indian Institute of Technology (IIT), Kharagpur, India. Dr. Dubey has more than 17 years of research, teaching, training and industrial outreach experience in the areas of Integrated Solid and Hazardous Waste Management, and Sustainable Engineering and Application of Life Cycle Assessment techniques. He also works in the area of Life Cycle Analysis and Sustainable Engineering. He has been teaching courses in the area of Solid Waste Management, Hazardous Waste Management, Life Cycle Analysis and Environmental Risk Assessment among other courses for nearly a decade. He has taught at several universities in USA, Canada, New Zealand, China and India. He has also conducted training programs in the Integrated Waste Management areas including that for Electronics Waste. Dr. Dubey has authored/co- authored more than 200 publications in his area of expertise and have presented at several national and international conferences. He has worked as Waste Management Expert for UN agencies and World Bank.

COURSE PLAN :

Week 1: An Introduction to Sustainability Concepts and Life Cycle Analysis (Introduction, Material flow and waste management, What it all means for an engineer? Water energy and food nexus)

Week 2: Risk and Life Cycle Framework for Sustainability (Introduction, Risk, Environmental Risk Assessment, Example Chemicals and Health Effects, Character of Environmental Problems)

Week 3: Environmental Data Collection and LCA Methodology (Environmental Data Collection Issues, Statistical Analysis of Environmental Data, Common Analytical Instruments, Overview of LCA Methodology - Goal Definition, Life Cycle Inventory, Life Cycle Impact Assessment, Life Cycle Interpretation, LCA Software tools)

Week 4: Life Cycle Assessment – Detailed Methodology and ISO Framework (Detailed Example on LCA Comparisons, LCA Benefits and Drawbacks, Historical Development and LCA Steps from ISO Framework)

Week 5: Life Cycle Inventory and Impact Assessments (Unit Processes and System Boundary Data Quality, Procedure for Life Cycle Impact Assessment, LCIA in Practice with Examples, Interpretation of LCIA Results)

Week 6: Factors for Good LCA Study (ISO Terminologies, LCA Steps Recap, Chemical Release and Fate and Transport, and Green Sustainable Materials)

Week 7: Design for Sustainability (Environmental Design for Sustainability: Economic, Environmental Indicators, Social Performance Indicators, Sustainable Engineering Design Principles and Environmental Cost Analysis)

Week 8: Case Studies (e.g., Odour Removal for Organics Treatment Plant, Comparison of Hand Drying Methods, Biofuels for Transportation, Kerosene Lamp vs. Solar Lamp, Bioplastic etc.).



SUSTAINABLE TRANSPORTATION SYSTEMS

PROF. BHOLA RAM GURJAR

Department of Civil Engineering
IIT Roorkee

INTENDED AUDIENCE : PG/Pre-PhD (UG Students, Professionals and Policy Makers can also attend)

INDUSTRIES APPLICABLE TO : Automobile, road and transportation related other industries may find this course informative.

COURSE OUTLINE :

The objective of the course is to impart knowledge and skills of environmental issues related to transportation systems, concept of sustainability and related issues. The course includes the various environmental aspects of mass rapid transportation systems, air quality management through transportation planning in mega cities and current case studies regarding the same.

ABOUT INSTRUCTOR :

Prof. Bhola Ram Gurjar holds a PhD in the area of Environmental Risk Analysis from India's premier technological institution I.I.T. Delhi followed by Postdoctoral research at the Max Planck Institute for Chemistry (MPIC) in Mainz, Germany. He is a Professor of Environmental Engineering in Civil Engineering Department and a Joint Faculty in Centre of Excellence for Sustainable Transportation Systems (CTRANS) at I.I.T. Roorkee. He has been Dean of Resources and Alumni Affairs (DORA) from June 2017 - April 2021 and Head of CTRANS from February 2015 - February 2018 at IIT Roorkee. He has also headed the Max Planck Partner Group for Megacities & Global Change at IIT Roorkee from 2006-2011. Prof. Gurjar has about 30 years' progressive professional experience in industry, teaching, training, research, and consultancy. He is among the leading academics and researchers who have worked extensively in the area of environmental science and engineering specially focused on air and water pollution, and environmental quality and health risk assessment, which is reflected in his several highly cited research papers published on these themes. His present research interests include megacities; air and water pollution; environmental impact and risk assessment; atmospheric emissions and climate change; Biofuels and their emissions, and integrated cross-disciplinary study of science and policy issues of the environment, health, energy, economy, technology, infrastructure and resources – particularly from the global change, sustainable development and risk governance perspectives.

COURSE PLAN :

Week 1: Introduction to Environmental Impact Assessment (EIA) and Transportation systems

Week 2: Land-use plans, zoning schemes and provisions

Week 3: Urban and regional transport planning

Week 4: Impacts on humans, flora and fauna, soil, water, air, climate and landscape

Week 5: Establishment of baseline conditions w.r.t soil, water and air quality

Week 6: Noise, air and water pollution modelling

Week 7: Modelling of impacts and scenario-based analysis

Week 8: Assessment of potential project impacts including indirect, cumulative and synergistic impacts

Week 9: Decision support systems for EIA of transport infrastructures

Week 10: Abatement measures

Week 11: Sustainable transportation systems

Week 12: Case studies of highway, railway and airport projects, OpenLCA tool for life Cycle Assessment, STAN for material flow analysis



SYSTEM DESIGN THROUGH VERILOG

PROF. SHAIK RAFI AHAMED

Department of Electronics & Electrical Engineering
IIT Guwahati

PRE-REQUISITES : Digital Circuits

INTENDED AUDIENCE : Undergraduate, post graduate students, faculty and industry people

INDUSTRIES APPLICABLE TO : Cadence/Mentor graphics

COURSE OUTLINE :

A comprehensive resource on Verilog HDL for beginners and experts large and complicated digital circuits can be incorporated into hardware by using Verilog, a hardware description language (HDL). A designer aspiring to master this versatile language must first become familiar with its constructs, practice their use in real applications, and apply them in combinations in order to be successful. Design Through Verilog HDL affords novices the opportunity to perform all of these tasks, while also offering seasoned professionals a comprehensive resource on this dynamic tool.

ABOUT INSTRUCTOR :

Prof. Shaik Rafi Ahamed is a professor with more than 20 years teaching experience. He had taught Digital design including verilog nearly 10 times for undergraduate students at IIT Guwahati and other institutions. He have published several papers in reputed Journals like IEEE, Elsevier, IET and Springer.

COURSE PLAN :

Week 1: Introduction to Verilog

Week 2: Gate level modelling

Week 3: Behavioral modelling I

Week 4: Behavioral modelling II

Week 5: Data flow modelling

Week 6: Switch level modelling

Week 7: Synthesis of combinational logic using verilog

Week 8: Synthesis of sequential logic using verilog



THE JOY OF COMPUTING USING PYTHON

PROF. SUDARSHAN IYENGAR

Department of Computer Science and Engineering
IIT Ropar

INTENDED AUDIENCE : Any interested audience

PREREQUISITES : 10th standard/high school

INDUSTRY SUPPORT : Every software company is aware of the potential of a first course in computer science. Especially of a first course in computing, done right.

COURSE OUTLINE :

A fun filled whirlwind tour of 30 hrs, covering everything you need to know to fall in love with the most sought after skill of the 21st century. The course brings programming to your desk with anecdotes, analogies and illustrious examples. Turning abstractions to insights and engineering to art, the course focuses primarily to inspire the learner's mind to think logically and arrive at a solution programmatically. As part of the course, you will be learning how to practice and culture the art of programming with Python as a language. At the end of the course, we introduce some of the current advances in computing to motivate the enthusiastic learner to pursue further directions.

ABOUT INSTRUCTOR :

Prof. Sudarshan Iyengar, Associate Professor at the CSE at IIT Ropar has a Ph.D. from the Indian Institute of Science (IISc). An exemplary teacher who has delivered over 350 popular science talks to students of high school and advanced graduate programmes. Prof. Sudarshan has offered more than 100 hours of online lectures with novel teaching methodologies that have reached lakhs of Students. His research interests include Data Sciences, Social Computing, Social Networks, Collective Intelligence, Crowdsourced Technologies and Secure Computation.

COURSE PLAN :

- Motivation for Computing
- Welcome to Programming!!
- Variables and Expressions : Design your own calculator
- Loops and Conditionals : Hopscotch once again
- Lists, Tuples and Conditionals : Lets go on a trip
- Abstraction Everywhere : Apps in your phone
- Counting Candies : Crowd to the rescue
- Birthday Paradox : Find your twin
- Google Translate : Speak in any Language
- Currency Converter : Count your foreign trip expenses
- Monte Hall : 3 doors and a twist
- Sorting : Arrange the books
- Searching : Find in seconds
- Substitution Cipher : What's the secret !!
- Sentiment Analysis : Analyse your Facebook data
- 20 questions game : I can read your mind
- Permutations : Jumbled Words
- Spot the similarities : Dobble game
- Count the words : Hundreds, Thousands or Millions.
- Rock, Paper and Scissor : Cheating not allowed !!
- Lie detector : No lies, only TRUTH
- Calculation of the Area : Don't measure.
- Six degrees of separation : Meet your favourites
- Image Processing : Fun with images
- Tic tac toe : Let's play
- Snakes and Ladders : Down the memory lane.
- Recursion : Tower of Hanoi
- Page Rank : How Google Works !!



THE PSYCHOLOGY OF LANGUAGE

PROF.NAVEEN KASHYAP

Department of Humanities and Social Sciences
IIT Guwahati

INTENDED AUDIENCE : Students, Teachers

COURSE OUTLINE :

The very basic form of exchanging information between two living beings is termed as communication. A highly developed form of communication is language, which is used mostly by human beings. The present course will introduce the concept of language and the psychology behind the learning and using of language

ABOUT INSTRUCTOR :

Prof. Naveen Kashyap, Ph.D is as Associate Professor of Psychology at the Indian Institute of Technology Guwahati. His research interests are sleep and human cognitive processes. Dr Kashyap has been teaching courses like cognitive psychology, introduction to psychology, consumer psychology, advance cognitive process and research methodology to UG and PG students of Guwahati for the past 10 years.

COURSE PLAN :

Week 1: Communication and Language

Week 2: The Science of Language

Week 3: Speech Perception

Week 4: Speech Production

Week 5: Words

Week 6: Sentences

Week 7: Discourse

Week 8: Reading and Writing



FUNDAMENTAL OF WELDING SCIENCE AND TECHNOLOGY

PROF. PANKAJ BISWAS

Department of Mechanical Engineering
IIT Guwahati

COURSE OUTLINE :

Prof. Pankaj Biswas going to offer a course on Fundamental of Welding Science and Technology under the MOOCS program of the MHRD. As the name implies in this course he will try to cover the fundamental overview of the traditional/ industrial welding technology especially those welding processes which are widely used in manufacturing industries. This will help the participants to understand and apply this knowledge of welding in practice for various industrial applications. It will also encourage academic participants to increase the research interest in the field of welding. Welding is a joining process which is an unavoidable technology in most of the manufacturing sector. It is such a topic in which you will get the taste of most of the science and engineering subjects. Knowledge of almost all science subjects like physics, chemistry, mathematics and engineering subjects like solid mechanics, thermal science, fluid mechanics etc. are highly essential to understand the area welding technology. It is observed that in manufacturing industry over 30 % expenditure is spent on welding. Welding has significant application in various manufacturing sectors like aerospace, automobile, ship building, railway etc. It plays very important and crucial role in service life of the structure. That's why basic fundamental knowledge of welding is highly essential. The brief overview of the course content can be stated like; this course will cover the classification of welding process, classification of welding joints, industrial relevance of welding, welding symbols, characteristics of traditional welding power sources. It will give the fundamental knowledge of principle and physics involve in various welding processes. It will also cover the importance and applications of different traditional welding techniques. This course will highlight safety precautions to be followed in welding. This course will also cover welding defects & inspection and with their remedies to improve the weld quality.

ABOUT INSTRUCTOR :

I, Prof. Pankaj Biswas, am a Professor in the Dept. of Mechanical Engineering, IIT Guwahati. I am working in the area of welding technology, 3-D printing and forming by line heating for the past 17 years. My areas of research are on computational weld mechanics, similar and dissimilar friction stir welding, friction stir welding of steel, hybrid welding technology, Finite Element analysis of weld induced distortion and residual stresses, Analysis of large welding structure, forming by line heating and modeling of welding processes using soft computing techniques. I guided 02 PDF, 10 PhD scholars in the area of welding and forming. Currently I am guiding 02 NPDF and 10 PhD students in the welding, 3-D printing and line heating areas. I already published about 104 journal articles, 95 conference proceedings, 28 book chapters and 06 patents. I worked in ten sponsored / consultancy projects. Currently, I am working in another eight sponsored / consultancy projects. I got IEI Young Engineers Award 2013- 2014' in Mechanical Engineering discipline.

COURSE PLAN :

- Week 1:** Introduction and classification of welding
- Week 2:** Nomenclature and symbol of welding joints
- Week 3:** Power source of welding
- Week 4:** Physics and principle of arc welding
- Week 5:** Different type of welding methods and their details
- Week 6:** Different type of welding methods their details
- Week 7:** Different type of welding methods their details
- Week 8:** Welding defects and inspection



WELDING PROCESSES

PROF. MURUGAIYAN AMIRTHALINGAM

Department of Metallurgy and Material Science
IIT Madras

PRE-REQUISITES : Graduates of Metallurgical/Mechanical/Automobile/Production Engineering

INTENDED AUDIENCE : Masters students in Metallurgical, Mechanical, Automobile and Production Engineering. Practicing welding engineers, welders, R&D personnel in academia and national laboratories, quality management personnel from welding and manufacturing industries and research scholars who are working in welding and joining.

INDUSTRIES APPLICABLE TO : Construction, Fabrication, Automobile and Power generation industries and research labs

COURSE OUTLINE :

The modern material assemblies require the combined use of alloys for a given commercial application. Welding technologies are of critical importance for the construction of virtually all components of the assemblies. This course aims to elaborate the physical principles of arc, plasma, laser, resistance spot, electron beam and solid state welding processes. This includes, physics of electric arc-plasma, engineering the arc-plasma for welding, metal transfer and mass flow in the weld pool, laser/electron beam - material interactions, pressure and force balance in keyhole mode power beam welding, fundamentals of heat generation by Joule heating and process principles and overview on types of resistance and solid state welding processes.

ABOUT INSTRUCTOR :

Prof. Murugaiyan Amirthalingam is currently working as an Assistant Professor in IIT-Madras. His research and teaching interests include welding metallurgy, welding processes development, steel product development and additive manufacturing.

COURSE PLAN :

Week 1 : Introduction to the course, learning outcomes, general survey and classification of welding processes, Conventional fusion welding processes, Principal heat sources

Week 2 : Physics of welding arc – Part I General characteristics of an arc, ionisation, dissociation, arc column, anode and cathode fall zones.

Week 3 : Physics of welding arc – Part II Electrical conductivity of the arc, heat transfer inside the arc and arc ignition.

Week 4 : Introduction to arc welding processes – Part I Principles of gas tungsten arc welding, plasma arc welding, advances in gas tungsten arc welding

Week 5 : Electrical power sources for welding - General characteristics, conventional and electronic power regulator systems - Tapped transformers, Moving-iron control, Variable inductor, Magnetic amplifier, SCR phase control, Transistor series regulator, Secondary switched transistor power supplies, Primary rectifier-inverter, hybrid designs and microprocessor controlled power sources.

Week 6 : Introduction to arc welding processes – Part II Gas metal arc, shielded metal arc, flux cored arc, submerged arc welding -consideration of shielding gases, electrode polarity, current setting, types of metal transfer, process efficiency, melting rate, spatter losses and influence of external magnetic field on arc stability and Advanced GMAW processes. Electrode coverings and their functions, types of fluxes,

Week 7 : Fundamentals of resistance welding – Part I Process principles and overview on types of processes (spot, projection, butt, seam, and flash) Joule effect and temperature distribution.

Week 8 : Fundamentals of resistance welding – Part II Process application range and typical problems (welding thin to thick material, welding of coated/ painted materials, welding dissimilar materials, mass effect, shunt effect, Peltier effect, resistance brazing.

Week 9 : Introduction to power beam welding processes Plasma, laser and electron beam welding processes - principles and modes of operation, applications and advantages.

Week 10 : Principles of power beam welding processes Keyhole formation, power densities, forces acting in keyhole, pressure balance for a generalised keyhole, heat transfer in laser and electron beam welding processes.

Week 11 : Introduction to pressure welding processes - solid state bonding, friction welding, friction stir welding, ultrasonic welding, explosive welding, diffusion bonding and adhesive bonding.

Week 12 : Principles and operational considerations of pressure welding processes



ADVANCED CONCRETE TECHNOLOGY

PROF. MANU SANTHANAM

Department of Civil Engineering
IIT Madras

INTENDED AUDIENCE : Post-graduate students, and final year undergraduate students

PRE-REQUISITES : Basic course on Construction Materials in UG level. Additional course on Concrete Technology (UG level) is optional.

INDUSTRIES APPLICABLE TO : Civil contracting firms, Ready mixed concrete companies, Cement companies, Construction chemicals companies, Materials research laboratories etc

COURSE OUTLINE :

This course explores the materials science of concrete, and attempts to bring about the understanding of concrete behavior from a fundamental perspective. The first part of the course discusses the structure and properties of concrete making materials. This is followed by mixture proportioning of high performance concrete, and a study of selected topics regarding fresh and hardened concrete behavior. The final part of the course deals with long term performance issues, related to creep, shrinkage and durability of concrete.

ABOUT INSTRUCTOR :

Prof. Manu Santhanam is a Professor in the Department of Civil Engineering at IIT Madras, where he has worked since October 2001. His primary research interests are in Cement Chemistry, Durability of Concrete and Non-Destructive Evaluation. He has published more than 75 refereed journal papers, and has guided 10 PhD theses, in addition to being lead investigator on several sponsored projects.

COURSE PLAN :

Week 01 : Cement production and composition

Week 02 : Cement chemistry

Week 03 : Aggregates for concrete

Week 04 : Chemical admixtures

Week 05 : Chemical and Mineral admixtures

Week 06 : Mineral admixtures

Week 07 : High performance concrete mixture proportioning

Week 08 : Topics in fresh concrete

Week 09 : Topics in hardened concrete

Week 10 : Creep and shrinkage

Week 11 : Durability of concrete

Week 12 : Durability of concrete



APPLIED NATURAL LANGUAGE PROCESSING

PROF. RAMASESHAN R

Department of Computer Science and Engineering
Chennai Mathematical Institute

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (20 Jul'20 - 9 Oct'20)

EXAM DATE : 17 Oct 2020

PRE-REQUISITES : Essential – Algorithms, Python Proficiency, Elementary probability and statistics, Linear Algebra, basic understanding of machine learning

COURSE OUTLINE :

A major portion of communication now is through text and any organization has more than 90% of its content in the unstructured form. Natural Language Processing (NLP), an important part in Artificial Intelligence, is one of the important technologies that would help in activities such as classification, retrieving and extraction of information, identifying important documents, etc. Students will gather knowledge in the fundamentals of NLP, methods and techniques and gain skills to use them in practical situations.

ABOUT INSTRUCTOR :

Prof. Rameseshan R is currently working as a Visiting faculty at Chennai Mathematical Institute and teaches this course to the students there. He has more than 30 years of experience in Research and Development, Teaching, Product Development, Information Technology, Innovation and Convergence.

COURSE PLAN :

Week 1: Introduction to language processing – tokens, sentences, paragraphs

Week 2: Regular expressions - extraction of information using Regex

Week 3: Document Similarity measures - Cosine and cluster measures

Week 4: Spelling correction - Edit distance

Week 5: Information retrieval, extraction

Week 6: Document Classification, Clustering, topic modeling techniques

Week 7: Vector Space Model - word vectors, GloVe/Word2Vec model, word embedding

Week 8: Text Classification, Clustering, and Summarization

Week 9: Machine Learning, Perceptron

Week 10: Back Propagation, Recurrent Neural network relevant to NLP

Week 11: Machine Translation, Language Generation

Week 12: Applications – Sentiment Analysis, Spam Detection, Resume Mining, Alnstein



BASIC PRINCIPLES AND CALCULATIONS IN CHEMICAL ENGINEERING

PROF. SUBRATA KUMAR MAJUMDAR

Department of Chemical Engineering

IIT Guwahati

PRE-REQUISITES : 10+2 Examination in science

INTENDED AUDIENCE : Chemical, BioChemical, chemical science and Technology / Chemical Engineering Petroleum science and technology

INDUSTRIES APPLICABLE TO : Industrial Research and development section of chemical and Biochemical Engineering

COURSE OUTLINE :

The objective of the course is to introduce chemical engineering students to the basic principles and calculation techniques used in the chemical industries and to acquaint them with the fundamentals of the material and energy balances as applied to chemical engineering processes. The course is mainly intended for graduate chemical engineering student. It will expose them to solve the problems in material and energy balances that arise in relation to the problems involving in different chemical process units. It also will introduce them to numerical methods used to solve the problems. The course will introduce in simple language and ample of examples so that it will encourage learners to get used to the course.

ABOUT INSTRUCTOR :

Prof. Subrata Kumar Majumder is a Professor in the Chemical Engineering Department, IIT Guwahati, India. His research interests include multiphase flow and reactor development, hydrodynamics in multiphase flow, mineral processing, process intensifications and micro-nano bubble science and technology and its applications. He is a Fellow of the International Society for Research and Development, 8A Kapteinsvigein, London, UK. He is also a recipient of various honours and awards like: Editor, Journal of Chemical Engineering Research Studies, Guest editor, American Journal of Fluid Dynamics, published by Scientific & Academic Publishing Co., CA, 91731, USA, Editorial board member of Scientific Journal of Materials Science, IIME Award on beneficitation from Indian Institute of Mineral Engineers (IIME), Editorial board Member of the Journal of Science and Technology, Scientific and Academic Publishing, USA, Advisory board member of Excelling Tech Publishers (ETP), London, UK. He is a life member of Indian Institute of Chemical Engineers, Indian Institute of Mineral Engineers, member of Institute of Engineers (India), Member of Asia-Pacific Chemical, Biological & Environmental Engineering Society (PCBEE), senior member of International Association of Engineers (IAE), Japan. He authored four books, five book chapters, and has more than 80 publications in several reputed international journals. Presently he is working in the field of Microbubble science and technology and its applications in mineral beneficiation, food processing and arsenic, ammonia and dye removal and process intensifications by developing ejector-induced gas aided extraction process.

COURSE PLAN :

Week 1: Introduction

Contents:

Definition, history and role of chemical engineers: Definition of chemical engineering, role of chemical engineers in society

Basic features of chemical process: Classifications and modes of chemical processes; basic features of chemical process and unit operation

Unit systems and dimensions: Dimensional homogeneity and its analysis, Analysis of problem with solution

Week 2: Process Variables and Rate

Contents:

Variables and properties of material in systems: Physical and transport properties of materials and mixtures, Analysis of problem with solution

Pressure and temperature of flow process: Pressure and temperature and their measurements in flow process, problem solving

Rate of chemical processes: Flow rate and its measurements, Flow rate and its measurements, Rate of momentum transfer, Rate of heat transfer, Rate of mass transfer, Analysis of problem with solution Solving problems³

Week 3: Fundamentals of Material Balance

Contents:

Principles of material balance and its calculation: basis of engineering calculations, the general material balance equation, Balances on single and multiple unit processes without reaction, Solving problems

Material balances on non-reactive processes: Material balances on non-reactive processes with recycle and bypass, Solving problems

Material balances on reactive processes: Material balances on reactive processes, Solving problems

Material balances on combustion processes: Material balances based on combustion reactions, Solving problems

Week 4: Basic Principles of Compressible System

Contents:

State equation of ideal gas and calculation: Basic equations of state for ideal gas and their calculations;

State equation of non-ideal gas and calculation: Basic equations of state for non-ideal gas and their calculations

Week 5: Basic Principles of Multiphase System

Contents:

Phase equilibrium and Vapour Pressure: Phase equilibrium, Gibb's phase law, Clausius-Clapeyron Equation, Antoine's Equation, Cox Chart

Equilibrium laws: Raoul's Law, Henry's law, volatility, their calculations with examples

Saturation and Humidity: Principles of saturation, humidity, Psychrometric chart and its use, problem solving

Process of phase change: Condensation, vaporization, Examples

Week 6: Energy and Its Forms

Contents:

Principles of Energy: concepts and units, Different forms of energy and their calculations, The general energy balance equation

Laws and Properties of thermodynamics: Laws of thermodynamics, definitions of thermodynamic properties like Heat capacity, enthalpy, entropy; Calculation of enthalpy changes (without change of phase), enthalpy changes for phase transitions

Heat of formation, reaction and solution: Definition and calculations

Week 7: Energy Balances on Non-reactive Processes

Contents:

The mechanical energy balance: basic understanding with example

Enthalpy balances without reaction: basic understanding with example

Energy balances on non-reactive processes of multiple inlet and outlet streams: basic understanding with example

Enthalpy balances for heat of solution: Analysis with example

Week 8: Energy Balances on Reactive Systems

Contents:

Energy balance with standard heat of reaction: basic understanding with example

Energy balance with heat of reaction: basic understanding with example

Energy balances on heat of combustion: basic understanding with example

Week 9: Balances on Unsteady State Processes

Contents:

Material balances of unsteady state process: basic understanding with example

Unsteady state energy balance: basic understanding with example; Example of simultaneous material and energy balance

Week 10: Computational Techniques

Contents:

The methods of least squares: Linear equation fitting with experimental data with example

Non-linear algebraic equation system: basic understanding with example

Numerical Integration: basic understanding with example

Week 11: Computer-aided Balance Calculations

Contents:

Degree of freedom analysis: basic understanding with example

Process flow sheeting and codes: basic understanding

Week 12: Case Studies on Chemical Process

Contents:

Case study-I on chemical process: Analysis with example

Case study-II on chemical process: Analysis with example 3



BASICS IN INORGANIC CHEMISTRY

PROF. D. MAITI

Department of Chemistry

IIT Bombay

PRE-REQUISITES : Basic Chemistry courses, Basic Mathematics from school, 10+2 standard

INTENDED AUDIENCE : Undergraduate students belonging to Science and Engineering

COURSE OUTLINE :

This course will mainly deal with basics of Inorganic Chemistry. This includes periodic properties of the elements, source and extraction of metals. The study of transition metals comprises major portion of Inorganic Chemistry. Therefore, we will discuss some common properties like crystal field stabilization energy, magnetic properties, spectroscopic properties and uses of these properties in various fields including biological systems.

ABOUT INSTRUCTOR :

I am Prof. Debabrata Maiti, Associate Professor at IIT Bombay. I have completed PhD from Johns Hopkins University with Prof. Kenneth D. Karlin in bioinorganic chemistry. Then I moved to MIT where I did my Post-doctoral research with Prof. Steven Buchwald. I have started independent carrier at IIT Bombay in 2011 and since then involved actively in teaching bio-inorganic chemistry and organometallic chemistry. Our group is also active in research areas of bio-inorganic chemistry and C-H activation.

COURSE PLAN :

Week 1: Basics in Inorganic Chemistry

Week 2: Purification of elements; Coordination Chemistry; 18 electron rule; Valence bond theory; Crystal field theory

Week 3: Term symbols; Spectroscopy of complexes; Jahn-Teller distortion; Spinels; Magnetism

Week 4: Bio-inorganic Chemistry, Enzymes; Hemoglobin and Myoglobin; Toxicity; Medicinal inorganic compounds



BIG DATA COMPUTING

PROF. RAJIV MISRA

Department of Computer science and engineering
IIT Patna

PRE-REQUISITES : Data Structure & Algorithms, Computer Architecture, OperatingSystem, Database Management Systems

INDUSTRY SUPPORT : Companies like Amazon, Microsoft, Google, IBM, Facebook

COURSE OUTLINE :

In today's fast-paced digital world , the incredible amount of data being generated every minute has grown tremendously from sensors used to gather climate information, posts to social media sites, digital pictures and videos, purchase transaction records, and GPS signals from cell phone to name a few. This amount of large data with different velocities and varieties is termed as big data and its analytics enables professionals to convert extensive data through statistical and quantitative analysis into powerful insights that can drive efficient decisions. This course provides an in-depth understanding of terminologies and the core concepts behind big data problems, applications, systems and the techniques, that underlie today's big data computing technologies. It provides an introduction to some of the most common frameworks such as Apache Spark, Hadoop, MapReduce, Large scale data storage technologies such as in-memory key/value storage systems, NoSQL distributed databases, Apache Cassandra, HBase and Big Data Streaming Platforms such as Apache Spark Streaming, Apache Kafka Streams that has made big data analysis easier and more accessible. And while discussing the concepts and techniques, we will also look at various applications of Big Data Analytics using Machine Learning, Deep Learning, Graph Processing and many others. The course is suitable for all UG/ PG students and practicing engineers/ scientists from the diverse fields and interested in learning about the novel cutting edge techniques and applications of Big Data Computing.

ABOUT INSTRUCTOR :

Prof. Rajiv Misra is working in Department of Computer Science and Engineering at Indian Institute of Technology Patna, India. He obtained his Ph.D degree from IIT Kharagpur, M.Tech degree in Computer Science and Engineering from the Indian Institute of Technology (IIT) Bombay, and Bachelor's of engineering degree in Computer Science from MNIT Allahabad. His research interests spanned a design of distributed algorithms for Mobile, Adhoc and Sensor Networks, Cloud Computing and Wireless Networks. He has contributed significantly to these areas and published more than 70 papers in high quality journals and conferences, and 2 book chapters. His h-index is 10 with more than 590 citations. He has authored papers in IEEE Transactions on Mobile Computing, IEEE Transaction on Parallel and Distributed Systems, IEEE Systems Journal, Adhoc Networks, Computer Network, Journal of Parallel and Distributed Computing. He has edited a book titled as "Smart Techniques for a Smarter Planet: Towards Smarter Algorithms" for the "Studies in Fuzziness and Soft Computing" book series, Springer (2018). He has supervised four Phd students and currently four Phd students working under his supervision in the area of big data, cloud computing, distributed computing, and sensor networks. He is a senior member of the IEEE and fellow of IETE. He has completed as the Principal Investigator of R&D Project Sponsored by DeITY entitled as "Vehicular Sensor and Mesh Networks based Future ITS". He has mentored the online courses on Cloud Computing, Advanced Graph Theory and Distributed Systems in the platform of NPTEL

COURSE PLAN :

Week 1: Introduction to Big Data

Week 2: Introduction to Enabling Technologies for Big Data

Week 3: Introduction to Big Data Platforms

Week 4: Introduction to Big Data Storage Platforms for Large Scale Data Storage

Week 5: Introduction to Big Data Streaming Platforms for Fast Data

Week 6: Introduction to Big Data Applications (Machine Learning)

Week 7: Introduction of Big data Machine learning with Spark

Week 8: Introduction to Big Data Applications (Graph Processing)



CHARACTERIZATION OF CONSTRUCTION MATERIALS

PROF. MANU SANTHANAM

Department of Civil Engineering
IIT Madras

TYPE OF COURSE : New | Elective | PG
COURSE DURATION : 12 weeks (27 Jan' 20 - 17 Apr' 20)
EXAM DATE : 26 Apr 2020

PROF. PIYUSH CHAUNSALI

Department of Civil Engineering
IIT Madras

PRE-REQUISITES : Basic Civil Engineering degree

INTENDED AUDIENCE : Interested Learners

INDUSTRIES APPLICABLE TO : Cement companies, Concrete Producers, Construction chemical manufacturers, Construction companies

COURSE OUTLINE :

The objective of the course is to introduce students to the characterization of construction materials and their behaviour, with a view of developing their understanding of the mechanisms that govern the performance of these materials. The course will be focused primarily on cement and concrete, and include a few techniques; the physics of the techniques and their application to cement science. Lab demonstrations and experiments will be covered.

ABOUT INSTRUCTOR :

Dr. Manu Santhanam is a Professor at the Department of Civil Engineering at IIT Madras. His research interests are in multi-scale characterization of concrete, supplementary cementing materials, durability and non-destructive evaluation

Dr. Piyush Chaunsali is an Assistant Professor at the Department of Civil Engineering at IIT Madras. His research focuses on the use of principles of materials science, life-cycle assessment and structural engineering to design sustainable building materials

COURSE PLAN :

Week 1: Introduction to course; Structure of Construction Materials – An Overview

Week 2: Calorimetry

Week 3: X-ray diffraction

Week 4: X-ray diffraction, cont'd

Week 5: Thermal analysis

Week 6: Surface area measurement

Week 7: Optical microscopy

Week 8: Scanning electron microscopy

Week 9: Image analysis

Week 10: Spectroscopic techniques

Week 11: Mercury intrusion porosimetry

Week 12: Impedance analysis and ultrasonic methods



GOOGLE CLOUD COMPUTING FOUNDATIONS

Prof. Soumya Kanti Ghosh

Department of Computer Science and Engineering
IIT Guwahati

COURSE OUTLINE :

The Google Cloud Computing Foundations course aims to provide a detailed overview of concepts covering cloud basics, big data, and machine learning and where and how the Google Cloud Platform fits in. The course involves understanding concepts and perform hands-on training (via Qwiklabs platform) to practice the learning. There are 26 labs on Qwiklabs that are part of the course.

Those enrolling for the course should ideally:

- Have basic IT knowledge and be interested in learning more about Cloud and ML.
- Have competency in at least one language (such as Python, Java).
- Be familiar with the basics of shell scripting, SQL.

Disclaimer:

Google may contact you by email to provision benefits and send surveys and other communication related to the Google Cloud Computing Foundations Course.

By joining, you agree to Google Cloud Training tracking your grades and other activity in it's learning program.

ABOUT INSTRUCTOR :

Prof. Soumya K. Ghosh received the Ph.D. and M.Tech. degrees from Department of Computer Science and Engineering, Indian Institute of Technology (IIT), Kharagpur, India. Presently, he is a Professor with Department of Computer Science and Engineering, IIT Kharagpur. Before joining IIT Kharagpur, he worked for the Indian Space Research Organization in the area of satellite remote sensing and geographic information systems. He has more than 200 research papers in reputed journals and conference proceedings. His research interests include spatial data science, spatial web services and cloud computing.

COURSE PLAN :

Week 0: Introduction to the course

Week 1: So, What's the Cloud anyway? Start with a Solid Platform

Week 2: Use GCP to build your Apps

Week 3: Where do I store this stuff?

Week 4: There's an API for that! You can't secure the Cloud right?

Week 5: It helps to network!

Week 6: It helps to network (continued)

Week 7: Let Google keep an eye on things. You have the data, but what are you doing with it?

Week 8: Let machines do the work



CLOUD COMPUTING AND DISTRIBUTED SYSTEMS

PROF. RAJIV MISRA

Department of Computer Science and Engineering
IIT Patna

PRE-REQUISITES : Minimum: Data Structures and Algorithms; Ideal: Computer Architecture, Basic OS and Networking concepts

INDUSTRIES SUPPORT : Companies like Amazon, Microsoft, Google, IBM, Facebook and start-ups working on this field.

COURSE OUTLINE :

Cloud computing is the on-demand delivery of computations, storage, applications, and other IT resources through a cloud services platform over the internet with pay-as-you-go business model. Today's Cloud computing systems are built using fundamental principles and models of distributed systems. This course provides an in-depth understanding of distributed computing "concepts", distributed algorithms, and the techniques, that underlie today's cloud computing technologies. The cloud computing and distributed systems concepts and models covered in course includes: virtualization, cloud storage: key-value/NoSQL stores, cloud networking, fault-tolerance cloud using PAXOS, peer-to-peer systems, classical distributed algorithms such as leader election, time, ordering in distributed systems, distributed mutual exclusion, distributed algorithms for failures and recovery approaches, emerging areas of big data and many more. And while discussing the concepts and techniques, we will also look at aspects of industry systems such as Apache Spark, Google's Chubby, Apache Zookeeper, HBase, MapReduce, Apache Cassandra, Google's B4, Microsoft's Swan and many others. Upon completing this course, students will have intimate knowledge about the internals of cloud computing and how the distributed systems concepts work inside clouds.

ABOUT INSTRUCTOR :

Prof. Rajiv Misra is an Associate Professor in Department of Computer Science and Engineering at Indian Institute of Technology Patna, India. He obtained his Ph.D degree from IIT Kharagpur, M.Tech degree in Computer Science and Engineering from the Indian Institute of Technology (IIT) Bombay, and Bachelors of engineering degree in Computer Science from MNIT Allahabad. His research interests spanned a design of distributed algorithms for Mobile, Adhoc and Sensor Networks, Cloud Computing and Wireless Networks. He has contributed significantly to these areas and published more than 70 papers in high quality journals and conferences, and 2 book chapters. His h-index is 10 with more than 590 citations. He has authored papers in IEEE Transactions on Mobile Computing, IEEE Transaction on Parallel and Distributed Systems, Adhoc Networks, Journal of Parallel and Distributed Computing.

COURSE PLAN :

Week 1: Introduction to Clouds, Virtualization and Virtual Machine

1. Introduction to Cloud Computing: Why Clouds, What is a Cloud, Whats new in todays Clouds, Cloud computing vs. Distributed computing, Utility computing, Features of today's Clouds: Massive scale, AAS Classification: HaaS, IaaS, PaaS, SaaS, Data-intensive Computing, New Cloud Paradigms, Categories of Clouds: Private clouds, Public clouds

2. Virtualization: What's virtualization, Benefits of Virtualization, Virtualization Models: Bare metal, Hosted hypervisor

3. Types of Virtualization: Processor virtualization, Memory virtualization, Full virtualization, Para virtualization, Device virtualization

4. Hotspot Mitigation for Virtual Machine Migration: Enterprise Data Centers, Data Center Workloads, Provisioning methods, Sandipiper Architecture, Resource provisioning, Black-box approach, Gray-box approach, Live VM Migration Stages, Hotspot Mitigation

Week 2: Network Virtualization and Geo-distributed Clouds

1. Server Virtualization: Methods of virtualization: Using Docker, Using Linux containers, Approaches for Networking of VMs: Hardware approach: Single-root I/O virtualization (SR-IOV), Software approach: Open vSwitch, Mininet and its applications
2. Software Defined Network: Key ideas of SDN, Evolution of SDN, SDN challenges, Multi-tenant Data Centers: The challenges, Network virtualization, Case Study: VL2, NVP
3. Geo-distributed Cloud Data Centers: Inter-Data Center Networking, Data center interconnection techniques: MPLS, Google's B4 and Microsoft's Swan

Week 3: Leader Election in Cloud, Distributed Systems and Industry Systems

1. Leader Election in Rings (Classical Distributed Algorithms): LeLann-Chang-Roberts (LCR) algorithm, The Hirschberg and Sinclair (HS) algorithm
2. Leader Election (Ring LE & Bully LE Algorithm): Leader Election Problem, Ring based leader election, Bully based leader election, Leader Election in Industry Systems: Google's Chubby and Apache Zookeeper
3. Design of Zookeeper: Race condition, Deadlock, Coordination, Zookeeper design goals, Data model, Zookeeper architecture, Sessions, States, Usecases, Operations, Access Control List (ACL), Zookeeper applications: Katta, Yahoo! Message Broker

Week 4: Classical Distributed Algorithms and the Industry Systems

1. Time and Clock Synchronization in Cloud Data Centers: Synchronization in the cloud, Key challenges, Clock Skew, Clock Drift, External and Internal clock synchronization, Christians algorithm, Error bounds, Network time protocol (NTP), Berkeley's algorithm, Datacenter time protocol (DTP), Logical (or Lamport) ordering, Lamport timestamps, Vector timestamps
2. Global State and Snapshot Recording Algorithms: Global state, Issues in Recording a Global State, Model of Communication, Snapshot algorithm: Chandy-Lamport Algorithm
3. Distributed Mutual Exclusion: Mutual Exclusion in Cloud, Central algorithm, Ring-based Mutual Exclusion, Lamport's algorithm, Ricart-Agrawala's algorithm, Quorum-based Mutual Exclusion, Maekawa's algorithm, Problem of Deadlocks, Handling Deadlocks, Industry Mutual Exclusion : Chubby

Week 5: Consensus, Paxos and Recovery in Clouds

1. Consensus in Cloud Computing and Paxos: Issues in consensus, Consensus in synchronous and asynchronous system, Paxos Algorithm
2. Byzantine Agreement: Agreement, Faults, Tolerance, Measuring Reliability and Performance, SLIs, SLOs, SLAs, TLAs, Byzantine failure, Byzantine Generals Problem, Lamport-Shostak-Pease Algorithm, Fischer-Lynch-Paterson (FLP) Impossibility
3. Failures & Recovery Approaches in Distributed Systems: Local checkpoint, Consistent states, Interaction with outside world, Messages, Domino effect, Problem of Livelock, Rollback recovery schemes, Checkpointing and Recovery Algorithms: Koo-Toueg Coordinated Checkpointing Algorithm

Week 6: Cloud Storage: Key-value stores/NoSQL

1. Design of Key-Value Stores: Key-value Abstraction, Key-value/NoSQL Data Model, Design of Apache Cassandra, Data Placement Strategies, Snitches, Writes, Bloom Filter, Compaction, Deletes, Read, Membership, CAP Theorem, Eventual Consistency, Consistency levels in Cassandra, Consistency Solutions
2. Design of HBase: What is HBase, HBase Architecture, Components, Data model, Storage Hierarchy, Cross-Datacenter Replication, Auto Sharding and Distribution, Bloom Filter, Fold, Store, and Shift

Week 7: P2P Systems and their use in Industry Systems

1. Peer to Peer Systems in Cloud Computing: Napster, Gnutella, FastTrack, BitTorrent, DHT, Chord, Pastry and Kelips.

Week 8: Cloud Applications: MapReduce, Spark and Apache Kafka

1. MapReduce: Paradigm, Programming Model, Applications, Scheduling, Fault-Tolerance, Implementation Overview, Examples
2. Introduction to Spark: Resilient Distributed Datasets (RDDs), RDD Operations, Spark applications: Page Rank Algorithm, GraphX, GraphX API, GraphX working
3. Introduction to Kafka: What is Kafka, Use cases for Kafka, Data model, Architecture, Types of messaging systems, Importance of brokers



COMPILER DESIGN

PROF. RUPESH NASRE

Department of Computer Science and Engineering
IIT Madras

TYPE OF COURSE : Core | UG

PRE-REQUISITES : Programming and Data Structures, C programming language, along with tools such as lex-yacc/bison

COURSE OUTLINE : The objectives are to teach students a understanding of some of the standard passes in a general purpose compiler and to provide hands-on experience in implementing a compiler for a subset of a high-level language such as C.

ABOUT INSTRUCTOR : Rupesh is an associate professor in the CSE Department at IIT Madras. He completed PhD from IISc Bangalore and Post-Doctoral Fellowship from the University of Texas at Austin. His research focus is in Compilers and Parallelization. He is a recipient of the Young Faculty Recognition Award at IIT Madras, Cray HPC Award, NVIDIA Special Prize for CodeForScience, a winner of the Yahoo! University Hack Day, and holds five US patents. He is the head of the National Supercomputing Mission's Nodal Centre at IITM for Training in HPC and AI.

COURSE PLAN :

Week 1: **Introduction** | **Concepts covered** - Programming languages and compilers, Language Translators

Keywords - Phases of a compiler, Static vs Dynamic contexts, Parameter passing

Week 2: **Lexical Analysis** | **Concepts covered** - Regular Expressions, flex tool, Finite Automata

Keywords - Terminology, Regex, flex tool, Lexical errors, Input buffering, Lookahead, KMP string matching, Regex to DFA conversion

Week 3: **Lexical Analysis, Parsing** | **Concepts covered** - Parse tree, Ambiguity

Keywords - CFG, Parse tree, Precedence, Ambiguity, Sentential forms, Error recovery, if-else ambiguity, Left recursion, Recursive descent parsing

Week 4: **Parsing** | **Concepts covered** - Predictive Parsing, LL(1) Grammars

Keywords - First and Follow, Predictive parsing table, Predictive parsing table, LL(1) grammars, Discussions and doubts clarification

Week 5: **Parsing** | **Concepts covered** - Bottom-up Parsing, Shift-Reduce Parsing

Keywords - SLR parsing, LR(0) automaton, SLR parsing using automaton

Week 6: **Parsing** | **Concepts covered** - SLR(1) Parsing

Keywords - SLR(1) parsing table, SLR(1) parsing algorithm

Week 7: **Parsing** | **Concepts covered** - LR(1) Parsing, LALR Parsing

Keywords - Viable prefixes, LR(1) automaton

Week 8: **Syntax Directed Translation** | **Concepts covered** - SDT, SDD

Keywords - Attributes, S- and L-attributed SDD, Applications, Actions within productions

Week 9: **Intermediate Code Generation** | **Concepts covered** - Syntax Trees and DAGs

Keywords - Code generation for while loop

Week 10: **Intermediate Code Generation** | **Concepts covered** - IR, Three Address Code

Keywords - Discussions and Doubt Clarifications, Static Single Assignment

Week 11: **Intermediate Code Generation** | **Concepts covered** - IR for various language constructs

Keywords - Type expressions, array expressions, boolean expressions, break, continue, switch

Week 12: **Code Generation** | **Concepts covered** - IR and Target Code

Keywords - Instruction Selection, Ordering, Basic Blocks, CFG, x86 Assembly Code

Week 13: **Code Optimization** | **Concepts covered** - Local, Peephole Optimizations, Data Flow Analysis

Keywords - Array References, Register Allocation, Liveness Analysis, Reaching Definitions



COMPUTER INTEGRATED MANUFACTURING

PROF. JANAKARAJAN RAMKUMAR

Department of Mechanical Engineering
IIT Kanpur

PROF. AMANDEEP SINGH

Department of Mechanical Engineering
IIT Kanpur

PRE-REQUISITES : The student should have completed two semesters of UG Engineering or Science program.

INTENDED AUDIENCE : Students of all Engineering and Science disciplines.

INDUSTRIES APPLICABLE TO : HAL, NAL, SAIL, ISRO

COURSE OUTLINE :

Use of computers in manufacturing in order to design and develop the products has found unprecedented applications. Computer integrated way of manufacturing provides a myriad of benefits such as speed, flexibility, and better control. In this course, Computer Integrated Manufacturing (CIM) approaches are discussed. CAD/CAM tools and their within and between the production systems are presented along with appropriate case studies. Data storage and handling is also the need of contemporary manufacturing systems. This is also catered using software tools. The course is reinforced with the laboratory demonstrations to add a practitioners' touch. Students would develop a process to largely plan, design and develop a product and a production system after completing this course

ABOUT INSTRUCTOR :

Prof. Janakarajan Ramkumar is Professor of Mechanical Engineering Department, and Design Program, at Indian Institute of Technology, Kanpur. He teaches manufacturing science, micro/nano technology, new product development. He has a bachelor's in Production Engineering with his doctorate in Defect quantification in drilling of composites from IIT Madras, India with a best thesis award. Over the years his contribution in teaching and research is remarkable. He has worked for BOSCH group and improved the productivity of the company. His research and teaching focus is on nano technology and inclusive design. He has several international and national patents in his credit and has published more than 100 journal papers

Prof. Amandeep Singh is working as Research Scientist in the Mechanical Engineering Department, and Design Program, Indian Institute of Technology, Kanpur, India. He holds PhD degree from Indian Institute of Technology Kanpur, India, and a bachelor degree in Production Engineering. Dr. Singh has ten years of industrial and academic experience. His research interests are Sustainable Manufacturing Processes and Systems, Simulation of Manufacturing Systems, Product Design and Manufacturing, Applied Ergonomics and Engineering Metrology. He has traveled in countries like US, Canada, and Australia to present his research in various international conferences organized by reputed bodies like CIRP and IEOM. His research is also published in various international reputed journals.

COURSE PLAN :

Week 1: Introduction to Computer Integrated Manufacturing (CIM)

Week 2: Computer Aided Design

Week 3: Computer Aided Manufacturing

Week 4: Computer Numerical Control

Week 5: Computer Aided Process Planning (CAPP)

Week 6: CIM interfaces: CAD vs CAM

Week 7: Data and information in CIM

Week 8: Manufacturing Systems and their design

Week 9: Simulation of Manufacturing Systems

Week 10: Computer Aided Maintenance

Week 11: Computer Integrated Additive Manufacturing

Week 12: Advanced CIM techniques



CONSTRUCTION METHODS AND EQUIPMENT MANAGEMENT

PROF. INDU SIVA RANJANI GANDHI

Department of Civil Engineering
IIT Guwahati

INTENDED AUDIENCE : Post graduate students of Construction Technology and Management

Specialization, Undergraduate students of Civil Engineering , People working in Construction Industry

INDUSTRIES APPLICABLE TO : Larsen and Toubro, Caterpillar, Liebherr, Hyundai Construction Equipment India and other Construction Equipment Companies.

PREREQUISITES : Engineering would be minimum qualification to understand the basics related to this course.

COURSE OUTLINE :

The key element for successful execution of any project is planning, which also includes planning of equipment. Due to recent advancement in mechanization, different models of machines are available in the market for a particular job. Hence the task of selection of right machine for the right job is quite challenging for project planner. Therefore, understanding of machine capabilities is very important for optimal selection and utilization of equipment. This course provides comprehensive information on guidelines for selection of equipment, estimation of cost and productivity of various equipment and determination of optimum replacement time of equipment. Knowledge on estimation of cost of equipment is very important, as accurate information on equipment cost is needed for preparation of bids. Further, a deep insight into excavation, pile driving methods, cranes and concreting equipment is provided, the information on which is very much essential for people working in construction industry

ABOUT INSTRUCTOR :

Prof. G. Indu Siva Ranjani holds a PhD degree in Civil Engineering (Building Technology and Construction Management) from Indian Institute of Technology Madras, India. She is recipient of Gold medal and Shree Gayathri Devi Award for securing highest CGPA in the Ph.D. Civil Engineering programme in July 2011 at IIT Madras. Presently she is working as Assistant Professor at Indian Institute of technology Guwahati, India. She has handled courses at IIT Guwahati related to both Construction Management and Construction materials. Some of the management related courses handled by her, to be mentioned are Construction methods and Equipment management, Quality and Safety management and Construction Technology and Management. Similarly, in materials domain, she has handled courses on Construction materials and Advanced Concrete Technology. Her major research interests are Lightweight concrete, sustainable construction materials and energy efficient structures. She has also proposed new materials for the production of foamed concrete. Her work has been published in peer reviewed journals and cited more than 500 times in leading scientific journals throughout the world. She has so far guided 21 MTechs, & 2 Ph.D. projects.

COURSE PLAN :

Week 1: Module 1: Introduction to course and Planning Process of Equipment

Lecture 1: Planning process of equipment

– Factors affecting equipment selection, Planning equipment utilization, Equipment utilization chart.

Module 2: Cost of Owning and Operating Construction Equipment

Lecture 2: Estimation of Ownership cost (Average Annual Investment method)

– Elements of ownership cost, Depreciation accounting methods, Cost Estimation using Average Annual Investment method.

Week 2: Module 2: Cost of Owning and Operating Construction Equipment

Lecture 3: Estimation of Ownership cost (Time value method)

– Use of compounding factors in Equipment cost estimation based on time value method.

Lecture 4: Operating cost of Equipment

– Operating cost components, Illustrations on estimation of operating cost.

Lecture 5: Equipment cost estimation

– Caterpillar & Peurifoy method – Illustrations on use of Caterpillar method and Peurifoy method for estimation of total equipment cost.

Week 3: Module 3: Equipment Life and Replacement Analysis

Lecture 6: Equipment Life and Replacement Analysis (Part 1)

- Physical life, Profit life, Economic life, Illustrations on determination of economic life of equipment.

Lecture 7: Equipment Life and Replacement Analysis (Part 2)

- Equipment Replacement analysis- Intuitive method, Minimum cost method, Maximum profit method.

Lecture 8: Equipment Life and Replacement Analysis (Part 3)

- Determination of economic life based on equivalent annual cost (using time value concept).

Week 4: Module 4: Engineering Fundamentals of Moving Earth

Lecture 9: Engineering Fundamentals of Moving Earth

- Machine Performance-Required power, Available power, Usable power, Rolling resistance, tractive force, co-efficient of traction, Effect of grade on tractive effort, Effect of altitude on performance of IC engines, Performance chart, ways to define payload of equipment.

Module 5: Earthmoving and Excavating equipment

Lecture 10: Bull Dozers

- Bull Dozers-Types of dozer blades, blade adjustments, Blade performance, production estimation.

Lecture 11: Scrapers (Part 1)

- Scrapers, Scraper operation, types of scraper, Components of production cycle of scraper and pusher.

Lecture 12: Scrapers (Part 2)

- Illustrations on production estimation of scraper and balancing interdependent machines.

Week 5: Module 5: Earthmoving and Excavating equipment

Lecture 13: Front End loaders

- Front-End loaders –loader attachments, productivity estimation.

Lecture 14: Excavators

- Excavators-Front shovels and backhoes, operation, factors affecting selection, production estimation.

Lecture 15: Trucks

- Production cycle, cycle time estimation, Productivity of trucks, balancing interdependent machines.

Week 6: Module 6: Piles and Pile driving equipment

Lecture 16: Piles and Pile driving equipment (Part 1)

- Pile types: Precast and cast in situ piles, pile hammers, principle of pile hammer, factors affecting pile hammer selection.

Lecture 17: Piles and Pile driving equipment (Part 2)

- Types of pile hammer: Drop hammer, Single acting and double acting steam hammers, Diesel hammers, Vibratory pile drivers.

Week 7: Module 7: Lifting equipment

Lecture 18: Cranes (Part 1)

- Cranes, Crane motions, Principles of lifting mechanism of crane, types of cranes-lattice boom crawler crane, lattice boom truck mounted cranes, telescopic boom crane.

Lecture 19: Cranes (Part 2)

- Types of cranes-Tower cranes, Factors affecting lifting capacity of crane, Range diagram.

Week 8: Module 8: Concreting equipment

Lecture 20: Concreting equipment (Part 1)

- Steps in concrete making process, types of concrete mixer machines.

Lecture 21: Concreting equipment (Part 2) & Conclusion

- Methods of handling and transporting concrete, Consolidation of concrete, Methods of finishing and curing of concrete.



DAIRY AND FOOD PROCESS AND PRODUCTS TECHNOLOGY

PROF. TRIDIB KUMAR GOSWAMI

Department of Agricultural and Food Engineering
IIT Kharagpur

INTENDED AUDIENCE : Agricultural Engineering, Food Technology, Food Engineering, Chemical Engineering, Biotechnological Engineering, Thermal Engineering, Biotechnology

INDUSTRIES APPLICABLE TO : Any Processing Industry such as Britannia, ITC, Hindustan Lever, Mother Dairy, Amul, etc.

COURSE OUTLINE :

This course will cover basics of dairy (liquid food) food processing and preservation technologies required in any dairy and food processing industries. The basic knowledge on dairy food processing is intermingled with most of the unit operations at some or other stage of processing. Since, this basic aspect of food processing and preservations not taught in most of the Agricultural engineering institutions elaborately, a comprehension of these aspects of processing and preservation will enrich the knowledge base of the students in general.

ABOUT INSTRUCTOR :

Prof. Tridib Kumar Goswami, a NAAS, ISAE, IE, AABS Fellow, did his B.Sc. in Chemistry (Hons) from University of Calcutta, B.Tech. in Food Technology and Biochemical Engineering from Jadavpur University, Ph.D. from IIT Kharagpur. After serving Kwality Ice Cream, Bombay for 1 years, he joined IIT Kharagpur in 1989 and is still continuing as a Professor. He has earned 5 Indian Patents, published 104 papers in peer reviewed reputed journals, 55 conference proceedings. He has written 4 books and 14 book chapters published by International publishers. He has travelled around the world for presenting papers and was specially invited by Jeonbuk National University, Korea with full sponsorship in 2009. He has guided 14 Ph.D., out of which 3 theses have been awarded the prestigious Jawaharlal Nehru Award offered by ICAR. One of his papers was awarded the prestigious N.N. Mohan Memorial Award for 2009 conferred by AIFPA, New Delhi for Best Paper of the year. He has also received several National and International awards. He has completed several sponsored research & consultancy projects as PI and co-PI. He is the first faculty from Agricultural Engineering discipline in India to contribute to the National program on technology enhanced learning.

COURSE PLAN :

Week 1 : Basic principles and methods of food processing and preservation. Emerging Technologies in food processing. Food additives and preservatives.

Week 2 : Food laws and standards. Effect of processing on acceptability and nutritive value of food.

Week 3 : Physico-chemical properties and structure of milk and milk constituents.

Week 4 : Chemical and microbial spoilage of milk and milk products; Fluid milk Processing, packaging and distribution.

Week 5 : Common dairy processes – cream separation (standardization), pasteurization, sterilization and Homogenization.

Week 6 : Process technology for manufacture of evaporated milk, condensed milk, dried milk, malted milk, infant and baby foods, ice-cream, cheese, butter, fermented milk and indigenous dairy products.

Week 7 : Methods and procedures for sampling and testing of milk and milk products. Laws and standards for milk and milk products.

Week 8 : Technological processes for industrially manufactured foods of commercial importance, from plant and animal origin.

Week 9 : Cereals, vegetables, fruits, meats, poultry and egg products; Bakery, pasta and confectionary products, ready to eat foods, fermented foods, alcoholic and non-alcoholic Beverages, tea, coffee and cocoa, fabricated foods.

Week 10 : Packaging materials; Characteristics, properties and their design. Packaging requirement for Different processed and unprocessed foods.

Week 11 : Working Principles of various type of fillers : form-fill- seal machine.

Week 12 : Gas packaging and modified atmosphere Package design. Shelf life prediction of foods in packages. Quality control in Food packaging. Product safety and packaging regulations.



DATA ANALYTICS WITH PYTHON

PROF. A RAMESH

Department of Management Studies
IIT Roorkee

INTENDED AUDIENCE : Management, Industrial Engineering and Computer Science Engineering Students

INDUSTRIES APPLICABLE TO : Any analytics company

COURSE OUTLINE :

We are looking forward to sharing many exciting stories and examples of analytics with all of you using python programming language. This course includes examples of analytics in a wide variety of industries, and we hope that students will learn how you can use analytics in their career and life. One of the most important aspects of this course is that you, the student, are getting hands-on experience creating analytics models; we, the course team, urge you to participate in the discussion forums and to use all the tools available to you while you are in the course!

ABOUT INSTRUCTOR :

Prof. Ramesh Anbanandam graduated in Production Engineering from Madras University, Chennai. He did his post-graduation from National Institute of Technology, Trichy. He later earned his Ph.D. in Supply Chain Management from Indian Institute of Technology Delhi. His professional interest includes Humanitarian Supply Chain Management, Operations Management, Operations Research, Healthcare Waste Management, Sustainable Multi-modal and Freight Transportation, Transportation Asset Management and Advanced Data Analytics using Python and R-programming. He has published various research articles in reputed journals. He was also awarded Emerald Literati Award for Excellence under "Highly Commended Research Paper in the Year 2011 and 2016" in the field of Supply Chain Management.

COURSE PLAN :

Week 1: Introduction to data analytics and Python fundamentals

Week 2: Introduction to probability

Week 3: Sampling and sampling distributions

Week 4: Hypothesis testing

Week 5: Two sample testing and introduction to ANOVA

Week 6: Two way ANOVA and linear regression

Week 7: Linear regression and multiple regression

Week 8: Concepts of MLE and Logistic regression

Week 9: ROC and Regression Analysis Model Building

Week 10: χ^2 Test and introduction to cluster analysis

Week 11: Clustering analysis

Week 12: Classification and Regression Trees (CART)

Week 1: Course Overview. Introduction to RDBMS

Week 2: Structured Query Language (SQL)

Week 3: Relational Algebra. Entity-Relationship Model

Week 4: Relational Database Design

Week 5: Application Development. Case Studies. Storage and File Structure

Week 6: Indexing and Hashing. Query Processing

Week 7: Query Optimization. Transactions (Serializability and Recoverability)

Week 8: Concurrency Control. Recovery Systems. Course Summarization.

- Week 1: 1D array, list and vector, 2D matrices and tables of objects
- Week 2: Java implementation of 1D and 2D arrays and its operations
- Week 3: Linked lists and its various operations, stack and queue
- Week 4: Java implementation of linked lists, stack and queue
- Week 5: Binary trees: Representation and operations. Variations of binary tree: Binary search tree, Height balanced search tree, Heap tree
- Week 6: Java implementation of binary trees and its variations
- Week 7: Graph : Structure, representation and operations
- Week 8: Java implementations of graph data structures
- Week 9: Algorithms (Part-I): Searching and sorting algorithms
- Week 10: Java implementation of Part-I algorithms
- Week 11: Algorithms (Part-II): Greedy algorithms, shortest path algorithms
- Week 12: Java implementation of Part-II algorithms



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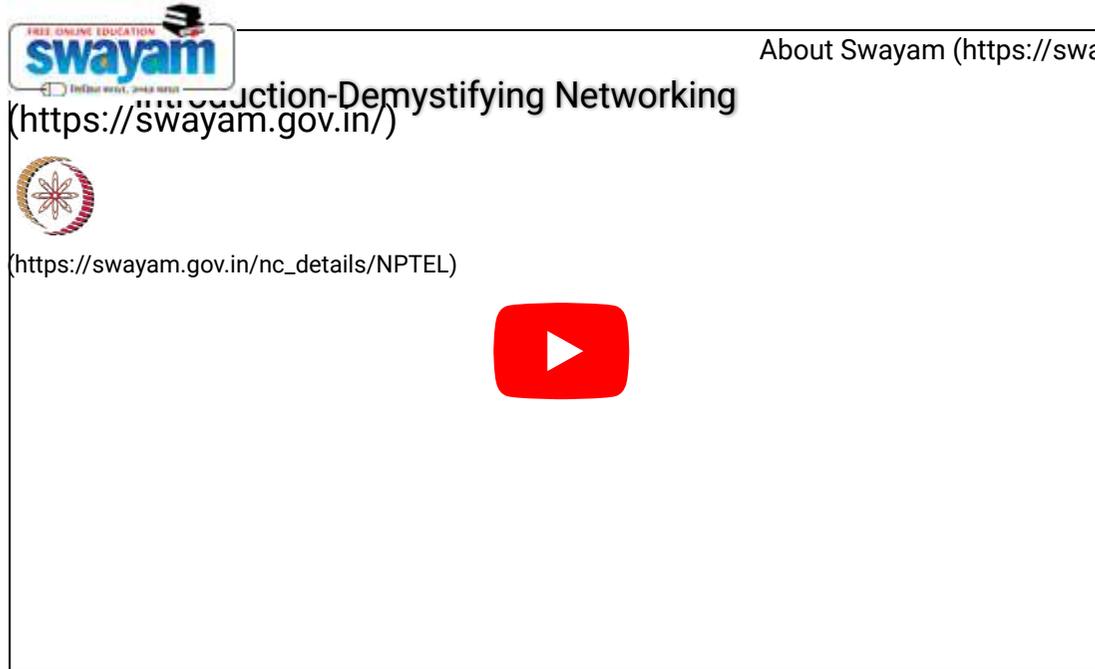
(https://swayam.gov.in/nc_details/NPTEL)

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Demystifying networking

By Prof. Sridhar Iyer | IIT Bombay

Learners enrolled: 5342



This course will provide students with an overview of networking concepts and technologies. It is meant as a primer for non-majors, i.e., for students who don't have networking as a core course in their curriculum. After this primer, students may choose to take other networking courses for delving deeper into specific technologies.

INTENDED AUDIENCE: Computer networking

PREREQUISITES: Nil

INDUSTRY SUPPORT: Networking, Security, Troubleshooting

About Swayam (<https://swayam.gov.in/about>)

Summary

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Course Status : Completed

Course Type : Elective

Duration : 4 weeks

Category :

- o Computer Science and Engineering

Credit Points : 1

Level : Undergraduate

Start Date : 29 Jul 2019

End Date : 23 Aug 2019

Exam Date : 29 Sep 2019 IST

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

This is an AICTE approved FDP course

(/ #facebook) (/ #x)

(/ #microsoft_teams) (/ #linkedin)



(/#whatsapp)

(<https://swayam.gov.in/>)



(https://www.addtoany.com/share?url=https%3A%2Fonlinecourses.nptel.ac.in%2Fnoc19_cs75%2Fpreview&title=Demystifying%20networking%20-%20Course)

(https://swayam.gov.in/nc_details/NPTEL)

About Swayam (<https://swayam.gov.in/about>) | All Courses |

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Course layout

Week 1: Layers of Computer Networks and Network Addressing

Week 2: Routing

Week 3: Transport and Application Layers

Week 4: Introduction to Security and Troubleshooting

Books and references

There are many textbooks on computer networking. Students may refer to any of them for the topics in this course.



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Prof. Sridhar Iyer is a faculty member in the Inter-Disciplinary Program in Educational Technology, and Department of Computer Science and Engineering at IIT Bombay. His current research interests include: Technology enhanced learning environments for thinking skills, Pedagogies for effective use of educational technologies, and Computer science education research. Sridhar Iyer received his BTech, MTech and PhD from the Dept of Computer Science & Engg. at IIT Bombay

Course certificate

CERTIFICATION EXAM :

- The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centers.
- The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).
- **Date and Time of Exams: 29th September 2019** Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.



url: Announcements will be made when the registration form is

registrations.

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The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form



is published. If there are any changes, it will be mentioned then.

Please check the form for more details on the cities where the exams will be

(https://swayam.gov.in/noc_details/NPTEL)

Here, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE

- Average assignment score = 25% of average of best 3 assignments out of the total 4 assignments given in the course.
- Exam score = 75% of the proctored certification exam score out of 100
- Final score = Average assignment score + Exam score

YOU WILL BE ELIGIBLE FOR A CERTIFICATE ONLY IF AVERAGE ASSIGNMENT SCORE $\geq 10/25$ AND EXAM SCORE $\geq 30/75$.

- If one of the 2 criteria is not met, you will not get the certificate even if the Final score $\geq 40/100$.
- Certificate will have your name, photograph and the score in the final exam with the breakup. It will have the logos of NPTEL and IIT Bombay. It will be e-verifiable at nptel.ac.in/noc (<http://nptel.ac.in/noc>).
- Only the e-certificate will be made available. Hard copies are being discontinued from July 2019 semester and will not be dispatched.



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DESIGN THINKING - A PRIMER

PROF. ASHWIN MAHALINGAM

Department of Civil Engineering
IIT Madras

PROF. BALA RAMADURAI

Department of Management Studies
IIT Madras

INTENDED AUDIENCE : General

INDUSTRIES APPLICABLE TO : Many industries and institute recognize the need for design thinking -
e.g., ICT, manufacturing, sales, marketing

COURSE OUTLINE :

Design thinking is a systematic method of solving problems. This method is unique that it starts and ends with humans. The design thinkers start by observing, interviewing or just plain experiencing a situation. Then, they proceed to improve the situation of the humans by solving problems for them.

ABOUT INSTRUCTOR :

Prof. Ashwin Mahalingam joined the faculty in the Building Technology and Construction Management division of the Civil engineering department at IIT-Madras in 2006. Ashwin received his B.Tech in Civil engineering from IIT-Madras and then proceeded to Stanford University for a Masters in Construction Engineering and Management. He then helped start up an internet based company in the USA called All Star Fleet, aimed at providing asset management services for construction companies. Following this he returned to Stanford University to pursue a PhD in the area of Infrastructure Project Management. Ashwin's research interests are in the areas of Public Private Partnerships (PPP) in Infrastructure, the management and governance of large engineering projects and the use of digital technologies in construction. Ashwin's current research focuses on institutional strengthening and post-award governance of PPP projects in India. Ashwin is also a co-founder of Okapi Advisory Services Pvt. Ltd and serves as a Director on the Board.

Prof. Bala Ramadurai is an independent innovation consultant and professor. He has 3 patents to his credit and 10+ publications in international research journals. He co-founded TRIZ Innovation India (<http://trizindia.org>) and is an Adjunct Professor at Symbiosis Institute of Business Management, India. He has a PhD from Arizona State University, USA, and a B.Tech from IIT Madras, India.

COURSE PLAN :

Week 1 : Introduction to Design Thinking

Week 2 : Empathize Phase: Customer Journey Mapping

Week 3 : Analyze Phase: 5-Whys and How might we...

Week 4 : Solve Phase: Ideation: Free Brainstorming & Make/Test Phase: Prototype



DIGITAL CIRCUITS

PROF. SANTANU CHATTOPADHYAY

Department of Electronics and Electrical Communication Engineering,
IIT Kharagpur.

INTENDED AUDIENCE : All Engineering Student/Faculty

PRE-REQUISITES : Basic Electronics

INDUSTRIES APPLICABLE TO : Companies involved in development digital products

COURSE OUTLINE :

Digital circuits are part of any electronic design today. This also happens to be one of the core subjects for the undergraduate students in Electronics, Electrical and Computer Engineering. It forms the basis of many of the next level courses. The proposed course on digital circuits will cover all the fundamental concepts in digital design. It will primarily focus on the prescribed GATE syllabus for Electronics and Communication Engineering (ECE) specialization. The course will start with the representations of numbers – different number systems and conversion between them, representation of integer and real numbers etc. This will be followed by combinational and sequential circuit design techniques. Data converters and semiconductor memories will be covered. Microprocessor 8085 will be discussed as a complete digital system example. Designed primarily as a single course covering the digital circuits portion of GATE syllabus, the course will also be helpful for any other aspirant willing to learn digital electronics principles comprehensively in today's perspective.

ABOUT INSTRUCTOR :

Prof. Santanu Chattopadhyay received his BE degree in Computer Science and Technology from Calcutta University (B.E. College) in 1990. He received M.Tech in Computer and Information Technology and PhD in Computer Science and Engineering from Indian Institute of Technology Kharagpur in 1992 and 1996, respectively. He is currently a Professor in the Department of Electronics and Electrical Communication Engineering, IIT Kharagpur. Prior to this, he had been a faculty member in the IEST Sibpur and IIT Guwahati in the departments of Computer Science and Engineering. In both these places he has taught the subject of Compiler Design several times. His research interests include Digital Design, Embedded Systems, System-on-Chip (SoC) and Network-on-Chip (NoC) Design and Test, Power- and Thermal-aware Testing of VLSI Circuits and Systems. He has published more than 150 papers in reputed international journals and conferences. He has published several text and reference books on Compiler Design, Embedded Systems and other related areas. He is a senior member of the IEEE and an Associate Editor of IET Circuits Devices and Systems journal.

COURSE PLAN :

Week 01 : Introduction, Number System

Week 02 : Boolean Algebra

Week 03 : Combinational function minimization – K Map, Boolean identities

Week 04 : Logic Gates

Week 05 : Arithmetic circuits, Code converters

Week 06 : Multiplexers, Decoders, PLA

Week 07 : Sequential Circuits – Latches and Flip-flops

Week 08 : Counters, Shift Registers, Finite State Machines

Week 09 : Data Converters – Sample and hold circuits, ADCs, DACs

Week 10 : Semiconductor Memories – ROM, SRAM, DRAM

Week 11 : Microprocessor 8085 – Part I

Week 12 : Microprocessor 8085 – Part II



ELECTROCHEMICAL TECHNOLOGY IN POLLUTION CONTROL

PROF. J. R. MUDAKAVI

Department of Chemical Engineering
IISc Bangalore

PRE-REQUISITES : 10 +2 + 3 years of BE / BSc Basic knowledge of differential calculus and integration

INTENDED AUDIENCE : Chemists and Chemical Engineers, Environmental Engineers, Environmental Scientists, Civil Engineers, Pollution Control Administrators, B.Sc, M.Sc and PhD students.

INDUSTRIES APPLICABLE TO : Chemical industries, Pollution Control

COURSE OUTLINE :

Electroanalytical techniques have assumed great importance in pollution monitoring of chemical species in the last 20 years. Electrochemical sensors including ion selective electrodes are employed to detect the pollution levels in all public spaces. They also find extensive applications in medical diagnosis, industrial process monitoring, communication industry etc. Fuel cells and battery technology are the energy sources of the future. Industrial wastes generated from electrochemical processes are one of the most hazardous wastes which need to be effectively managed. The course aims to introduce the fundamental principles of electrochemistry for routine and non-routine analysis, electrochemical processes used in the industry, battery and fuel cell technologies and recent advances in hazardous electrochemical waste management including concepts of zero liquid discharge.

ABOUT INSTRUCTOR :

Prof. J.R Mudakavi is a former faculty of Chemical Engineering Department in Indian Institute of Science, Bangalore. He has taught "Modern Instrumental Methods of analysis and Pollution Control" for 36 years. He is the author of 2 books on Air Pollution and Hazardous Waste management. He has published more than 100 papers in National and International Journals, conferences, Symposia etc. He is a member of several expert committees such as CSIR, DST, MOEF, KSPCB etc., He is a popular science writer and lecturer and environmentalist.

COURSE PLAN :

Week 1: Atomic and Molecular structure

Week 2: Properties of solutions

Week 3: Electrochemical methods-1

Week 4: Electrochemical methods-2

Week 5: Electrochemical methods-3

Week 6: Ion selective electrodes and Electrochemical sensors

Week 7: Process waste handling and Electroplating

Week 8: Batteries and fuel cells and ZLD



ELECTRONIC WASTE MANAGEMENT – ISSUES AND CHALLENGES

PROF. BRAJESH KUMAR DUBEY

Department of Civil Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | PG

COURSE DURATION : 4 weeks (24 Jan' 22-18 Feb' 22)

EXAM DATE : 27 March 2022

PRE-REQUISITES : Environmental Sciences, Introduction to Environmental Engineering

INTENDED AUDIENCE : Disciplines of Engineering, Science, Humanities and Management

INDUSTRIES APPLICABLE TO : E Parisaraa, Ecoreco Recycling, Earth Sense, Attero Recycling, EWRI, WEEE Recycle, J. S. Pigments Limited. In addition ULBs across the country will be interested in this course, so as professionals from SPCB and CPCB.

COURSE OUTLINE :

This course will discuss the overall scenario of E-Waste management in India in comparison with other countries around the globe. At first, the present scenario of E-Waste management in India will be discussed along the role of various stakeholders. Then, the effects of recycling and management of Electronic Waste on human health, environment and society will also be presented. This will be followed by the risk assessment owing to pollutants released from E-Waste recycling in soil, air and water. The possible option of extraction of Rare-Earth Minerals will also be discussed in this course. The E-Waste management Rules of India and around the World will be compared. Finally a Life-Cycle Analysis approach will be employed for a possible sustainable solution of E-Waste Management for cutting the ill-effects of informal recycling.

ABOUT INSTRUCTOR :

Prof. Brajesh Kr. Dubey has his Bachelors Degree in Civil Engineering (Hons) from Indian Institute of Technology (IIT) Kharagpur, India and PhD in Environmental Engineering Sciences, University of Florida, Gainesville, Florida, USA. He is presently Associate Professor (Integrated Waste Management and Sustainable Engineering) in the Division of Environmental Engineering and Management at Indian Institute of Technology (IIT), Kharagpur, India. Dr. Dubey has more than 17 years of research, teaching, training and industrial outreach experience in the areas of Integrated Solid and Hazardous Waste Management, and Sustainable Engineering and Application of Life Cycle Assessment techniques. He also works in the area of Life Cycle Analysis and Sustainable Engineering. He has been teaching courses in the area of Solid Waste Management, Hazardous Waste Management. Dr. Dubey has authored/co-authored more than 200 publications in his area of expertise and have presented at several national and international conferences. He has worked as Waste Management Expert for UN agencies and World Bank.

COURSE PLAN :

Week 1: Overview of the course

Week 2: Exposure pathway of pollutants emitted from Recycling of E-Waste

Week 3: E-Waste Management Rules of India (2011 and 2016 Rules)

Week 4: E-waste Management: Case Studies and Unique Initiatives from around the World



EMOTIONAL INTELLIGENCE

PROF.RABINDRA KUMAR PRADHAN

Department of Humanities and Social Sciences
IIT Kharagpur

INTENDED AUDIENCE : Engineering, Management, Social Sciences and Law students

INDUSTRIES APPLICABLE TO : Human resource management division, training & development division of both manufacturing and service industries, MBA and HRM students

COURSE OUTLINE :

“Intelligence quotient (IQ) gets you hired but emotional quotient (EQ) gets you promoted”. This popular quote by Times magazine during late nineties has made the concept of emotional intelligence more popular among people by highlighting its multiple implications and applications. The uses and utility of emotional intelligence at home, school and workplace have benefited thousands in many disciplines. This course is designed to sensitize the participants about the concept, theory and applications of emotional intelligence. The participants will get to know the added advantage of EQ the software of the brain over the hardware (IQ). This programme will also explore how our hearts rule over our heads for creative creation. It will also focus on how various principles of emotional intelligence guide us in different contexts of life. The awareness about the credo of emotional intelligence will develop insights into self-regulation and realization of one’s optimum potentials for better performance. The participants will come to know about many unknowns of life, which will further help them to enhance their awareness to be effective on their roles. The course will offer useful lessons with the help of practical exercises, games, audio-visual instruments, case studies, classroom interaction to show the road map how to foster emotional intelligence in organisation for achieving health, happiness and optimal performance at work.

ABOUT INSTRUCTOR :

Prof. Rabindra Kumar Pradhan is currently working as associate professor in the department of humanities and social sciences, indian institute of technology kharagpur. He is currently working in diverse areas of behavioral sciences and human resource management. He is actively involved in teaching, training & research in the fields of positive psychology, industrial and organizational psychology, human resource development and management, and organizational behavior. He has 18 years of experience in teaching, research and training. He has published 02 books on emotional intelligence, 01 book on human resource management and 01 book on human development through training. He has also published more than 70 journal articles and 22 book chapters. His research papers/ articles have been published in international journal emerald insights, inderscience publishers, sage, springer, taylor & francis, etc. Recently, dr. Pradhan has been awarded with the “best trainer award-2012” by istd, hyderabad and “best teacher award-2013” by istd, kolkata for outstanding contribution in training & hrd. Some of his research papers have been awarded as “best paper” in icom-2015, abu dhabi and ibrc-2015, India.

COURSE PLAN :

Week 1: Introduction to emotion, intelligence & wisdom

Week 2: Concept, theory, measurement and applications of intelligence

Week 3: Emotional intelligence: concept, theory and measurements

Week 4: Correlates of emotional intelligence

Week 5: Emotional intelligence, culture, schooling and happiness

Week 6: For enhancing emotional intelligence EQ mapping

Week 7: Managing stress, suicide prevention, through emotional intelligence, spirituality and meditation

Week 8: Application of emotional intelligence at family, school and workplace



ENHANCING SOFT SKILLS AND PERSONALITY

PROF.T. RAVICHANDRAN

Department of Humanities and Social Sciences
IIT Kanpur

INTENDED AUDIENCE : Students, Teachers, Professionals, Trainers, Leaders, Employers

INDUSTRIES APPLICABLE TO : All industry/companies/organisations will recognize and value this course and recommend this for their employees and trainee programs.

COURSE OUTLINE :

The course aims to cause an enhanced awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality. Hard or technical skills help securing a basic position in one's life and career. But only soft skills can ensure a person retain it, climb further, reach a pinnacle, achieve excellence, and derive fulfilment and supreme joy. Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills. The focus of this course is on interpersonal and management skills. It has been approved for "Faculty Development Programme" by AICTE.

ABOUT INSTRUCTOR :

Prof. T. Ravichandran is presently a Professor of English in the Department of Humanities and Social Sciences at the Indian Institute of Technology Kanpur, Uttar Pradesh, India. He has written about fifty research articles/book chapters, supervised six doctoral theses, edited a special issue on Cyberpunk Literature for the Creative Forum Journal, and published a book on Postmodern Identity. He is a recipient of the Fulbright-Nehru Academic and Professional Excellence Fellowship (2014-15) for his research/teaching at Duke University, North Carolina, USA. He is honored with Champa Devi Gangwal Chair Professorship at IIT Kanpur. In his distinguished twenty-five years of teaching career, he has taught various courses in English Language and Literature. His NPTEL Video and Web courses on Communication Skills are well-acclaimed nationally and internationally. His NPTEL MOOC on Developing Soft Skills and Personality became hugely popular and well-received by about fifteen thousand participants from India and abroad.

COURSE PLAN :

Week 1 : Highlights of Developing Soft Skills and Personality Course-1-24 ; Highlights of Developing Soft Skills and Personality Course-25-48 ; Definitions and Types of Mindset ; Learning Mindsets ; Secrets of Developing Growth Mindsets

Week 2 : Importance of Time and Understanding Perceptions of Time ; Using Time Efficiently ; Understanding Procrastination ; Overcoming Procrastination ; Don't Say "Yes" to Make Others Happy!

Week 3 : Types of People ; How to Say "No" ; Controlling Anger ; Gaining Power from Positive Thinking-1 ; Gaining Power from Positive Thinking-2

Week 4 : What Makes Others Dislike You? ; What Makes Others Like You?-1 ; What Makes Others Like You?-2 ; Being Attractive-1 ; Being Attractive-2

Week 5 : Common Errors-1 ; Common Errors-2 ; Common Errors-3 ; Common Errors-4 ; Common Errors-5

Week 6 : Humour in Communication ; Humour in the Workplace ; Function of Humour in the Workplace ; Money and Personality ; Managing Money

Week 7 : Health and Personality ; Managing Health-1: Importance of Exercise ; Managing Health-2: Diet and Sleep ; Love and Personality ; Managing Love

Week 8 : Ethics and Etiquette ; Business Etiquette ; Managing Mind and Memory ; Improving Memory ; Care for Environment ; Highlights of the Course



ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY

PROF. ANJALI PAL

Department of Civil Engineering
IIT Kharagpur

PROF. SUDHA GOEL

Department of Civil Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 24 Apr' 2022

PRE-REQUISITES : Basic chemistry - Class XII

INTENDED AUDIENCE : Masters degree students of any of the Civil Engineering, Chemical Engineering Environmental Engineering, Mining Engineering, Geology and Geophysics, and Bioengineering/Biotechnology

INDUSTRIES APPLICABLE TO : Environmental consulting firms, Coal India, Thermal power plants

COURSE OUTLINE :

The objective of the course is to provide students with basic concepts from environmental chemistry and microbiology for understanding and solving environmental problems. Major topics that will be covered in environmental chemistry are: review of basic concepts in chemistry, concept of chemical equilibria, equilibrium constants and activity, reaction kinetics, acid and basis, polyprotic acids and bases, acidity, alkalinity, carbonate system, pH-Ct, buffers, and solubility reactions, nuclear chemistry, nitrogen chemistry and chlorination. Major topics that will be covered in environmental microbiology are: Introduction, the bacteria, the fungi, the algae, protozoa and other higher forms, viruses, pathogens and disease, microbial growth and enumeration, control of microorganisms, microbial diversity and metabolic pathways for remediating contaminated water, solid and hazardous waste, and soil.

ABOUT INSTRUCTOR :

Prof. Anjali Pal did her M.Sc & PhD from Calcutta University in Chemistry and at present teaching as a full professor in the Department of Civil Engineering, Indian Institute of Technology, Kharagpur. Prof. Pal is actively engaged in teaching and research in the field of Environmental Engineering and Science. She has published more than 215 research papers and received International Hall of Fame award (USA), R & D 100 award (USA) for her contribution in the field of pollution monitoring. Her Convention Award from the Indian Chemical Society is for her independent contribution to organic chemistry. Her research interest includes adsorbilization, adsorption, advanced oxidation processes (AOPs), catalysis and spectroscopy. She has developed a number of new methods for trace detection / determination of pollutants. She has visited many countries like USA, UK, Japan, France, Taiwan etc. as a visiting professor.

Prof. Sudha Goel did her B.E. (1990) in Environmental Engineering from L.D. College of Engineering, Gujarat University, Ahmedabad and M.S.E. (1992) and Ph.D. (1997) in Environmental Engineering from The Johns Hopkins University (JHU), Baltimore, US. She is currently Associate Professor, Department of Civil Engineering and School of Environmental Science and Engineering, IIT Kharagpur. She has been teaching Environmental Microbiology and some aspects of Environmental chemistry regularly since 2004. Her research interests include Water quality and treatment, and Solid and Hazardous Waste Management. She developed a web-based course 'Water and Wastewater Engineering' and wrote a textbook of the same name. She has several publications, taught several courses, and guided students at all levels in their research work.

COURSE PLAN :

Week 1: Concepts of acids, bases and salts, strengths of acids and bases, buffers, acid-base indicators, choice of indicators

Week 2: Concept of chemical equilibrium, solubility and solubility product, activity, Le Chatelier principle

Week 3: Reaction kinetics, rate and order of a reaction, determination of order

Week 4: Reaction mechanism, rate determining step, catalysts, activation energy

Week 5: Radioactivity and nuclear chemistry

Week 6: Nitrogen chemistry and chlorination

Week 7: Introduction and overview of environmental applications; major groups of microbes: bacteria, fungi, algae, protozoa and virus.

Week 8: Cell chemistry, biology and microscopy

Week 9: Microbial Metabolism

Week 10: Microbial Growth and Control

Week 11: Pathogens and diseases, metabolic diversity-1

Week 12: Metabolic Diversity-2 and Biogeochemical Cycles

Experimental Stress Analysis - Video course

COURSE OUTLINE

The course covers the basic aspects of experimental stress analysis that includes exhaustive treatment of the most versatile techniques like photoelasticity and strain gauges and also a brief introduction to the emerging techniques like digital image correlation. In addition it also provides the fundamental aspects of six different experimental techniques such as Moiré, Brittle Coatings, Holography, Speckle Methods, Thermoelastic Stress Analysis and Caustics.

COURSE ORGANISATION

Modules	Titles	Lectures	Hours
1	Overview of Experimental Stress Analysis	1-10	10
2	Transmission Photoelasticity	11-23	13
3	Introduction to Three Dimensional Photoelasticity and Digital Photoelasticity	24-25	2
4	Photoelastic Coatings and Brittle Coatings	26-30	5
5	Strain Gauges	31-40	10
6	Discussion Section	41	1

COURSE DETAIL

Lecture	Concepts Covered
1. Overview of Experimental Stress Analysis	Overview of experimental stress analysis, Stress analysis – Analytical, Numerical and Experimental approaches, Specific domain of these approaches, Advantages and disadvantages.



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Mechanical Engineering

Pre-requisites:

- Strength of Materials.

Additional Reading:

Articles from the journals:

- Experimental Techniques
- Experimental Mechanics
- Strain
- Journal of Strain Analysis for Engineering Design and Optics and Lasers in Engineering etc.

Coordinators:

Prof. K. Ramesh
Department of Applied Mechanics IIT Madras

2. Optical Methods Work as Optical Computers	Optical methods work as optical computers, Direct information provided by various experimental methods – brief description, Visual appreciation of field information – Listing of various problems of different complexity.
3. Stress, Strain and Displacement Fields	Stress, Strain and Displacement fields for various problems, Beam under pure bending, Analytical solution, Fringe contours from various experimental methods, Disc under diametral compression – Analytical solution, Fringe contours from various experimental techniques, Clamped circular plate under a central load – Analytical solution, Fringe contours from various experimental techniques.
4. Physical Principle of Strain Gauges, Photoelasticity and Moiré	Spanner tightening a nut – completeness of a numerical solution, comparison with photoelastic fringes. Physical principle behind various experimental techniques, Strain Gauges, Photoelasticity, Grids for determining plastic strains, Geometric moiré, grating details – u and v displacements, Demonstration of fringes due to translation and rotation of gratings of various types
5. Introduction to Moiré, Brittle Coatings and Holography	Brief introduction to Moiré, Brittle coatings and Holography. Difference between normal photography and holography, Visualising the depth information, Formation of speckles due to illumination by a laser, Rainbow hologram.
6. Hologram Interferometry, Speckle Methods	Hologram interferometry, Steps in a double exposure hologram interferometry, Speckle methods, Objective speckles, Subjective speckles
7. Introduction to Shearography, TSA, DIC and Caustics	Brief introduction to Speckle interferometry, Shearography, Thermoelastic Stress Analysis (TSA), Digital Image Correlation (DIC) and Caustics. Caustics in a tea cup, dimple formation, Class demonstration of Caustic experiment.
8. Fringe Patterns – Richness of Qualitative Information	Coherent gradient sensor, Naming of experimental methods, Fringe patterns – Richness of qualitative information, Information provided by fringe thickness, density. Optical methods for quality inspection, Comparison of various designs – Streamline fillet, Key technologies that have influenced Experimental Mechanics.
9. Multi-Scale Analysis in Experimental Mechanics	Multi-scale analysis in experimental mechanics, Trends in experimental mechanics, Discussion on selection of an experimental technique,

10. Selection of an Experimental Technique	Discussion on selection of an experimental technique contd., References. Review of solid mechanics, definition of free surface, ambiguity in associating the correct value of principal stress direction to the magnitude of the principal stress, Eigen value approach or use of Mohr's circle, Shear distribution in a three point bend specimen
11. Introduction to Transmission Photoelasticity	Physical principle, Historical development, Various branches of photoelasticity, Birefringence, Nature of light, Polarisation, Methods to get polarized light, Understanding polarization, Class experiment on showing crossed polarizers, Passage of light through isotropic media.
12. Ordinary and Extraordinary Rays	Snell's laws, Passage of light through crystalline media, Demonstration of birefringence effect of Calcite prism, Influence on the role of optical axis of the crystal, Light ellipse.
13. Light Ellipse, Passage of Light Through a Crystal Plate	Light ellipse (contd.) Retardation plates and wave plates, Historical development on polarization optics, Dichroism, Sheet polarisers
14. Retardation Plates, Stress-optic Law	Sheet polarisers contd., Retardation plates and wave plates, Quarter wave, Half wave and Full wave plates, Stress-optic law, Maximum stress information obtainable by photoelasticity.
15. Plane Polariscope	Plane polariscope, Logical explanation of formation of fringes, Understanding isochromatics, isoclinics. Intensity of light transmitted in a plane polariscope by trigonometric resolution.
16. Jones Calculus	Jones calculus, Rotation matrix, Retardation matrix, Representation of a retarder, Elements of the polariscope, Analysis of plane polariscope by Jones calculus, Circular polariscope, Dark and bright fields.
17. Circular Polariscope	Circular polariscope (contd.), Intensity of light transmitted by Jones calculus, Various optical arrangements possible, Demonstration of a commercial polariscope, Use of white light, Colour code, Tint of passage, Storage of photoelastic materials, Time-edge effect, Summary of photoelastic fringes.
18. Determination of Photoelastic Parameters at an Arbitrary Point	Review of colour code, Determination of photoelastic parameters at an arbitrary point, Compensation techniques, Babinet-Soleil compensator in

	detail, Steps in Tardy's Method of compensation.
19. Tardy's Method of Compensation	Tardy's method of compensation, Brief exposure to digital photoelasticity, Need for calibration of photoelastic materials, advantage of circular disk, Calibration of photoelastic model materials, Stress field in a circular disc under diametral compression.
20. Calibration of Photo elastic Materials	Conventional approach to calibration, Linear least squares analysis, Sampled least squares, Introduction to the use of Image processing techniques, Image sampling and quantization
21. Fringe Thinning Methodologies	Fringe thinning methodologies, Thresholding to find fringe areas, Binary based and intensity based algorithms, Chen & Taylor algorithm for one scanning direction, Fringe skeletonisation, Global fringe thinning algorithm, Experimental evaluation, Theoretical reconstruction of fringe pattern, Opening remarks on comments on fringe ordering.
22. Fringe Ordering in Photoelasticity	Importance of accurate evaluation of material stress fringe value, Global fringe thinning – summary, Comments on fringe ordering (contd.), Features of isochromatic and isoclinic fringe field, Positive and negative isotropic points, Role of principles of solid mechanics in fringe ordering, Identification of zeroth fringe order.
23. Miscellaneous Topics in Transmission Photoelasticity	Resolving the ambiguity on the principal stress direction, Determination of the sign of the boundary stress, Compatibility conditions, Role of elastic constants on stress field, Model to prototype relations, Properties of photoelastic model materials.
24. Three Dimensional Photoelasticity	Three dimensional photoelasticity, Stress freezing, Slicing, Application to a complex problem, Integrated photoelasticity, Principle of optical equivalence.
25. Overview of Digital Photoelasticity	Introduction to digital photoelasticity, Use of colour information for quantitative analysis, Three Fringe Photoelasticity (TFP), Refined TFP (RTFP) to solve slow time variant problems. Paradigm shift in data processing, Processing of intensity data for photoelastic data extraction, Overview of digital photoelasticity, Ten-step method, Understanding phasemaps.
26. Introduction to Photoelastic Coatings	Photoelastic coatings, Historical development, Optical arrangements, Photoelastic strain gauges, Strain-optic relation for coating, Evaluation of coating and specimen stresses.

27. Correction Factors for Photoelastic Coatings	Correction factors for photoelastic coatings, Correction factor for bending, Combined in-plane and bending loads, Correction factor for torsion, Correction factor for pressure vessel.
28. Coating Materials, Selection of Coating Thickness, Industrial Application of Photoelastic Coatings	Correction factors – Summary, Handling mismatch of Poisson's ratio, Coating materials, Properties of photoelastic coating materials, Selection of the coating thickness, Maximum fringe order obtainable, Use of photoelastic coatings to solve a range of problems of practical interest.
29. Calibration of Photoelastic Coatings, Introduction to Brittle Coatings	Demonstration of photoelastic coating test, Calibration of photoelastic coatings, Compact displacement controlled loading jig. Historical development of brittle coatings, Methodology of brittle coatings, Crack patterns produced by direct loading, Uniaxial, Biaxial and Isotropic stress fields, Steps in brittle coating tests, Coating selection, Surface preparation.
30. Analysis of Brittle Coatings	Undercoating, Application of the coating, Drying. Coating stresses, Uniaxial specimen stress, Nature of coating stress, Calibration of brittle coatings, Influence of Poisson's ratio mismatch, Crack patterns by refrigeration, Crack patterns by relaxation, Stresscoat.
31. Introduction to Strain Gauges	Analysis of Isoentatic data, Strain Gauges: Physical principle, Historical development, Development of SR-4 gauges, Strain sensitivity of a conductor, Gauge construction, Gauge length, Gauge length error in measurement, Thumb rule in selection of gauge length, Commonly used strain gauge materials.
32. Strain Sensitivity of a Strain Gauge, Bridge Sensitivity, Rosettes	Strain sensitivity of a strain gauge, Transverse sensitivity factor, Gauge factor, Experimental determination of gauge factor, Wheatstone bridge, Strain measurement options, Bridge sensitivity, Bridge factor, Accuracy achievable in Foil strain gauges, Linearity, Hysteresis and Zero shift, Determination of strain at a point, Three element rectangular rosette.
33. Strain Gauge Alloys, Carriers and Adhesives	Delta rosette, Metallic alloys commonly employed, Advance, Isoelastic alloy, Karma alloy, Thermally induced apparent strain, Nichrome-D, Strain gauge carriers, Types, Cements for bonding a strain gauge: Cynoacrylate, Epoxy cements and Polyester cements.
34. Performance of Strain Gauge System	Ceramic cements, High temperature strain gauge, Flame spraying Rokide process, Strain gauge linearity, Hysteresis, Drift, Stability, Heat dissipation,

	Allowable power density, Selection of bridge voltage, Sensitivity of gauge to temperature, Strain sensitivity of a conductor as a function of temperature.
35. Temperature Compensation, Two-wire and Three-wire Circuits	Temperature compensation, Temperature compensated gauges, Measurement techniques: Two-wire circuit, Gauge factor desensitization, Role of change in temperature, Three-wire circuit, Benefits of three-wire circuits.
36. Strain Gauge Selection	Selection compromises, Strain gauge designation systems, Various gauge patterns for different applications, Guidelines for strain gauge selection.
37. Bonding of a Strain Gauge	Temperature effects guiding the selection of certain parameters, Importance of following a bonding procedure, Surface preparation: Strain gauge installation kit, Solvent degreasing, Surface abrading, Layout lines, Surface conditioning, Neutralizing. Strain gauge bonding: Strain gauge handling, Strain gauge alignment, Catalyst application, Bonding with adhesive.
38. Soldering, Accounting for Transverse Sensitivity Effects	Masking, Tinning, Soldering, Application of protective coating, Testing the installation, Transverse sensitivity, Actual and apparent strains, Corrections for transverse strain effects for the case of known ratio of the transverse strain to the axial strain.
39. Correction Factors for Special Applications	Corrections for transverse strain effects for a general case, T-rosette, Rectangular rosette. Effect of hydrostatic pressure, Effect of nuclear radiation, Effect of high temperature, Effect of cryogenic temperature, Effect of strain cycling, Environmental effects.
40. Special Gauges	Environmental effects contd., Torque gauge, Stress gauge, Single element strain gauge as stress gauge, Evaluation of SIF by strain gauges, Strip gauge, Single element strain gauge to evaluate SIF. Summary of the course.
41. Questions & Answers	A few questions from the whole course were discussed.

References:

1. K. Ramesh, e-Book on Experimental Stress Analysis, IIT Madras, 2009. URL: http://apm.iitm.ac.in/smlab/kramesh/book_5.htm
2. K. Ramesh, Digital Photoelasticity – Advanced Techniques and Applications, Springer, 2000.
3. W.N. Sharpe (Ed.), Springer Handbook of Experimental Solid Mechanics,

Springer, 2008.

4. J.W. Dally and W.F. Riley, Experimental Stress Analysis, McGraw-Hill, 1991.
5. L.S. Srinath, M.R. Raghavan, K. Lingaiah, G. Gargesa, B. Pant, and K. Ramachandra, Experimental Stress Analysis, Tata Mc Graw Hill, 1984.



FOUNDATIONS OF COMPUTATIONAL MATERIALS MODELLING

PROF. NARASIMHAN SWAMINATHAN

Department of Mechanical Engineering
IIT Madras

TYPE OF COURSE : Rerun | Elective | PG

COURSE DURATION : 12 weeks (26 Jul' 21 - 15 Oct' 21)

EXAM DATE : 24 Oct 2021

PRE-REQUISITES : Basic Materials Science Course at the undergraduate level, MATLAB programming, familiarity with LINUX is preferred.

INTENDED AUDIENCE : All Engineering students

INDUSTRIES APPLICABLE TO :None. This course will be useful for students pursuing research requiring molecular simulations of solids.

COURSE OUTLINE :

This course provides the necessary foundations to (a) build computational samples of crystals (b) Introduce statistical mechanics and its connection to Molecular dynamics (c) Provide enough ground in Molecular dynamics using LAMMPS

ABOUT INSTRUCTOR :

The instructor Dr. Narasimhan Swaminathan is an Associate Professor in the Dept. of Mechanical Engineering at IIT Madras. Prior to this, he was a Post Doctoral Research Associate in the Materials Science and Engineering Department at University of Wisconsin, USA. Dr. Narasimhan obtained his Ph.d. from the Georgia Institute of Technology in 2009. His current research areas include molecular simulations to study radiation damage, polymer mechanics, etc. He also studies stress-diffusion interaction in Li-ion battery electrodes using continuum mechanics.

COURSE PLAN :

Week 1: Introduction to Computational Modeling

Week 2: Introduction to Crystals

Week 3: Symmetry in Crystals

Week 4: Plane Groups

Week 5: Space Groups

Week 6: Construction of 2D and 3D crystals in MATLAB

Week 7: Statistical Mechanics

Week 8: Statistical Mechanics, cont'd

Week 9: Introduction to Molecular Dynamics

Week 10: Molecular dynamics using LAMMPS – 1

Week 11: Molecular dynamics using LAMMPS -2

Week 12: Molecular dynamics using LAMMPS -3 and Closure



FUNDAMENTALS OF SEMICONDUCTOR DEVICES

PROF. DIGBIJOY N. NATH

Centre for Nano Science and Engineering (CeNSE)
IISc Bangalore

PRE-REQUISITES : High school physics & math, 10+2 physics

INTENDED AUDIENCE : Students pursuing B.E./B.Tech in ECE/EE, or M. Sc Physics

INDUSTRIES APPLICABLE TO : Semiconductor

COURSE OUTLINE :

This course seeks to cover the basics of semiconductor devices including the physics of energy bands, doping and carrier statistics and transport leading up to the understanding of common semiconductor devices including p-n junctions and their applications, BJTs and MOSFETs. The course will also give a flavour of the basics of compound semiconductors and their devices, and also touch base with opto-electronic devices such as solar cells, photodetectors and LEDs. The course will ensure that undergraduates, college teachers and other interested audience with no background in semiconductors are able to grasp the content. In parallel, the course will consistently seek to engage the audience by giving real-life examples pertaining to the content, and also seek to calibrate the content with respect to practical and commercial technologies which are all around us and which use semiconductor devices. There will be enough food for thought even for advanced learners such as PhD students and active researchers.

ABOUT INSTRUCTOR :

Prof. Digbijoy N. Nath completed his B.E. (Hons) in Electrical and Electronics Engineering from BITS, Pilani (Rajasthan) and PhD in Electrical Engineering from Ohio State University, Columbus specializing in gallium nitride based semiconductor devices. He has been as Assistant Professor at Centre for Nano Science and Engineering (CeNSE) at Indian Institute of Science (IISc), Bangalore since Aug 2014. His research interests lie in wide band gap semiconductor devices for high power & RF electronics/deep-UV opto-electronics. He has authored/co-authored 46 publications so far. He has been teaching a postgraduate level course Semiconductor Devices and IC Technology for PhD/Masters students at IISc for four years while he has also started a new advanced-level course titled Semiconductor Opto-electronics and Photovoltaics (jointly with another faculty member).

COURSE PLAN :

Week 1 : Importance of semiconductor devices and their diverse applications. Introduction to semiconductors, concept of energy bands and how bands form. Effective mass of electrons, E-k diagram. Concept of holes. Concept of Fermi level, Fermi-Dirac distribution. Doping (extrinsic & intrinsic semiconductor), density of states.

Week 2 : Equilibrium electron-hole concentration, temperature-dependence. Carrier scattering and mobility, velocity saturation, Drift-diffusion transport

Week 3 : Excess carrier decay & recombination, charge injection, continuity equation, quasi-Fermi level

Week 4 : p-n junction: static behaviour (depletion width, field profile), p-n junction under forward & reverse bias, current equations, generation-recombination current and reference to typical devices.

Week 5 : Zener and avalanche breakdown, Capacitance-voltage profiling, metal/semiconductor junction – Ohmic and Schottky contacts, reference to device applications.

Week 6 : MOS capacitor, charge/field/energy bands, accumulation, inversion, C-V (high and low frequencies), deep depletion, Real MOS cap: Flat-band & threshold voltage, Si/SiO₂ system.

Week 7 : MOSFET: structure and operating principle, derivation of I-V, gradual channel approximation, substrate bias effects, sub-threshold current and gate oxide breakdown. Control of threshold voltage, short channel effects. Moore's Law and CMOS scaling

Week 8 : Introduction to compound semiconductors & alloys, commonly used compound semiconductors, heterostructure band diagrams and basics of MODFET & HEMT, introduction to quantum well, applications of heterostructure device technologies

Week 9 : BJT: working principle, DC parameters and current components, base transport factor, Early Effect, charge control equation & current gain, need for HBT. Applications of BJTs/HBTs in real-life.

Week 10 : (Basics of) - transistors for high-speed logic, transistors for high frequency (RF), transistors for high power switching, transistors for memories, transistors for low noise, transistors for the future.

Week 11 : Solar cells: principle, efficiency, Fill factor, Shockley-Queisser limit, silicon solar cells, multi-junction solar cell, Photodetectors: operation, figures of merit (responsivity, QE, bandwidth, noise, Detectivity), examples from IR to UV detectors.

Week 12 : LEDs: working principle, radiative/non-radiative recombination, various types of efficiencies (EQE, WPE, IQE), light extraction and escape cone. Blue LED and the Nobel Prize, visible LEDs and chromaticity.



FUNDAMENTALS OF SURFACE ENGINEERING: MECHANISMS, PROCESSES AND CHARACTERIZATIONS

PROF. D.K. DWIVEDI

Department of Mechanical Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Elective | PG
COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)
EXAM DATE : 24 Apr 2022

INTENDED AUDIENCE : UG and PG Student, Research Scholar & Practicing Engineers

INDUSTRIES APPLICABLE TO : Mining, Hydropower, Cement and Manufacturing

COURSE OUTLINE :

The course content is designed to have systematic and comprehensive understanding on various aspects related with surface engineering of metallic components for enhanced tribological life. It is proposed to include fundamental mechanisms of wear such as adhesive, abrasive, erosive, cavitation, corrosion etc., governing laws, materials properties importance for improved wear resistance under different wear conditions, materials increased tribological life, processes for engineering surfaces of three broad categories a) regulating the micro-structure without changing chemical composition b) modification of chemical composition of near surface layers and c) developing of films, coating, and cladding on the. Methods of characterization needed for evaluating the metallurgical and mechanical and tribological properties and performance of engineered surfaces shall also be presented. Presentations will be supported with case studies for effective communication of concepts and procedures. Case studies will be taken up regarding surface engineering of various metal systems like ferrous and non-ferrous metals using different approaches discussed.

ABOUT INSTRUCTOR :

Prof. D.K. Dwivedi obtained BE (Mechanical Engineering) , in 1993 from GEC Rewa, ME (welding engineering) from Univ. of Roorkee in 1997 and PhD in Met. Engineering from MNIT, Jaipur in 2003. He has about 9 years teaching experience at NIT Hamirpur and 12 years at IIT Roorkee of subjects related with manufacturing at UG level and welding engineering related subjects at PG level including failure analysis of welded joints. He has undertaken work of failure investigation valves, penstocks, bridges for many private and public sector industries especially in hydropower sector.

COURSE PLAN :

- Week 01** : Introduction
- Week 02** : Introduction - contd.
- Week 03** : Surface damage
- Week 04** : Surface damage - contd.
- Week 05** : Materials for wear resistant applications
- Week 06** : Processes for Controlling Wear: Structural Modification
- Week 07** : Processes for Controlling Wear: Composition Modification
- Week 08** : Processes for Controlling Wear: Composition Modification - contd.
- Week 09** : Processes for Controlling Wear: Composition Modification & Weld Surfacing
- Week 10** : Processes for Controlling Wear: Coatings & Cladding
- Week 11** : Processes for Controlling Wear: Coatings & Overlays
- Week 12** : Processes for Controlling Wear: Coatings & Characterization



GEOGRAPHIC INFORMATION SYSTEMS

PROF. ARUN K. SARAF

Department of Civil Engineering
IIT Roorkee

PRE-REQUISITES : Current students of engineering, post graduate science students and PhD students should have basic knowledge of computers

INTENDED AUDIENCE : Under and post-graduate engineering, post graduate and doctoral students

INDUSTRIES APPLICABLE TO : Geoinformatics companies, e.g NIIT, ESRI India, Leica Geoinformatics, MapmyIndia, ISRO, etc.

COURSE OUTLINE :

The proposed course provides detailed understanding about Geographic Information Systems and their applications in Civil Engineering and Earth Sciences. All aspects starting from data input to modelling would be discussed in this course. Further, in the proposed course various datasets including DEMs, their source, generation techniques, derivatives, errors and limitations would be discussed extensively. Surface Hydrologic Modelling using DEMs, modelling derivatives and their applications would also be discussed.

ABOUT INSTRUCTOR :

Prof. Arun K. Saraf is Ph. D. (Remote Sensing) from University of Dundee, United Kingdom. Presently he is working as Professor in the Department of Earth Sciences, Indian Institute of Technology, Roorkee, and teaches courses on Geographic Information Systems (GIS), Advanced GIS, Remote Sensing, Geomorphology etc. to under- and post-graduate students of Geological Technology and Applied Geology. He was also Head of Department of Earth Sciences between Jan. 2012-Feb. 2015. He was first in the country to introduce GIS course to post-graduate students in the year 1990. In 1986, he was awarded National Fellowship to Study Abroad by Govt. of India for his doctoral degree.

COURSE PLAN :

Week 1: What is Geographic Information Systems?, Essential components of GIS, Different types of vector data, Concept of topology, Demonstration through GIS software

Week 2: Raster data model and comparisons with vector, TIN data model and comparisons with raster, Non-spatial data (attributes) and their types, Vector Data Compression Techniques, Demonstration through GIS software

Week 3: Raster Data Compression Techniques-01, Raster Data Compression Techniques-02, Georeferencing, Pre- processing of spatial datasets-01, Demonstration through GIS software

Week 4: Pre-processing of spatial datasets-02, Pre-processing of spatial datasets-03, Spatial Interpolation Techniques-01, Spatial Interpolation Techniques-02, GIS Analysis- 01

Week 5: GIS Analysis-02, GIS Analysis-03, GIS Analysis- 04, GIS Analysis-05, Demonstration through GIS software

Week 6: GIS Analysis-06, GIS Analysis-07, Attributes Classification Methods, Spatial Database systems and their types-01, Demonstration through GIS software

Week 7: Spatial Database systems and their types-02, Concept of NoData in Raster, Different map projections, Concept of digital elevation model (DEM) and how it is represented, Demonstration through GIS software

Week 8: Various techniques to generate digital elevation models-1, Various techniques to generate digital elevation models-2, Various techniques to generate digital elevation models-3, Digital Elevation Models and different types of resolutions, Demonstration through GIS software

Week 9: How to assess quality of a DEM, Integration of DEMs with satellite data, Common derivatives of DEMs - Slope and aspect-01, Common derivatives of DEMs - Slope and aspect-02, Demonstration through GIS software

Week 10: Common derivatives of DEMs - Slope and aspect-03, DEMs derivatives-1, DEMs derivatives-2, DEMs derivatives-3, DEMs derivatives-4

Week 11: Triangulated Irregular Network (TIN) and its derivatives, Shaded relief models and their applications, DEM based Surface Hydrologic Modelling-1, DEM based Surface Hydrologic Modelling-2, DEMs and Dam Simulation and its application in groundwater hydrology

Week 12: DEMs Sources, limitations and future of Digital Elevation Models, Applications of DEMs in Viewshed and Flood Hazard Mapping, Applications of DEMs in solar and wind energy potential estimations, Errors in GIS and key elements of maps, Limitations and Rules of GIS



GERMAN - I

PROF. MILIND BRAHME

Department of Humanities and Social Sciences
IIT Madras

INTENDED AUDIENCE : Anyone interested in learning elementary German

INDUSTRIES APPLICABLE TO : Companies / Organisations / Individuals having business / work with Germany, Austria and/or Switzerland

COURSE OUTLINE :

German I is meant to be an introduction to the German language and a basic orientation towards Germany (and to some extent Austria and Switzerland). Learning to understand and articulate oneself in day to day real life situations, and to begin to make sense of Germany as a cultural space are the overall objectives of the course. Serious learners should be able to grasp the basic sentence structure and build a good foundational vocabulary through this course.

ABOUT INSTRUCTOR :

Prof. Milind Brahme has an MA, M Phil and a PhD in German language and literature from the Centre of German Studies, JNU. He has been on the faculty of IIT Madras since 2003, and has more than 25 years of experience of teaching German language and literature in diverse situations and contexts.

COURSE PLAN :

Week 1: Themes: Introducing oneself and others; Grammar: W questions, personal pronouns, simple sentence, verb conjugation

Week 2: Themes: hobbies, the week, numbers, the alphabet, months, seasons / Grammar : articles , plural, the verbs to have and to be

Week 3: Theme: In the city / naming places and buildings, means of transport, basic directions / Grammar : definite and indefinite articles; negation - kein and nicht; imperative

Week 4: Themes: food, drink, family / groceries and meals / Grammar : the accusative

Week 5: Theme: Everyday life, telling time, making appointments / Grammar : prepositions am, um, von..bis; modal verbs, possessive articles

Week 6: Leisure activity, celebrations / Grammar: separable verbs, the accusative, past tense of to have and to be

Week 7: Contacts, writing letters / Grammar: dative

Week 8: My apartment, rooms, furniture, colours / Grammar: changing prepositions

Week 9: Professions / Grammar : perfect tense

Week 10: Clothes / Grammar: perfect tense and dative

Week 11: Health and the body / Grammar: the imperative and modal verbs

Week 12: Holiday and weather



GPS SURVEYING

PROF. JAYANTA KUMAR GHOSH

Department of Civil Engineering

IIT Roorkee

- INTENDED AUDIENCE** : Diploma/Degree/Master/Doctoral students; Field surveyors; Professional persons dealing with GPS surveying.
Application based.As core course (partial) for Civil Engineering,Geo-spatial Technology etc.
As elective course (partial) for Earth Sciences,Geography etc for all domains in which GPS surveying may be applied.
May be considered for both course (UG & PG).
Part of any of the degrees: (BE/ME/BSc/MSc etc).
- PRE-REQUISITES** : Basics of Physics and mathematics upto 12th standard and familiarity with use of computer.

COURSE OUTLINE :

The objective of the course is to provide optimal insights into land surveying using GPS (Global Positioning System). The course starts with an introduction to land surveying leading to GPS as the state-of-art for surveying of land. Then, different aspects of GPS systems such as GPS architecture, GPS signals, GPS receivers, GPS software has been discussed followed by GPS positioning & GPS observables. Next, it provides GPS processing fundamentals consisting of pre-processing and processing steps under different processing strategies followed by quality assessment and field procedure of GPS surveying. The course concludes with a detail demonstration of GPS field surveying followed by processing of collected data.

ABOUT INSTRUCTOR :

Prof. Jayanta Kumar Ghosh is working as Associate Professor in the Civil Engineering Department (Geomatics Engineering Group) of Indian Institute of Technology Roorkee. He is engaged in teaching, research and consultancy works in Geomatics engineering for more than 30 years. He is pioneer in introducing courses on GPS surveying in the UG & PG curriculum of Civil Engineering in India, since 1999. He has conducted many short term courses on GPS Surveying for the building professionals as early as 2002. He has more than 85 publications in the International and National journals and conferences of repute. He is member of different National and International technical associations.

COURSE PLAN :

Week 1: Introduction; GPS System

Week 2: GPS Positioning; GPS Observables

Week 3: GPS Data Processing

Week 4: GPS Field Surveying; GPS Field Data Processing

Graph Theory - Video course

COURSE OUTLINE

In computer science, graph theory is used extensively. The intension of this course is to introduce the subject of graph theory to computer science students in a thorough way.

While the course will cover all elementary concepts such as coloring, covering, hamiltonicity, planarity, connectivity and so on, it will also introduce the students to some advanced concepts.

COURSE DETAIL

Sl.No.	Topics	No.of Hours
1	Vertex Cover	1
2	Matchings	3
3	Pathcover	1
4	Connectivity	3
5	Hamiltonicity	3
6	Vertex Coloring	4
7	Edge Coloring	3
8	Other Coloring Problems	2
9	Perfect graphs	2
10	Planar graphs	3
11	Other special classes of graphs	2
12	Network flow	3
13	Introduction to minor theory	3



NP-TEL

NPTEL

<http://nptel.iitm.ac.in>

Computer Science and Engineering

Coordinators:

Dr. L. Sunil Chandran
Department of Computer Science and
Automation IISc Bangalore

14	Probabilistic Methods: Basics	3
15	Markov, Chebishey Inequalities	1
16	Lovasz Local Lemma	2
17	Random graph	1
	Total	40

References:

1. R. Diestel, "Graph Theory", Springer-Verlag, 2nd edition, 2000.
2. N. Alon and J. Spenser, "Probabilistic Methods", John Wiley and Sons, 2nd edition, 2000.



HUMAN BEHAVIOUR

PROF. NAVEEN KASHYAP

Department of Humanities and Social Sciences
IIT Guwahati

INTENDED AUDIENCE : UG/PG/PhD students

COURSE OUTLINE:

We as intelligent beings have always wondered why we do what we do. The most interesting knowledge that humans beings would kill to possess would be the knowledge to control other people. The basic premise of being human is individual difference (we are all different). One science that helps people in understanding other people and scientifically predicting their actions is the science of psychology. In the present course, I will make an attempt to simplify the science of human behavior.

ABOUT INSTRUCTOR :

Prof. Naveen Kashyap, Ph.D is as Associate Professor of Psychology at the Indian Institute of Technology Guwahati. His research interests are sleep and human cognitive processes. Dr Kashyap has been teaching courses like cognitive psychology, introduction to psychology, consumer psychology, advance cognitive process and research methodology to UG and PG students of IITG Guwahati for the past 10 years.

COURSE PLAN :

Week 1 : Introduction to the science of human behavior

Week 2 : Sensation & Perception-I

Week 3 : Perception-II, Learning

Week 4 : Memory and Language-I

Week 5 : Language-II and Emotion

Week 6 : Intelligence

Week 7 : Personality

Week 8 : Social influence and cognition



INTRODUCTION TO AEROSPACE ENGINEERING-FLIGHT

PROF. RAJKUMAR S. PANT

Department of Aerospace Engineering
IIT Bombay

INTENDED AUDIENCE : Any discipline of Engineering, who are interested in the subject

INDUSTRY SUPPORT : DRDO, HAL, NAL, IAF

COURSE OUTLINE :

The aim of this course is to provide a general overview of the field of Aeronautical Engineering to interested students. The course will consist of ten Capsules, each consisting of two Lectures. Each Lecture will cover a specific concept or area relevant to the subject. An attempt will be made to cover the contents in an interesting manner, by a judicious use of a mix of powerpoint presentations, in-class activities, quizzes, innovative and hands on assignments that will not only increase the awareness of the students, but also satiate their curiosity and desire to know more about the various concepts related to the subject.

ABOUT INSTRUCTOR :

Prof. Rajkumar S. Pant has Bachelors, Masters and Ph.D. degrees in Aerospace Engineering. His areas of specialization include Aircraft Conceptual Design, Air Transportation, and Optimization. He has been a member of faculty of Aerospace Engineering Department at the Indian Institute of Technology Bombay since December 1989. Prof. Pant is an alumnus of College of Aeronautics, Cranfield University, UK, where he earned his Ph.D. under Commonwealth Scholarship Scheme, IIT Madras, where he did his Masters in Aeronautical Engineering, and PEC Chandigarh where he underwent his undergraduate studies in Aeronautical Engineering. He has also worked for five years in Hindustan Aeronautics Limited in the Design & Engineering Department at Kanpur (3.5 years) and Nasik (1.5 years) Divisions. He has published and presented ~ 220 scientific papers, of which ~ 170 are in international journals and conferences. He has also visited several top ranking institutes and universities all over the world. Prof. Pant was a Visiting Professor at School of Mechanical & Aerospace Engineering at Nanyang Technological University, Singapore in 2015-16, visiting faculty at Department of Aerospace & Ocean Engineering at Virginia Polytechnic Institute and State University in 2010-11, and a visiting researcher at Instituto Tecnológico de Aeronáutica, Brazil in 2012, Texas A&M University in 2011, Cambridge University in 2008, and Imperial College London in 2006. In November 2012, he was appointed as a Special Visiting Researcher under the Science Without Borders program of the Brazilian Government for three years

COURSE PLAN :

Week 1: Atmosphere and its properties

Week 2: Nomenclature of aircraft components

Week 3: Fluid Mechanics – I : Incompressible flow, Bernoulli's Equation, Coanda Effect, and Mach No..

Week 4: Fluid Mechanics –II : Viscous Flow, Boundary Layer, Pressure Measurement

Week 5: Aerodynamics – I : Airfoils, and Lift Generation Theories

Week 6: Aerodynamics – II : Critical Mach no., Types of Drag

Week 7: Propulsion : Types of Aircraft Engines

Week 8: Aircraft Performance - I : Steady Level Flight and Altitude effects

Week 9: Aircraft Performance- II : Glide, Climb, Ceilings, Turn, and Pull up

Week 10: Aircraft Longitudinal Stability, and V-n Diagram

Week 11: Aircraft Performance- III : Takeoff and Landing, Range and Endurance, Range-Payload Diagram

Week 12: Flapping Wing Aerodynamics



INTRODUCTION TO BRAIN & BEHAVIOUR

PROF. ARK VERMA

Department of Humanities and Social Sciences
IIT Kanpur

TYPE OF COURSE : Rerun | Core | PG

COURSE DURATION : 8 weeks (21 Feb' 22 - 15 Apr' 22)

EXAM DATE : April 24, 2022

INTENDED AUDIENCE : Students across various disciplines from the Cognitive Sciences, Neurosciences, Psychology doing either their Bachelors or Masters, and even PhD may benefit from this course.

COURSE OUTLINE :

The course is meant to familiarise the students with the neural basis of mental/cognitive processes. The course will stress on both how the mental functions operate to give rise to human behaviour and also simultaneously show how these processes are implemented in the human brain.

ABOUT INSTRUCTOR :

Prof. Ark Verma have done my Bachelor's Degree in Psychology & English Literature from the University of Allahabad in 2007. After that I did my Master's Degree in Cognitive Science at the Centre of Behavioral & Cognitive Sciences, University of Allahabad in 2009. I joined the PhD program in the Department of Experimental Psychology at Ghent University, Belgium in January 2010 & was awarded my PhD in 2014. I joined IIT Kanpur as an Assistant Professor of Psychology in May 2015. My research lies in the field of Cognitive Psychology (Lateralisation, Symmetry Detection, Attention) & Psycholinguistics (Visual Word Recognition & Bilingualism).

COURSE PLAN :

Week 1 : A Brief History of Cognitive Neuroscience. Structure and Function of the Nervous System.

Week 2 : Methods in Cognitive Neuroscience

Week 3 : Neural Basis of Sensation and Perception.

Week 4 : Neural Basis of Object Recognition.

Week 5 : Neural Basis of Attention and Consciousness.

Week 6 : Neural Basis of Learning and Memory.

Week 7 : Neural Basis of Language & Cognitive Control.

Week 8 : Special Topics in Cognitive Neuroscience.



INTRODUCTION TO EMBEDDED SYSTEM DESIGN

PROF. DHANANJAY V. GADRE

Department of Electrical, Electronics and Communications Engineering
Netaji Subhas University of Technology,

PROF. BADRI SUBUDHI

Department of Electrical, Electronics and Communications Engineering
IIT Jammu

PRE-REQUISITES : Anyone with understanding of basic electronic components and circuits, digital electronics and C programming.

INTENDED AUDIENCE : Undergraduate students in engineering and science.

INDUSTRIES APPLICABLE TO : Supported by Texas Instruments.

COURSE OUTLINE :

Embedded Systems surround us in the form of gadgets and devices that we use. There is no aspect of human lives, which is untouched by such devices at home or for health diagnostics, transportation, entertainment. Learning out Embedded Systems will give the skills to design and manufacture embedded system products of the future which will help participants towards better employability. This course teaches embedded system design using a building block approach, which allows one to visualize the requirement of an embedded system and then to design it efficiently. The course will teach embedded system design using a microcontroller, namely Texas Instruments MSP430 low power microcontroller. The course will introduce various interfacing techniques for popular input devices including sensors, output devices and communication protocols. It will teach power supply design for embedded applications. It will also teach effective embedded programming techniques in C and how to maintain code using GIT. It will have a significant practical component, which will be achieved through any available MSP430 microcontroller kit

ABOUT INSTRUCTOR :

Dhananjay V. Gadre (New Delhi, India) completed his Ph.D. in Instrumentation and Control Engineering from University of Delhi. He has a M.Engr. (Computer Engineering) from the University of Idaho, USA after his M.Sc. (Electronic Science) from the University of Delhi, South Campus and B.Sc. (General with Electronics) from the Atma Ram Sanatan Dharma College, University of Delhi.

Prof. Gadre teaches at the Netaji Subhas University of Technology (formerly Netaji Subhas Institute of Technology) in the Department of Electronics and Communication Engineering, currently as an Associate Professor. He is also the founder director of CEDT and TI-CEPD.

At NSUT, he established two open access laboratories, namely Centre for Electronics Design and Technology (CEDT) and Texas Instruments Centre for Embedded Product Design (TI-CEPD). CEDT started functioning at NSUT (NSIT at the time) under his guidance in 2003 and has trained more than 5000 students in various activities related to hands-on electronics and system design. TI-CEPD started as a result of an MOU between Texas Instruments India and NSIT in 2012, under his direction. At TI-CEPD, he organized month-long, hands-on "Internship Workshops on Embedded System Design" for undergraduate and postgraduate engineering and science students, PhD scholars and young faculty and 12 such workshops were organized between June 2013 and July 2017 benefiting around 1000 participants. Activities in these two labs have resulted in many projects, products, and publications including books as well as mentoring of a few startups and providing help and guidance to science related NGOs.

Since 2001, he has been a member of an expert committee constituted by Centre for Development of Advanced Computing (CDAC), Pune for their flagship post graduate diploma program in Embedded System Design (DESD). This program has been running continuously for more than 20 years and has graduated more than 15,000 professionals in this field. Since January 2018, he has been an editor of IETE Journal of Education. Also in 2018, he received an invitation to be an adjunct faculty at IIT Jammu.

Prof. Gadre is keenly interested in creating content and pedagogy material for online learning. In September 2020, his first Massive Open Online Course (MOOC) on 'Introduction to Embedded System Design' was launched on the NPTEL platform of the Swayam portal of Government of India. This course is suitable for undergraduate and postgraduate students in science and engineering, and has been supported by Texas Instruments. This course was offered again in the January 2021 session, January 2023 session and January 2024 session at the NPTEL platform. More than seventy thousand students registered for these three editions of his MOOC. Incidentally, this is the only MOOC by any faculty member of DU/IGDTUW/NSUT/JMI/IPU.

Since 2016 he has been mentoring schools to acquire an 'Atal Tinkering Laboratory' under a Niti Aayog scheme of the Government of India and to help the selected schools run these laboratories efficiently. In December 2020, AICTE launched the IDEA Lab scheme. Prof. Gadre was co-opted as a founding member of the National Steering Committee to oversee the effective operation and implementation of the IDEA Lab scheme.

In his professional career of 34 years, he taught at the SGTB Khalsa College, University of Delhi followed by a stint as a scientific officer at the Inter University Centre for Astronomy and Astrophysics (IUCAA), Pune, designing instrumentation for use in astronomy. He has lectured and demonstrated his work extensively across the length and breadth of India and five continents, including at the World Economic Forum at Davos in Switzerland on topics related to electronics and embedded systems.

Prof. Gadre is the author of several professional articles and six books. One of his books has been translated into Chinese and another one into Greek. His recent book "TinyAVR Microcontroller Projects for the Evil Genius", published by McGraw Hill International (New York) consists of more than 30 hands-on projects and has been translated into Chinese and Russian. His latest book on TIVA ARM Cortex M4 microcontrollers is published by Springer Nature.

His professional interests include scientific instrumentation, digital systems design and computer architecture, embedded systems and Internet of Things. He is a licensed radio amateur with a call sign VU2NOX since 1986 and hopes to design, build and launch an amateur radio satellite in the near future.

Prof. Badri N Subudhi received M.Tech. in Electronics and System Communication from National Institute of Technology, Rourkela, India, in 2008-09. He worked for his PhD from Machine Intelligence Unit, Indian Statistical Institute, Kolkata, India in year 2014 (degree from Jadavpur University). Currently he is serving as an Assistant Professor at Indian Institute of Technology Jammu, India. Prior to this he was working as an Assistant Professor at NIT Goa from July 2014 to March 2017. He received CSIR senior research fellowship for the year 2011-2015. He was nominated as the Young Scientist Awardees by Indian Science Congress Association for the year 2012-2013. He was awarded with Young Scientist Travel grant award from DST, Government of India and Council of Scientific and Industrial Research, India in the year 2011. He is the recipient of Bose-Ramagnosi Award for the year 2010 from DST, Government of India under India-Trento Programme for Advanced Research (ITPAR). He was a visiting scientist at University of Trento, Italy during Aug. 2010 to Feb 2011. His research interests include Video Processing, Image Processing, Medical Image Processing, Machine Learning, Pattern Recognition, and Remote Sensing Image Analysis.

COURSE PLAN:

Week 1: Introduction to Embedded Systems and Computer Systems Terminology. Modular approach to Embedded System Design using Six-Box model: Input devices, output devices, embedded computer, communication block, host and storage elements and power supply.

Week 2: Microcontroller Based Embedded System Design. Salient Features of Modern Microcontrollers. Elements of Microcontroller Ecosystem and their significance.

Week 3: Design of Power Supply for Embedded Systems. Linear Regulator Topologies. Switching Power Supply Topologies. Power Supply Design Considerations for Embedded Systems.

Week 4: Introduction to MSP430 Microcontroller. MSP430 CPU Architecture. Programming Methods for MSP430. Introduction to Lunchbox Platform.

Week 5: Fundamentals of Physical Interfacing. Connecting Input Devices: Switches, Keyboard and Output devices: LEDs, Seven Segment Displays(SSD). Assignment: MCQ/MSQ

Week 6: Advanced Physical Interfacing: Driving load - high side, low side and H-bridge. Multiplexing displays including Charlieplexing. Shaft encoder.

Week 7: Programming the MSP430. Basics of version control system - Git. Installing and using Code Composer Studio(CCS). Introduction to Embedded C. Interfacing LEDs and Switches with MSP430 using Digital Input and Output.

Week 8: MSP430 Clock and Reset System. MSP430 Clock sources and distribution. Types of Reset sources. Handling Interrupts in MSP430. Writing efficient Interrupt Service Routine (ISR).

Week 9: Interfacing Seven Segment Displays and Liquid Crystal Displays with MSP430. Low Power Modes in MSP430. Introduction to MSP430 Timer Module and its Modes of Operation.

Week 10: Generating Pulse Width Modulation (PWM) using Timer Capture Mode. ADC operation in MSP430. Interfacing analog inputs. Generating random numbers using LFSR and other methods. Adding DAC to MSP430. Custom Waveform generation using MSP430.

Week 11: Timer Capture Modes. Measuring frequency and time period of external signals and events. Serial Communication Protocols: UART, SPI, I2C. Interfacing Universal Serial Communication Interface (USCI) Module of the MSP430 for UART Communication. Advanced Coding Exercises based on Interrupt driven Programming. Building an Electronics Project.

Week 12: Circuit Prototyping techniques. Designing Single Purpose Computers using Finite State Machine with Datapath (FSMD) approach. MSP430 Based Project Design and Implementation. Recap of Course Coverage.



INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS

PROF. SUDIP MISRA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Basic knowledge of computer and internet

INTENDED AUDIENCE : CSE, IT, ECE, EE, Instrumentation Engg, Industrial Engineering, Industry Professionals

INDUSTRIES APPLICABLE TO : All Industrial Sectors

COURSE OUTLINE :

Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing. Technologies such as Cyber Physical Systems (CPS), Internet of Things (IoT), Cloud Computing, Machine Learning, and Data Analytics are considered to be the different drivers necessary for the transformation. Industrial Internet of Things (IIoT) is an application of IoT in industries to modify the various existing industrial systems. IIoT links the automation system with enterprise, planning and product lifecycle. This course has been organized into the following modules:.

ABOUT INSTRUCTOR :

Prof. Sudip Misra is a Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Kharagpur. Prior to this he was associated with Cornell University (USA), Yale University (USA), Nortel Networks (Canada) and the Government of Ontario (Canada). He received his Ph.D. degree in Computer Science from Carleton University, in Ottawa, Canada. He has several years of experience working in the academia, government, and the private sectors in research, teaching, consulting, project management, architecture, software design and product engineering roles. His current research interests include Wireless Ad Hoc and Sensor Networks, Internet of Things (IoT), Computer Networks, Learning Systems, and algorithm design for emerging communication networks. Dr. Misra is the author of over 260 scholarly research papers, including 140+ reputed journal papers. He has won seven research paper awards in different conferences. Recently, he and his students won Samsung Innovation Award and the IEEE ComSoc Student Competition. He was awarded the fellow of NASI. He was also awarded the IEEE ComSoc Asia Pacific Outstanding Young Researcher Award at IEEE GLOBECOM 2012, Anaheim, California, USA. He was also the recipient of several academic awards and fellowships such as the Young Scientist Award (National Academy of Sciences, India), Young Systems Scientist Award (Systems Society of India), Young Engineers Award (Institution of Engineers, India), (Canadian) Governor General's Academic Gold Medal at Carleton University, the University Outstanding Graduate Student Award in the Doctoral level at Carleton University and the National Academy of Sciences, India - Swarna Jayanti Puraskar (Golden Jubilee Award). Dr. Misra was also awarded the Canadian Government's prestigious NSERC Post-Doctoral Fellowship and the Humboldt Research Fellowship in Germany. Dr. Misra has been serving the editorial boards of distinguished journals such as the Transactions on Vehicular Technology, Transactions on Mobile Computing, International Journal of Communication Systems (Wiley) and the IET Wireless Sensor Systems (UK). In the past, he served as the Associate Editor/Editorial Board Member of the Telecommunication Systems Journal (Springer), Security and Communication Networks Journal (Wiley), and the EURASIP Journal of Wireless Communications and Networking, IET Communications Journal, and the Computers and Electrical Engineering Journal (Elsevier). Dr. Misra has published 10 books in the areas of wireless ad hoc networks, wireless sensor networks, wireless mesh networks, communication networks and distributed systems, network reliability and fault tolerance, and information and coding theory, published by reputed publishers such as Cambridge University Press, Springer, Wiley, and World Scientific.

COURSE PLAN:

Week 1 : Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II

Week 2 : Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories

Week 3 : Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis

Week 4 : Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.

Week 5 : IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.

Week 6 : Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.

Week 7 : Industrial IoT- Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.

Week 8 : Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.

Week 9 : Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II.

Week 10 : Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.

Week 11 : Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

Week 12 : Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies :

Case study - I : Milk Processing and Packaging Industries

Case study - II: Manufacturing Industries - Part I

Case study - III : Manufacturing Industries - Part II

Case study - IV : Student Projects - Part I

Case study - V : Student Projects - Part II

Case study - VI : Virtual Reality Lab

Case study - VII : Steel Technology Lab



INTRODUCTION TO INTERNET OF THINGS

PROF. SUDIP MISRA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Basic programming knowledge

INTENDED AUDIENCE : CSE, IT, ECE, EE, Instrumentation Engineering, Industrial Engineering

COURSE OUTLINE :

Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

ABOUT INSTRUCTOR :

Prof. Sudip Misra is a Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Kharagpur. Prior to this he was associated with Cornell University (USA), Yale University (USA), Nortel Networks (Canada) and the Government of Ontario (Canada). He received his Ph.D. degree in Computer Science from Carleton University, in Ottawa, Canada. He has several years of experience working in the academia, government, and the private sectors in research, teaching, consulting, project management, architecture, software design and product engineering roles. His current research interests include Wireless Ad Hoc and Sensor Networks, Internet of Things (IoT), Computer Networks, Learning Systems, and algorithm design for emerging communication networks. Dr. Misra is the author of over 260 scholarly research papers, including 140+ reputed journal papers. He has won seven research paper awards in different conferences. Recently, he and his students won Samsung Innovation Award and the IEEE ComSoc Student Competition. He was awarded the fellow of NASI. He was also awarded the IEEE ComSoc Asia Pacific Outstanding Young Researcher Award at IEEE GLOBECOM 2012, Anaheim, California, USA. He was also the recipient of several academic awards and fellowships such as the Young Scientist Award (National Academy of Sciences, India), Young Systems Scientist Award (Systems Society of India), Young Engineers Award (Institution of Engineers, India), (Canadian) Governor General's Academic Gold Medal at Carleton University, the University Outstanding Graduate Student Award in the Doctoral level at Carleton University and the National Academy of Sciences, India - Swarna Jayanti Puraskar (Golden Jubilee Award). Dr. Misra was also awarded the Canadian Government's prestigious NSERC Post-Doctoral Fellowship and the Humboldt Research Fellowship in Germany. Dr. Misra has been serving the editorial boards of distinguished journals such as the Transactions on Vehicular Technology, Transactions on Mobile Computing, International Journal of Communication Systems (Wiley) and the IET Wireless Sensor Systems (UK). In the past, he served as the Associate Editor/Editorial Board Member of the Telecommunication Systems Journal (Springer), Security and Communication Networks Journal (Wiley), and the EURASIP Journal of Wireless Communications and Networking, IET Communications Journal, and the Computers and Electrical Engineering Journal (Elsevier). Dr. Misra has published 10 books in the areas of wireless ad hoc networks, wireless sensor networks, wireless mesh networks, communication networks and distributed systems, network reliability and fault tolerance, and information and coding theory, published by reputed publishers such as Cambridge University Press, Springer, Wiley, and World Scientific.

COURSE PLAN :

Week 1: Introduction to IoT: Part I, Part II, Sensing, Actuation, Basics of Networking: Part-I

Week 2: Basics of Networking: Part-II, Part III, Part IV, Communication Protocols: Part I, Part II

Week 3: Communication Protocols: Part III, Part IV, Part V, Sensor Networks: Part I, Part II

Week 4: Sensor Networks: Part III, Part IV, Part V, Part VI, Machine-to-Machine Communications

Week 5: Interoperability in IoT, Introduction to Arduino Programming: Part I, Part II, Integration of Sensors and Actuators with Arduino: Part I, Part II

Week 6: Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi

Week 7: Implementation of IoT with Raspberry Pi (contd), Introduction to SDN, SDN for IoT

Week 8: SDN for IoT (contd), Data Handling and Analytics, Cloud Computing

Week 9: Cloud Computing(contd), Sensor-Cloud

Week 10: Fog Computing, Smart Cities and Smart Homes

Week 11: Connected Vehicles, Smart Grid, Industrial IoT

Week 12: Industrial IoT (contd), Case Study: Agriculture, Healthcare, Activity Monitoring



INTRODUCTION TO INTERNET OF THINGS

PROF. SUDIP MISRA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Basic programming knowledge

INTENDED AUDIENCE : CSE, IT, ECE, EE, Instrumentation Engineering, Industrial Engineering

COURSE OUTLINE :

Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

ABOUT INSTRUCTOR :

Prof. Sudip Misra is a Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Kharagpur. Prior to this he was associated with Cornell University (USA), Yale University (USA), Nortel Networks (Canada) and the Government of Ontario (Canada). He received his Ph.D. degree in Computer Science from Carleton University, in Ottawa, Canada. He has several years of experience working in the academia, government, and the private sectors in research, teaching, consulting, project management, architecture, software design and product engineering roles. His current research interests include Wireless Ad Hoc and Sensor Networks, Internet of Things (IoT), Computer Networks, Learning Systems, and algorithm design for emerging communication networks. Dr. Misra is the author of over 260 scholarly research papers, including 140+ reputed journal papers. He has won seven research paper awards in different conferences. Recently, he and his students won Samsung Innovation Award and the IEEE ComSoc Student Competition. He was awarded the fellow of NASI. He was also awarded the IEEE ComSoc Asia Pacific Outstanding Young Researcher Award at IEEE GLOBECOM 2012, Anaheim, California, USA. He was also the recipient of several academic awards and fellowships such as the Young Scientist Award (National Academy of Sciences, India), Young Systems Scientist Award (Systems Society of India), Young Engineers Award (Institution of Engineers, India), (Canadian) Governor General's Academic Gold Medal at Carleton University, the University Outstanding Graduate Student Award in the Doctoral level at Carleton University and the National Academy of Sciences, India - Swarna Jayanti Puraskar (Golden Jubilee Award). Dr. Misra was also awarded the Canadian Government's prestigious NSERC Post-Doctoral Fellowship and the Humboldt Research Fellowship in Germany. Dr. Misra has been serving the editorial boards of distinguished journals such as the Transactions on Vehicular Technology, Transactions on Mobile Computing, International Journal of Communication Systems (Wiley) and the IET Wireless Sensor Systems (UK). In the past, he served as the Associate Editor/Editorial Board Member of the Telecommunication Systems Journal (Springer), Security and Communication Networks Journal (Wiley), and the EURASIP Journal of Wireless Communications and Networking, IET Communications Journal, and the Computers and Electrical Engineering Journal (Elsevier). Dr. Misra has published 10 books in the areas of wireless ad hoc networks, wireless sensor networks, wireless mesh networks, communication networks and distributed systems, network reliability and fault tolerance, and information and coding theory, published by reputed publishers such as Cambridge University Press, Springer, Wiley, and World Scientific.

COURSE PLAN :

Week 1: Introduction to IoT: Part I, Part II, Sensing, Actuation, Basics of Networking: Part-I

Week 2: Basics of Networking: Part-II, Part III, Part IV, Communication Protocols: Part I, Part II

Week 3: Communication Protocols: Part III, Part IV, Part V, Sensor Networks: Part I, Part II

Week 4: Sensor Networks: Part III, Part IV, Part V, Part VI, Machine-to-Machine Communications

Week 5: Interoperability in IoT, Introduction to Arduino Programming: Part I, Part II, Integration of Sensors and Actuators with Arduino: Part I, Part II

Week 6: Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi

Week 7: Implementation of IoT with Raspberry Pi (contd), Introduction to SDN, SDN for IoT

Week 8: SDN for IoT (contd), Data Handling and Analytics, Cloud Computing

Week 9: Cloud Computing(contd), Sensor-Cloud

Week 10: Fog Computing, Smart Cities and Smart Homes

Week 11: Connected Vehicles, Smart Grid, Industrial IoT

Week 12: Industrial IoT (contd), Case Study: Agriculture, Healthcare, Activity Monitoring



INTRODUCTION TO PROGRAMMING IN C

PROF. SATYADEV NANDAKUMAR

Dept. of Computer Science and Engineering
IIT Kanpur

INTENDED AUDIENCE : Any interested learners.

PRE-REQUISITES : No prior programming required; mathematical maturity of a second level UG student in science or engineering.

COURSE OUTLINE :

This is a course in programming in C. No prior programming experience is assumed; however, mathematical maturity at the level of a second year science or engineering undergraduate is assumed. We emphasize solving problems using the language, and introduce standard programming techniques like alternation, iteration and recursion. We will briefly glimpse the basics of software engineering practices like modularization, commenting, and naming conventions which help in collaborating and programming in teams.

ABOUT INSTRUCTOR :

Prof. Satyadev Nandakumar is an Assistant Professor from the Department of Computer Science and Engineering IIT Kanpur who specialises in Computable Analysis, Algorithmic Information Theory, Symbolic Dynamics. His research interests includes Theoretical Computer Science, Algorithmic Information Theory, Computable Analysis.

COURSE PLAN :

Week 01 : Introduction. Straight-Line Code. Variables, Operators, Expressions and Conditionals.

Week 02 : Loops.

Week 03 : Functions.

Week 04 : One-Dimensional Arrays and Pointers.

Week 05 : Recursion.

Week 06 : Multi-dimensional Arrays, Linked Lists.

Week 07 : Operating on Files.

Week 08 : Organizing C projects, working with multiple source directories, makefiles.



INTRODUCTION TO PSYCHOLOGY

PROF. BRAJ BHUSHAN

Department of Humanities and Social Sciences

IIT Kanpur

INTENDED AUDIENCE : Elective UG, BE, BSc

INDUSTRIES APPLICABLE TO : HR section the companies

COURSE OUTLINE :

This course is designed for better understanding of the self and others. It will help you understand the how and why of thinking, feeling, and action. This introductory psychology course will cover the major psychological constructs and principles, primarily focusing on the perceptual processes, learning, memory, emotions, genetic and environmental determinants of behavior and personality. In the last week it will also demonstrate some lab sessions whereby the relevant construct and phenomena can be empirically tested.

ABOUT INSTRUCTOR :

Prof. Braj Bhushan is a professor of psychology at IIT Kanpur.

COURSE PLAN :

Week 1: Why Psychology? Major milestones in psychology, Major areas of psychology, Major methods used in psychology, Redefining boundaries of the discipline

Week 2: Perception

Week 3: Learning

Week 4: Memory

Week 5: Emotion

Week 6: Genetic and Environmental bases of behaviour

Week 7: Personality

Week 8: Lab session: Perception



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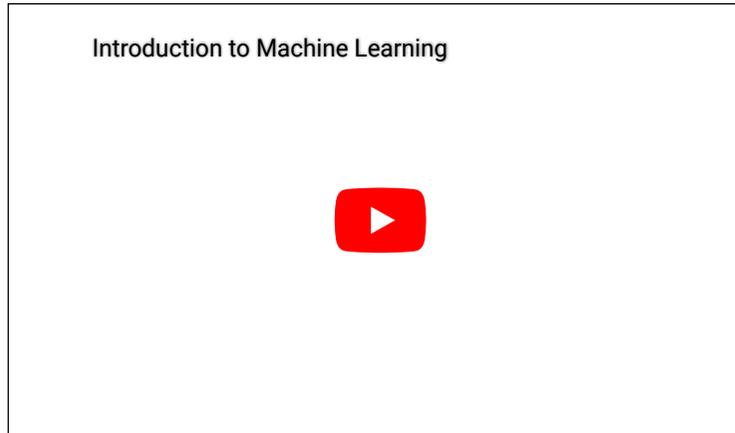
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Introduction to Machine Learning

By Prof. Balaraman Ravindran | IIT Madras

Learners enrolled: 33946



ABOUT THE COURSE :

With the increased availability of data from varied sources there has been increasing attention paid to the various data driven disciplines such as analytics and machine learning. In this course we intend to introduce some of the basic concepts of machine learning from a mathematically well motivated perspective. We will cover the different learning paradigms and some of the more popular algorithms and architectures used in each of these paradigms.

Summary

Course Status : Completed

Course Type : Elective

Duration : 12 weeks

Category :

- Computer Science and Engineering
- Artificial Intelligence
- Data Science
- Programming
- Robotics

Credit Points : 3

Level : Undergraduate/Postgraduate

Start Date : 23 Jan 2023

End Date : 14 Apr 2023



About Swayam (<https://swayam.gov.in/about>)

PREREQUISITE: This is an elective course. Intended for senior UG/PG students.
(<https://swayam.gov.in/>)

PREREQUISITES: We will assume that the students know programming for some of the assignments. If the students have done introductory courses on probability theory and linear algebra it would be helpful. We will review some of the basic topics in the first two weeks as well.

INDUSTRY SUPPORT: Any company in the data analytics/data science/big data domain would value this course.

Enrollment | All Courses | 06 Feb 2023 ()
Ends :

Exam

Registration 17 Mar 2023

Ends :

Exam Date : 30 Apr 2023 IST

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

This is an AICTE approved FDP course

(/ #facebook) (/ #x)

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(https://www.addtoany.com/share?url=https%3A%2F%2Fonlinecourses.nptel.ac.in%2Fnoc23_cs18%2Fpreview&title=%20Course)

Course layout

Week 0: Probability Theory, Linear Algebra, Convex Optimization - (Recap)

Week 1: Introduction: Statistical Decision Theory - Regression, Classification, Bias Variance

Week 2: Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares

Week 3: Linear Classification, Logistic Regression, Linear Discriminant Analysis

Week 4: Perceptron, Support Vector Machines

Week 5: Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation

Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Pruning, Multiway Splits, Missing Values, About Swayam (<https://swayam.gov.in/about>) | All Courses |

(<https://swayam.gov.in/>)

Week 7: Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting

Week 8: Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks

Week 9: Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation

Week 10: Partitional Clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density-based Clustering

Week 11: Gaussian Mixture Models, Expectation Maximization

Week 12: Learning Theory, Introduction to Reinforcement Learning, Optional videos (RL framework, TD learning, Solution Methods, Applications)

Books and references

1. The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman (freely available online)
2. Pattern Recognition and Machine Learning, by Christopher Bishop (optional)

Instructor bio



Prof. Balaraman Ravindran

IIT Madras

Prof. Balaraman Ravindran is currently an Professor in Computer Science at IIT Madras and Mindtree Faculty Fellow . He has nearly two decades of research experience in machine learning and specifically reinforcement learning. Currently his research interests are centered on learning from and through interactions and span the areas of data mining, social network analysis, and reinforcement learning.

Course certificate

The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.

The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).

Date and Time of Exams: **30 April 2023** Morning session 9am to 12 noon; Afternoon



m.

Announcements will be made when the registration form is published. [About Swayam \(https://swayam.gov.in/about\)](https://swayam.gov.in/about) | [All Courses](#) | [0](#)

[\(https://swayam.gov.in/\)](https://swayam.gov.in/)

The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.

<https://swayam.gov.in/noc-details/NPTEL>
Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE

Average assignment score = 25% of average of best 8 assignments out of the total 12 assignments given in the course.

Exam score = 75% of the proctored certification exam score out of 100

Final score = Average assignment score + Exam score

YOU WILL BE ELIGIBLE FOR A CERTIFICATE ONLY IF AVERAGE ASSIGNMENT SCORE $\geq 10/25$ AND EXAM SCORE $\geq 30/75$. If one of the 2 criteria is not met, you will not get the certificate even if the Final score $\geq 40/100$.

Certificate will have your name, photograph and the score in the final exam with the breakup. It will have the logos of NPTEL and IIT Madras. It will be e-verifiable at npTEL.ac.in/noc (<http://npTEL.ac.in/noc>).

Only the e-certificate will be made available. Hard copies will not be dispatched.

Once again, thanks for your interest in our online courses and certification. Happy learning.

- NPTEL team



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Initiative by : Ministry of Education (Govt of India)



MUNICIPAL SOLID WASTE MANAGEMENT

PROF. AJAY KALAMDHAD

Department of Civil Engineering
IIT Guwahati

INTENDED AUDIENCE : PG Level course for Environmental Engineering and UG level for Civil Engineering

INDUSTRY SUPPORT : Synergy waste management Pvt Ltd, UPL Environmental Engineers Pvt Ltd, Green power systems, A2Z group, Timarpu-Okhla waste management pvt ltd, Ramky Enviro Engineers Limited

COURSE OUTLINE :

The problems affiliated with solid waste management (SWM) in today's sprawling civilized and urbanized society are intricate because of the quantity and varied nature of wastes, the funding restriction for public disposal, interference of technology (energy and raw materials), and complex infrastructure development network in urban cities. As a result, if SWM is to achieve in consummate approach, the fundamentals aspects need to be identified. Thus, there is dire need to group the activities from the generation to the disposal point. The six different functional elements (generation, handing and separations, storage and processing at source, collection, the transformation of wastes, transfer and transport, and final disposal) for the engineering comparison and treatment need to be understood in detail. The understanding of the functional element is important because it helps in evaluating the impacts of projected changes and technological developments. Solid waste management is an essential part of every society, but it is also one of the most neglected one. An in-depth understanding of the subject is required to tackle the current solid waste management crisis effectively. This course attempts to familiarize various steps involved in solid waste management.

ABOUT INSTRUCTOR :

Prof. Ajay Kalamdhad is a Professor in the Department of Civil Engineering, Indian Institute of Technology Guwahati. He received his PhD from Indian Institute of Technology Roorkee in the year of 2008 and started working as a Lecturer in Visvesvaraya National Institute of Technology from September 2008. He joined Indian Institute of Technology Guwahati in June 2009 as an Assistant Professor. His research interests include Solid waste management, Mechanical composting and vermicomposting, Anaerobic digestion, Analysis of solid wastes, Microbiology of composting, Biosorption and Water & Wastewater Treatment. He has published numerous papers in various reputed journals. He is also the head of Waste Management Research Group (WMRG), a group that focuses on the biological treatment of various wastes.

COURSE PLAN :

- Week 1:** Evolution of Solid Waste Management
- Week 2:** Sources/Types and Characteristics of Solid Waste
- Week 3:** Generation of Solid Waste
- Week 4:** Waste Handling, Separation, storage, and Processing
- Week 5:** Collection of Solid Waste
- Week 6:** Transfer and Transport
- Week 7:** Separation and processing of Solid Waste
- Week 8:** Chemical Transformation (combustion/incineration)
- Week 9:** Biological Treatment (Composting)
- Week 10:** Biological Treatment (Anaerobic Digestion)
- Week 11:** Disposal of Solid Waste
- Week 12:** ISWM and legislation



NATURAL HAZARDS

PROF. JAVED N. MALIK

Department of Civil Engineering
IIT Kanpur

PRE-REQUISITES : Basic knowledge of Earth Science or Natural Disasters is recommended.

INTENDED AUDIENCE : PG students of Science and Engineering, Advance UG students too can take this course.

COURSE OUTLINE :

The course introduces students to natural disasters and their phenomenon, ground deformations, land-level changes, event recurrence intervals, associated environmental and depositional changes, sedimentation patterns, and all the related hazards. Some of the well-known natural disasters are earthquakes, landslides, floods, tsunamis, volcanic eruptions, storms, and cyclones etc. which cause different types of natural hazards in the associated environment and landscape. This course will emphasize their mechanism, origin, and impacts in the associated regions such as mainland, hilly terrain, floodplain/alluvial plain, and coastal regions etc., and also focus on the approaches for mitigating and minimizing hazards along with related hazard assessment.

ABOUT INSTRUCTOR :

Prof. Javed N. Malik finished his Ph. D in 1998 from M. S. University Baroda, Vadodara. Gujarat (Geology), did Post-Doctorate (Japan Society for Promotion of Science) from (1999-2001) Hiroshima University, JAPAN. Joined IIT Kanpur in 2001.

COURSE PLAN :

- Week 1:** Natural Hazards and Disasters ,Natural Hazards and Disasters ,Human Impact on Natural Disaster
- Week 2:** Mitigating Hazards,Plate Tectonics and related Hazards,Plate Tectonics and related Hazards
- Week 3:** Earthquakes and their causes,Earthquakes and their causes,Ground Motion and Failures
- Week 4:** Tsunami: Gaint Tsunamis,Tsunami: Gaint Tsunamis ,Tsunami: Generation and Movement
- Week 5:** Tsunami Hazard Assessment,Tsunami Hazard Assessment,Volcanic Hazard
- Week 6:** Landslide and their causes, Type of downslope movement, associated hazard,Landslide and their causes
- Week 7:** Floods and Human Interaction,Flood Frequency and Recurrence Interval,Flood Frequency and Recurrence Interval
- Week 8:** Storms: Tropical Cyclone,Storms: Tropical Cyclone,Hurricane, Tornado, Storm damage and safety,Wildfires



POWER QUALITY IMPROVEMENT TECHNIQUE

PROF. AVIK BHATTACHARYA

Department of Electrical and Electronics Engineering
IIT Roorkee

PRE-REQUISITES : Power Electronics

INTENDED AUDIENCE : Final year B.Tech, M.Tech students of Power Electronics and power system, Power electronics Engineer / Experts from industry

INDUSTRIES APPLICABLE TO : ABB, GE, Statcon Energeia, CESC, NTPC, NHPC all state electric supply board, AAI

COURSE OUTLINE :

The power quality of modern power distribution system is vulgarized due to the increased use of distributed sources, adjustable speed drive, nonlinear load and unbalanced load. The main challenge in the distribution system is the mitigation of power quality problems produced by load disturbances and supply disturbances. It can be mitigated by passive filters as well as active filters. The passive filters are economically cheap but their performance is poor compared to the active power filters. Hence active power filters are preferred in the modern power system.

ABOUT INSTRUCTOR :

Prof. Avik Bhattacharya is working as Assistant Professor in IIT Roorkee from February 2014. Before joining IIT Roorkee he was research and development team of Danfoss Solar inverter and ABB. He has over a decade of experience in power quality issues and published four IEEE transaction on it. He is also teaching this course in IIT Roorkee for past two years for UG and PG (B.Tech fourth year and M.Tech) . His teaching is right blending of Industry, research and academic interest

COURSE PLAN :

Week 1 : Concept of Power Quality: Frequency variations, voltage variations- sag and swell, waveform distortion –dc offset,harmonics, inter-harmonics, notching and noise.

Week 2 : Representation of harmonics, waveform, harmonic power,measures of harmonic distortion; Current and voltage limits of harmonic distortions: IEEE, IEC, EN, NORSO

Week 3 : Causes of Harmonics: 2-pulse, 6-pulse and 12-pulse converter configurations, input current waveforms and their harmonic spectrum; Input supply harmonics of AC regulator, integral cycle control, cycloconverter, transformer, rotating machines, ARC furnace, TV and battery charger.

Week 4 : Elimination/ Suppression of Harmonics: High power factor converter, multi-pulse converters using transformer connections
(delta, polygon)

Passive Filters: Types of passive filters, single tuned and high pass filters, filter design criteria, double tuned filters, damped filters
and their design

Week 5 : PWM Inverter: Voltage sourced active filter, current sourced active filter, constant frequency control, constant tolerance band control,variable tolerance band control.

Week 6 : Active Power Filters: Compensation principle, classification of active filters by objective, system configuration, power circuit andcontrol strategy

Week 7 : Hybrid Shunt Active power filter: Principle of operation, analysis and modelling

Week 8 : Unified power quality conditioner, voltage source and current source configurations, principle of operation for sag, swell and flicker control



PRIVACY AND SECURITY IN ONLINE SOCIAL MEDIA

PROF. PONNURANGAM KUMARAGURU

Department of Computer Science and Engineering
IIIT Hyderabad

PRE-REQUISITES : Basic / Intermediate programming course. Understanding of Python will be necessary for the course. Should be able to quickly learn APIs, and to collect data from social networks.

INTENDED AUDIENCE : Interested students

INDUSTRIES APPLICABLE TO : Any company which is interested in social media / networks data will be interested in recruiting the students finishing the course.

COURSE OUTLINE :

With increase in the usage of the Internet, there has been an exponential increase in the use of online social media and networks on the Internet. Websites like Facebook, YouTube, LinkedIn, Twitter, Flickr, Instagram, Google+, FourSquare, Pinterest, Tinder, and the likes have changed the way the Internet is being used. However, widely used, there is a lack of understanding of privacy and security issues on online social media. Privacy and security of online social media need to be investigated, studied and characterized from various perspectives (computational, cultural, psychological, etc.). Student completing the course will be able to appreciate various privacy and security concerns (spam, phishing, fraud nodes, identity theft) on Online Social Media and Student will be able to clearly articulate one or two concerns comprehensively on one Online Social Media, this will be achieved by homework.

ABOUT INSTRUCTOR :

Prof.Ponnurangam Kumaraguru ("PK") is a Professor of Computer Science at IIIT-Hyderabad. He is a Visiting Faculty at IIT Kanpur and an Adjunct faculty at IIIT Delhi. PK is an ACM India Council Member, and Chair of the Publicity & Membership Committee of ACM India. PK is a TEDx and an ACM Distinguished & ACM India Eminent Speaker. PK received his Ph.D. from the School of Computer Science at Carnegie Mellon University (CMU). His Ph.D. thesis work on anti-phishing research at CMU contributed in creating an award-winning startup - Wombat Security Technologies, wombatsecurity.com. Wombat was acquired in March 2018 for USD 225 Million. PK was listed in the World's 2% Scientists by Stanford University in Nov 2020. He is a senate member of IIIT Una, and is on various Board of Studies / Academic Council of different institutes across the country. PK has been teaching on NPTEL for the last 5 years, with great feedback from students. He has co-authored research papers in the field of Privacy and Security in Online Social Media, Cyber Security, Computational Social Science, Social Computing, Data Science for Social Good, amongst others. PK's research work regularly gets featured on news media, including print, online, and TV within India and across the world; to list a few, BBC, CBC, CBS, CNN, Doordarshan, Economic Times, Indian Express, NBC, New Scientist, NewYorker, Reuters, Times of India, USA Today, Washington Post, and many more. PK Spear heads ACM India's programs on improving the quality of PhD students in Computing in India -- PhDclinic & Anveshan Setu Fellowship. In his Dean's role at IITD, he managed a team of 15 faculty members and 10+ admin staff, including Associate Dean of Student Affairs, overseeing hostel, sports centre, health centre, student {well-being, clubs, mentorship program}, technical & cultural fests. He was the Founding Head of Cybersecurity Education and Research Centre (CERC) at IIIT-Delhi. PK started and successfully manages PreCog (precog.iiitd.edu.in), a research group at IIIT-Delhi and IIIT Hyderabad. In addition to his contributions to academia, PK is on advisory role on various government organizations, government committees, including a 8 member committee on Non-Personal Data by Government of India, chaired by Mr. Kris Gopalakrishnan.

COURSE PLAN :

Week 1: What is Online Social Networks, data collection from social networks, challenges, opportunities, and pitfalls in online social networks, APIs

Week 2: Collecting data from Online Social Media.

Week 3: Trust, credibility, and reputations in social systems

Week 4: Trust, credibility, and reputations in social systems, cont'd

Week 5: Online social Media and Policing

Week 6: Information privacy disclosure, revelation and its effects in OSM and online social networks

Week 7: Phishing in OSM & Identifying fraudulent entities in online social networks

Week 8: Refresher for all topics

Week 9 to 12 : Research paper discussion



PROBLEM SOLVING THROUGH PROGRAMMING IN C

PROF. ANUPAM BASU

Department of Computer Science and Engineering
IIT Kharagpur

INTENDED AUDIENCE : BE/BTech in all disciplines BCA/MCA/M. Sc

INDUSTRIES APPLICABLE TO : All IT Industries

COURSE OUTLINE : This course is aimed at enabling the students to

- Formulate simple algorithms for arithmetic and logical problems
- Translate the algorithms to programs (in C language)
- Test and execute the programs and correct syntax and logical errors
- Implement conditional branching, iteration and recursion
- Decompose a problem into functions and synthesize a complete program using divide and conquer approach
- Use arrays, pointers and structures to formulate algorithms and programs
- Apply programming to solve matrix addition and multiplication problems and searching and sorting problems
- Apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration

ABOUT INSTRUCTOR :

Prof. Anupam Basu is Professor in the Dept. of Computer Science Engineering, IIT Kharagpur, and has been an active researcher in the areas of Cognitive and Intelligent Systems, Embedded Systems and Language Processing, Presently he is acting as the Chairman and Head of the Center for Educational Technology, IIT Kharagpur. He has developed several embedded system based tools empowering the physically challenged and has led several national projects in the area. He has taught at the University of California, Irvine at the Center for Embedded Systems. He is an Alexander von Humboldt Fellow and a Fellow of the Indian National Academy of Engineering. The awards won by him include the State Award for the Best Contribution to the Cause of Empowerment of the Disabled (2014), Universal Design Award 2011, for contributions in design for the disabled, by National Council for Promotion of Employment of Disabled Persons, India, the National Award for the Best Technology Innovation for the Physically Disabled (2007) and the Da-Vinci Award 2004 from the Engineering Society of Detroit.

COURSE PLAN :

- Week 1:** Introduction to Problem Solving through programs, Flowcharts/Pseudo codes, the compilation process, Syntax and Semantic errors, Variables and Data Types
- Week 2:** Arithmetic expressions, Relational Operations, Logical expressions; Introduction to Conditional Branching
- Week 3:** Conditional Branching and Iterative Loops
- Week 4:** Arranging things : Arrays
- Week 5:** 2-D arrays, Character Arrays and Strings
- Week 6:** Basic Algorithms including Numerical Algorithms
- Week 7:** Functions and Parameter Passing by Value
- Week 8:** Passing Arrays to Functions, Call by Reference
- Week 9:** Recursion
- Week 10:** Structures and Pointers
- Week 11:** Self-Referential Structures and Introduction to Lists
- Week 12:** Advanced Topics



PROGRAMMING IN JAVA

PROF. DEBASIS SAMANTA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : This course requires that the students are familiar with programming language such as C/C++ and data structures, algorithms.

INTENDED AUDIENCE : The undergraduate students from the engineering disciplines namely CSE, IT, EE, ECE, etc. might be interested for this course.

INDUSTRIES APPLICABLE TO : All IT companies.

COURSE OUTLINE :

With the growth of Information and Communication Technology, there is a need to develop large and complex software. Further, those software should be platform independent, Internet enabled, easy to modify, secure, and robust. To meet this requirement object-oriented paradigm has been developed and based on this paradigm the Java programming language emerges as the best programming environment. Now, Java programming language is being used for mobile programming, Internet programming, and many other applications compatible to distributed systems. This course aims to cover the essential topics of Java programming so that the participants can improve their skills to cope with the current demand of IT industries and solve many problems in their own field of studies.

ABOUT INSTRUCTOR :

Prof. Debasis Samanta holds a Ph.D. in Computer Science and Engineering from Indian Institute of Technology Kharagpur. His research interests and work experience spans the areas of Computational Intelligence, Data Analytics, Human Computer Interaction, Brain Computing and Biometric Systems. Prof. Samanta currently works as a faculty member at the Department of Computer Science Engineering at IIT Kharagpur.

COURSE PLAN :

Week 1: Overview of Object-Oriented Programming and Java

Week 2: Java Programming Elements

Week 3: Input-Output Handling in Java

Week 4: Encapsulation

Week 5: Inheritance

Week 6: Exception Handling

Week 7: Multithreaded Programming

Week 8: Java Applets and Servlets

Week 9: Java Swing and Abstract Windowing Toolkit (AWT)

Week 10: Networking with Java

Week 11: Java Object Database Connectivity (ODBC)

Week 12: Interface and Packages for Software Development



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Programming, Data Structures And Algorithms Using Python

By Prof. Madhavan Mukund | Chennai Mathematical Institute

Learners enrolled: 41331



This course is an introduction to programming and problem solving in Python. It does not assume any prior knowledge of programming. Using some motivating examples, the course quickly builds up basic concepts such as conditionals, loops, functions, lists, strings and tuples. It goes on to cover searching and sorting algorithms, dynamic programming and backtracking, as well as topics such as exception handling and using files. As far as data structures are concerned, the course covers Python dictionaries as well as classes and objects for defining user defined datatypes such as linked lists and binary search trees.

Summary

Course Status :	Completed
Course Type :	Elective
Duration :	8 weeks
Category :	<ul style="list-style-type: none">◦ Computer Science and Engineering◦ Programming◦ Data Science◦ Artificial Intelligence◦ Foundations of Computing
Credit Points :	2
Level :	Undergraduate
Start Date :	24 Jan 2022
End Date :	18 Mar 2022



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Enrollment Ends | All Courses | 07 Feb 2022 (0)

(<https://swayam.gov.in/>)

INTENDED AUDIENCE: Students in any branch of mathematics/science/engineering, 1st

Exam Date : 27 Mar 2022 IST



PREREQUISITES: School level mathematics.

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

INDUSTRY SUPPORT: This course should be of value to any company requiring programming skills.

This is an AICTE approved FDP course

ABOUT CMI: [Click here \(https://www.youtube.com/watch?v=J_cz9JvbTg4\)](https://www.youtube.com/watch?v=J_cz9JvbTg4)

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(https://www.addtoany.com/share?url=https%3A%2F%2Fonlinecourses.nptel.ac.in%2Fnoc22_cs26%2Fpreview&title=P%20Course)

Course layout

Week 1

Informal introduction to programmin, algorithms and data structures viagcd
 Downloading and installing Python
 gcd in Python: variables, operations, control flow - assignments, condition-als, loops, functions

Week 2

Python: types, expressions, strings, lists, tuples
 Python memory model: names, mutable and immutable values
 List operations: slices etc
 Binary search
 Inductive function denitions: numerical and structural induction
 Elementary inductive sorting: selection and insertion sort
 In-place sorting



analysis: input size, asymptotic complexity, About Swayam (<https://swayam.gov.in/about>) | All Courses |

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(<https://swayam.gov.in/>)

Merge sort



Quick sort

Stable sorting

(https://swayam.gov.in/nc_details/NPTEL)

Week 4

Dictionaries

More on Python functions: optional arguments, default values

Passing functions as arguments

Higher order functions on lists: map, lter, list comprehension

Week 5

Exception handling

Basic input/output

Handling files

String processing

Week 6

Backtracking: N Queens, recording all solutions

Scope in Python: local, global, nonlocal names

Nested functions

Data structures: stack, queue

Heaps

Week 7

Abstract datatypes

Classes and objects in Python

"Linked" lists: find, insert, delete

Binary search trees: find, insert, delete

Height-balanced binary search trees

Week 8

Efficient evaluation of recursive definitions: memoization

Dynamic programming: examples

Other programming languages: C and manual memory management

Other programming paradigms: functional programming

Books and references

NIL



(<https://swayam.gov.in/>)



**Prof. Madhavan
Mukund**

Chennai
Mathematical
Institute

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Prof. Madhavan Mukund studied at IIT Bombay (BTech) and Aarhus University (PhD). He has been a faculty member at Chennai Mathematical Institute since 1992, where he is presently Executive Director. His main research area is formal verification. He has active research collaborations within and outside India and serves on international conference programme committees and editorial boards of journals.

He has served as President of both the Indian Association for Research in Computing Science (IARCS) (2011-2017) and the ACM India Council (2016-2018). He has been the National Coordinator of the Indian Computing Olympiad since 2002. He served as the Executive Director of the International Olympiad in Informatics from 2011-2014.

In addition to the NPTEL MOOC programme, he has been involved in organizing IARCS Instructional Courses for college teachers. He is a member of ACM India's Education Committee. He has contributed lectures on algorithms to the Massively Empowered Classroom (MEC) project of Microsoft Research and the QEEE programme of MHRD.

Course certificate

The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.

The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).

Date and Time of Exams: **27 March 2022** Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.

Registration url: Announcements will be made when the registration form is open for registrations.

The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.

Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE


 You will have an unproctored programming exam also apart from the Proctored Exam. Please check the announcement section for date and time. [About Swayam \(https://swayam.gov.in/about\)](https://swayam.gov.in/about) | All Courses | [\(https://swayam.gov.in/\)](https://swayam.gov.in/)

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Final score = Assignment score + Unproctored programming exam score + Proctored Exam score
https://swayam.gov.in/noc_details/NPTEL

Assignment score = 25% of average of best 6 assignments out of the total 8 assignments given in the course.

- (All assignments in a particular week will be counted towards final scoring - quizzes and programming assignments).
- Unproctored programming exam score = 25% of the average scores obtained as part of Unproctored programming exam - out of 100
- Proctored Exam score =50% of the proctored certification exam score out of 100

YOU WILL BE ELIGIBLE FOR A CERTIFICATE ONLY IF ASSIGNMENT SCORE >=10/25 AND UNPROCTORED PROGRAMMING EXAM SCORE >=10/25 AND PROCTORED EXAM SCORE >= 20/50.

If any one of the 3 criteria is not met, you will not be eligible for the certificate even if the Final score >= 40/100.

Certificate will have your name, photograph and the score in the final exam with the breakup. It will have the logos of NPTEL and IIT Madras .It will be e-verifiable at npTEL.ac.in/noc (<http://npTEL.ac.in/noc>).

Only the e-certificate will be made available. Hard copies will not be dispatched.

Once again, thanks for your interest in our online courses and certification. Happy learning.

- NPTEL team



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Initiative by : Ministry of Education (Govt of India)



PROJECT PLANNING & CONTROL

PROF. KOSHY VARGHESE

Department of Civil Engineering
IIT Madras

INTENDED AUDIENCE : UG/PG/Industry Participants

PRE-REQUISITES : Basic Mathematics with Probability & Statistics

INDUSTRIES APPLICABLE TO : All leading construction companies.

COURSE OUTLINE :

This course will cover the basic concepts in Project Planning and Control with a focus on construction projects. The course is relevant to Civil Engineering senior level undergraduate as well as post-graduate students in the area of construction management. Practicing engineers who are part of the planning team on construction projects will also benefit from the concepts covered in the course.

ABOUT INSTRUCTOR :

Prof. Koshy Varghese is a Professor with the Building Technology & Construction Management Division of Department of Civil Engineering, Indian Institute of Technology Madras (IITM). Prof. Varghese earned his Doctoral Degree at the University of Texas at Austin in 1992 and worked as a Post-Doctoral Fellow for a year after which he joined IIT Madras. Prof. Varghese is a pioneer in construction management education and research in India and He has received numerous academic honors, and he is on the editorial-board of several international journals. He is also a Member of the Board of Directors of ILCE (Institute for Lean Construction Excellence).

COURSE PLAN :

Week 01 : Introduction, Course Context, Construction Project Management

Week 02 : Time Management, Work Breakdown Structure (WBS), Gantt Charts

Week 03 : Duration Estimation, Network Representation & Analysis -1

Week 04 : Network Representation & Analysis -2; Two-Span Bridge: Scheduling, Network Analysis and Application

Week 05 : Time-Cost Trade-off (Crashing)

Week 06 : Resource Scheduling

Week 07 : Precedence Diagramming Method (PDM), Project Monitoring & Control

Week 08 : Project Monitoring & Control (Earned Value Concepts), Uncertainty in Project Schedules (PERT), Course Summary

Week 1:

BASICS OF PYTHON SPYDER (TOOL)

- Introduction Spyder
- Setting working Directory
- Creating and saving a script file
- File execution, clearing console, removing variables from environment, clearing environment
- Commenting script files
- Variable creation
- Arithmetic and logical operators
- Data types and associated operations

Week 2:

Sequence data types and associated operations

- Strings
- Lists
- Arrays
- Tuples
- Dictionary
- Sets
- Range

NumPy

- ndarray

Week 3:

Pandas dataframe and dataframe related operations on Toyota Corolla dataset

1. Reading files
2. Exploratory data analysis
3. Data preparation and preprocessing

Data visualization on Toyoto Corolla dataset using matplotlib and seaborn libraries

1. Scatter plot
2. Line plot
3. Bar plot
4. Histogram
5. Box plot
6. Pair plot

Control structures using Toyota Corolla dataset

1. if-else family
2. for loop
3. for loop with if break
4. while loop

Week 4: CASE STUDY

Regression

1. Predicting price of pre-owned cars

Classification

1. Classifying personal income



QUALITATIVE RESEARCH METHODS AND RESEARCH WRITING

PROF. ARADHNA MALIK
Department of Management Studies
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | PG
COURSE DURATION : 12 weeks (18 Jan' 21 - 09 Apr' 21)
EXAM DATE : 24 Apr 2021

PRE-REQUISITES : Bachelors Degree

INTENDED AUDIENCE : Interested Students

INDUSTRIES APPLICABLE TO : Education.

COURSE OUTLINE :

Qualitative research methods serve to explore the grey areas that remain outside the confines of quantitative predictive research in human behavior. Training in qualitative research is absolutely essential to understand and explore the dynamic nature of the society in which we function. This course introduces students to qualitative research and helps them understand how qualitative research supplements quantitative inquiry in human behavior and the social sciences.

ABOUT INSTRUCTOR :

Prof. Aradhna Malik earned her Masters in Child Development from Panjab University, Chandigarh, India and PhD from University of Denver, USA. She has been serving Indian Institute of Technology Kharagpur as faculty in the School of Management since 2008. Aradhna teaches intercultural communication, business ethics and organizational behavior to Undergraduate, Masters and Doctoral level students. Her research and academic interests include, ageing, orality, human technology interaction, intercultural communication, communication disorders, management of public health and neuro linguistic programming (NLP).

COURSE PLAN :

Week 1: Introduction to qualitative research, Introduction, The Qualitative Researcher

Week 2: Major paradigms & perspectives, Dominant paradigms of qualitative research, Interpretivist thinking, Verstehen

Week 3: Major paradigms & perspectives (Contd.), Critical theory, Characteristics of critical theory

Week 4: Strategies of inquiry, Introduction to qualitative inquiry, Qualitative research design

Week 5: Strategies of inquiry (Contd.), Grounded Theory, Participatory Action Research

Week 6: Methods of collecting & analyzing empirical materials, Observations, Interviewing

Week 7: Methods of collecting & analyzing empirical materials (Contd.), Analyzing talk & text

Week 8: Interpretation, evaluation & presentation, The problem of criteria, Interpretation

Week 9: What, why and how of technical and research writing.

Week 10: Literature review.

Week 11: Writing about methods, results, and discussion of results.

Week 12: Referencing, academic integrity, and writing for different types of readers



RENEWABLE ENERGY ENGINEERING: SOLAR, WIND AND BIOMASS ENERGY SYSTEMS

Prof. R. Anandalakshmi

Department of Chemical Engineering
IIT Guwahati

Prof. Vaibhav Vasant Goud

Department of Chemical Engineering
IIT Guwahati

INTENDED AUDIENCE : The target audience for this course is

1. B.Tech/M.Tech/PhD students or faculties interested in acquiring knowledge of solar, wind and biomass renewable energy systems
2. Chemical engineer/Mechanical engineer or Biosciences and Bioengineer designing renewable energy systems such as solar, wind and biomass systems
3. Executives, engineers and researchers from manufacturing, service and government organizations including R&D laboratories working in the area of energy engineering.

INDUSTRIES APPLICABLE TO : All Energy Industries and Energy Equipment Manufacturing Industries

COURSE OUTLINE :

In this course an attempt has been made to standardize the course material and to emphasize on the fundamental of non-conventional energy sources (solar, wind, and biomass). Harnessing the energy through these sources using efficient technologies is expected to play an important role in serving as clean energy source for mankind. Thus, processes to harness energy are steadily gaining technical and economic importance worldwide. Therefore, it is necessary for energy planners/ users to know the facts as well as limitations of these technologies. This course aims at bringing the technological developments and research trends in the field of non-conventional energy sources with emphasis on engineering and design aspects. After attending this course students will have insight of biomass types, classifications, selective utilization of biomass resource for extraction of energy, bio-digester, wind machine and thermo-digester design.

ABOUT INSTRUCTOR :

Prof. R. Anandalakshmi is an Associate Professor in the Department of Chemical Engineering, Indian Institute of Technology, Guwahati. Her research interests are in the area of Computational Heat Transfer and Fluid Flow, Process Modeling and Simulation, Solar Thermal Energy Conversion, Energy Efficient Design of Thermal Systems, Microwave Assisted Food and Material Processing, Food Packaging and Preservation, Refrigeration and Air-conditioning Systems

Prof. Vaibhav V. Goud is Professor in the Department of Chemical Engineering, Indian Institute of Technology Guwahati, India since 2018. Principal research interests of Dr. Goud are in the fields of reaction engineering, renewable energy, supercritical fluids, bio lubricants. He has published more than 120 papers in international peer reviewed journals and made presentations of his research in several national/ international conferences. He has also written 14 book chapters in the area of renewable energy. He has taught energy resources as an elective course to UG, PG and Ph.D. students at IIT Guwahati for six consecutive years (2014, 2015, 2016, 2017, 2018 and 2019).

COURSE PLAN :

Week 1: Solar Energy: Basics and Concepts

Week 2: Non-Concentrating Solar Collectors

Week 3: Non-Concentrating Solar Collectors : Practice Problems

Week 4: Concentrating Solar Collectors

Week 5: Storage Systems

Week 6: Biomass types and characterization

Week 7: Biochemical conversion processes

Week 8: Biochemical conversion processes (Contd.)

Week 9: Bioconversion of substrates into alcohol and thermo-chemical conversion of biomass

Week 10: Bioconversion of substrates into alcohol and thermo-chemical conversion of biomass (Contd.)

Week 11: Wind Energy: Basics: Turbine terms, types and theories

Week 12: Characteristics and Power Generation from Wind Energy



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Software Testing

By Prof. Meenakshi D'souza | IIIT Bangalore

Learners enrolled: 15572

Software Testing _ Course Introduction



ABOUT THE COURSE :

This course will cover various techniques for test case design, as used for testing of software artifacts including requirements, design and code. We will discuss algorithms and techniques for test case design based on graphs, logic, syntax of programming

Summary

Course Status : Completed
Course Type : Elective
Duration : 12 weeks
Category :

- Computer Science and Engineering

Credit Points : 3
Level : Undergraduate/Postgraduate
Start Date : 25 Jul 2022
End Date : 14 Oct 2022
Enrollment Ends : 08 Aug 2022
Exam Date : 30 Oct 2022 IST





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INTENDED AUDIENCE: Any Interested Learners

PRE-REQUISITES: Programming, Algorithms, Discrete Mathematics (basics)

INDUSTRY SUPPORT: The material

of this course has been used to offer training for Samsung, ABB and Mindtree. The course will be useful for any firm that does tests their software.

inputs. Special techniques for testing object-oriented features and web

so be discussed. The course will end with a About Swayam (<https://swayam.gov.in/about>)

cover test cases for both white-box and black-box.

Note: This exam date is subjected to change based

on the availability. You can check final exam date ()

on your hall ticket.

This is an AICTE approved FDP course

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Course layout

Week 1: Techniques and algorithms for test case design: Graphs based testing-structural coverage criteria.

Week 2: Graphs based testing: Data flow coverage criteria

Week 3: Graphs based testing: Data flow coverage criteria

Week 4: Graphs coverage for source code, design elements and requirements

Week 5: Techniques and algorithms for test case design: Logic based testing-Predicates, logic based coverage criteria

Week 6: Specification based logic coverage, logic coverage on finite state machines

Week 7: Input space partitioning: Input domain modeling, combination strategies criteria

Week 8: Syntax based testing: Coverage criteria based on syntax, mutation testing

Week 9: Test case design (as learnt above) applied to object-oriented applications

Week 10: Test case design (as learnt above) applied to web applications

Week 11: Symbolic testing

Week 12: Concolic testing, Conclusion





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Instructor bio

(https://swayam.gov.in/nc_details/NPTEL)



**Prof. Meenakshi
D'souza**

IIIT Bangalore

Prof. Meenakshi D'souza is currently an Associate Professor at IIIT-Bangalore. Meenakshi did her Master TMs in Mathematics from University of Madras, Chennai and her Ph. D. in Theoretical Computer Science from The Institute of Mathematical Sciences, Chennai. She joined the research department of Honeywell Technology Solutions, Bangalore soon after completing her Ph. D. and worked there in the areas of Formal Verification of Software Design, Model Based Development and Physical Access Control before joining IIIT-Bangalore. Her research interests are in Formal Methods, Model Based Development, Software Testing and Automata Theory.

Course certificate

The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.

The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).

Date and Time of Exams: **30 October 2022** Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.

Registration url: Announcements will be made when the registration form is open for registrations.

The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.

Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE

Average assignment score = 25% of average of best 8 assignments out of the total 12





in the course.

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Final score = Average assignment score + Exam score



YOU WILL BE ELIGIBLE FOR A CERTIFICATE ONLY IF AVERAGE ASSIGNMENT SCORE $\geq 10/25$ AND EXAM SCORE $\geq 30/75$. If one of the 2 criteria is not met, you will not get the certificate even if the Final score $\geq 40/100$.

Certificate will have your name, photograph and the score in the final exam with the breakup. It will have the logos of NPTEL and IIT Madras. It will be e-verifiable at nptel.ac.in/noc (<http://nptel.ac.in/noc>).

Only the e-certificate will be made available. Hard copies will not be dispatched.

Once again, thanks for your interest in our online courses and certification. Happy learning.

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Initiative by : Ministry of Education (Govt of India)





Strength Of Materials - IITM

Prof. K. Ramesh

Department of Mechanical Engineering
IIT Madras

INTENDED AUDIENCE: Undergraduate students and practicing engineers/scientists from mechanical sciences Industries and Research laboratories

PREREQUISITES: Engineering Mechanics

INDUSTRY SUPPORT: All Mechanical, Aerospace and Structural Design Industries dealing with structural design would require this

COURSE OUTLINE:

The course will cover the basics of mechanics of deformable solids undergoing small deformations. The syllabus includes: Concepts of state of stress, strain and stress-strain and stress-strain-temperature relations. Exposure to experimental evaluation of stresses by photoelasticity and strain gauges. Stresses developed in torsion, bending, and shear-stresses in bending for slender members. Exposure to unsymmetrical bending and shear center. Bending deflection by various methods with particular emphasis to method of superposition. Stability of columns. Concepts of stress concentration, stress intensification and theories of failures. Extensive use of animations with supportive experimental results will be the unique feature of the course

ABOUT THE INSTRUCTOR:

Prof .K. Ramesh is currently the K Mahesh Chair Professor at the Department of Applied Mechanics, IIT Madras; and formerly a Professor at the Department of Mechanical Engineering, IIT Kanpur. He has made significant contributions to the advancement of Digital Photoelasticity. He received his undergraduate degree in Mechanical Engineering from the Regional Engineering College, Trichy (now NIT, Trichy), Postgraduate degree from the Indian Institute of Science, Bangalore and the Doctoral Degree from the Indian Institute of Technology Madras.

He has made significant contributions to the advancement of Digital Photoelasticity. This has resulted in a Monograph on Digital Photoelasticity Advanced Techniques and Applications (2000), Springer, a chapter on Photoelasticity in the Springer Handbook of Experimental Solid Mechanics (2009), a chapter on Digital Photoelasticity in the book on Digital Optical Measurement Techniques and Applications (2015), Artech House London and a recently published book on Developments in Photoelasticity - A renaissance (2021), IOP Publishing, UK. He has over 190 publications to date of which two have been reproduced in the Milestone Series of SPIE. His research has been funded by organizations such as ARDB, ISRO, DST, EU (FP7) and NSF. He received the Zandman award for the year 2012, the first Indian to receive it since its inception in 1989, instituted by the Society for Experimental Mechanics, USA for his outstanding research contributions in applications utilizing photoelastic coatings.

He has been a Fellow of the Indian National Academy of Engineering since 2006. He received several awards such as Distinguished Alumnus Award of NIT, Trichy (2008), President of India Cash Prize (1984). He has been a member of the Editorial Boards of the International Journals: Strain (since 2001), Journal of Strain Analysis for Engineering Design (2009–10), Optics and Lasers in Engineering, and a steering committee member of Asian Society for Experimental Mechanics since its inception in 2000.

For Details See: <https://home.iitm.ac.in/kramesh>

COURSE PLAN:

Week 1: Introduction to the course, Stress vector

Week 2: Stress tensor, Equilibrium conditions, Mohr's circle

Week 3: Proof of Mohr's circle, Principal stress and its directions, Octahedral and deviatoric stresses

Week 4: Free surface, Stress and Strain measurement (Photoelasticity and various strain measurement techniques)

Week 5: Strain Tensor, Tension test

Week 6: Stress strain relations, Interrelations between elastic constants, Thermal strain

Week 7: Torsion

Week 8: Bending - Euler Bernoulli hypothesis, Flexure formula, Engineering analysis

Week 9: Bending - Shear stresses, Composite beams, Shear in I beams and shear centre

Week 10: Unsymmetrical bending, Deflection

Week 11: Deflection, Theories of failure

Week 12: Theories of failure, Stability



THE JOY OF COMPUTING USING PYTHON

PROF. SUDARSHAN IYENGAR

Department of Computer Science and Engineering
IIT Ropar

INTENDED AUDIENCE : Any interested audience

PREREQUISITES : 10th standard/high school

INDUSTRY SUPPORT : Every software company is aware of the potential of a first course in computer science. Especially of a first course in computing, done right.

COURSE OUTLINE :

A fun filled whirlwind tour of 30 hrs, covering everything you need to know to fall in love with the most sought after skill of the 21st century. The course brings programming to your desk with anecdotes, analogies and illustrious examples. Turning abstractions to insights and engineering to art, the course focuses primarily to inspire the learner's mind to think logically and arrive at a solution programmatically. As part of the course, you will be learning how to practice and culture the art of programming with Python as a language. At the end of the course, we introduce some of the current advances in computing to motivate the enthusiastic learner to pursue further directions.

ABOUT INSTRUCTOR :

Prof. Sudarshan Iyengar, Associate Professor at the CSE at IIT Ropar has a Ph.D. from the Indian Institute of Science (IISc). An exemplary teacher who has delivered over 350 popular science talks to students of high school and advanced graduate programmes. Prof. Sudarshan has offered more than 100 hours of online lectures with novel teaching methodologies that have reached lakhs of Students. His research interests include Data Sciences, Social Computing, Social Networks, Collective Intelligence, Crowdsourced Technologies and Secure Computation.

COURSE PLAN :

- Motivation for Computing
- Welcome to Programming!!
- Variables and Expressions : Design your own calculator
- Loops and Conditionals : Hopscotch once again
- Lists, Tuples and Conditionals : Lets go on a trip
- Abstraction Everywhere : Apps in your phone
- Counting Candies : Crowd to the rescue
- Birthday Paradox : Find your twin
- Google Translate : Speak in any Language
- Currency Converter : Count your foreign trip expenses
- Monte Hall : 3 doors and a twist
- Sorting : Arrange the books
- Searching : Find in seconds
- Substitution Cipher : What's the secret !!
- Sentiment Analysis : Analyse your Facebook data
- 20 questions game : I can read your mind
- Permutations : Jumbled Words
- Spot the similarities : Dobble game
- Count the words : Hundreds, Thousands or Millions.
- Rock, Paper and Scissor : Cheating not allowed !!
- Lie detector : No lies, only TRUTH
- Calculation of the Area : Don't measure.
- Six degrees of separation : Meet your favourites
- Image Processing : Fun with images
- Tic tac toe : Let's play
- Snakes and Ladders : Down the memory lane.
- Recursion : Tower of Hanoi
- Page Rank : How Google Works !!



ADVANCED CONCEPTS IN FLUID MECHANICS

PROF. SUMAN CHAKRABORTY
PROF. ADITYA BANDOPADHYAY
IIT Kharagpur
Mechanical Engineering

TYPE OF COURSE : New | Core | UG
COURSE DURATION : 12 weeks (29 Jul'19 - 18 Oct'19)
EXAM DATE : 16 Nov 2019

INTENDED AUDIENCE : B. Tech/M. Tech/MS/B.Sc./M.Sc./PhD students of all disciplines and teachers of undergraduate Fluid Mechanics

INDUSTRIES APPLICABLE TO : Oil Companies (IOCL, SHELL, BPCL and others), Automobile and Aviation companies (GE, AIRBUS, TATA Motors and others)

COURSE OUTLINE :

This is a course which deals with advanced concepts in Fluid Mechanics. The course emphasizes the fundamental in underlying fluid mechanical principles and application of those principles to solve real life problems. There is a well-balanced coverage of physical concepts, mathematical operations along with examples and exercise problems of practical importance.

ABOUT INSTRUCTOR :

Prof. Suman Chakraborty is a Professor in the Mechanical Engineering Department of the Indian Institute of Technology (IIT) Kharagpur, India, and Indian National Academy of Engineering Chair Professor. He is also currently the Head, School of Medical Science and Technology at IIT Kharagpur. He has research interests in the area of Microfluidics and MicroNano scale transport processes, including their theoretical, computational, and experimental modeling, encompassing the underlying fundamentals as well as bio-medical.

Prof. Aditya Bandopadhyay is currently an Assistant Professor in the Mechanical Engineering Department at Indian Institute of Technology Kharagpur, India. His research interests include micro- and nanofluidics, transport through porous media, and electrohydrodynamics. He completed his Dual Degree from IIT Kharagpur (Insitute Silver Medal) in 2012 and received his Ph.D. from IIT Kharagpur in 2015.

COURSE PLAN :

Week 1: Essential Mathematical Foundations

Week 2: Kinematics of Fluid Flows

Week 3: Dynamics of Inviscid Flows

Week 4: Potential Flows

Week 5: Integral forms of Conservation Equations: Reynolds Transport Theorem

Week 6: Dynamics of Viscous Flows: Derivation of Navier-Stokes Equation

Week 7: Exact Solutions of Navier-Stokes Equations for Fully Developed Laminar Flows and some Unsteady Flows

Week 8: Laminar Boundary Layers

Week 9: Instability; Introduction to Turbulence

Week 10: Turbulence (contd.); Fluid flow about Immersed bodies

Week 11: Geophysical Fluid Dynamics

Week 12: Creeping Flows; Microscale Fluid Flows



NATURE AND PROPERTIES OF MATERIALS- AN INTRODUCTORY COURSE

PROF. ASHISH GARG

Department of Sustainable Energy Engineering
IIT Kanpur

PRE-REQUISITES : 12th standard science background

INTENDED AUDIENCE : UG and PG students of science and engineering of non-materials related background.

INDUSTRY SUPPORT : Materials related companies

COURSE OUTLINE :

The course is first part of the broader course on Introduction to Nature of materials and would be suitable for undergraduate and postgraduate students of every branch of science and engineering. The first part of this course will focus on essentials of crystallography, crystal structures of different classes of materials, structure determination and defects in materials.

ABOUT INSTRUCTOR :

Prof. Ashish Garg is Professor of Materials Science and Engineering at IIT Kanpur. Details of his research and teaching can be accessed on home.iitk.ac.in/~ashishg/

COURSE PLAN :

Week 1 : Introduction and Basic crystallography

Week 2 : Symmetry

Week 3 : Crystal Systems, Bravais Lattices and Miller Indices, Interstices

Week 4 : Structure of Metals and Alloys

Week 5 : Structure of Ceramics

Week 6 : Structure of Polymers

Week 7 : Structure Determination: X-ray diffraction

Week 8 : Defects in Materials



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C Programming And Assembly Language

By Prof. Janakiraman | IIT Madras

Learners enrolled: 31779 | Exam registration: 1816

Introduction



ABOUT THE COURSE :

Students who complete their bachelors degree (BE/ BTech) in computer science or electrical engineering do extensive course work in Microprocessors and then in C programming. However, what is missing in the current curriculum is to explicitly establish the link between the two. Specifically we look at how a C program is translated to assembly language and how it eventually gets executed on a microprocessor. Through animations we show what happens in the stack, data and code segment, of the microprocessor when a C program is executed.

Summary

Course Status :	Completed
Course Type :	Elective
Duration :	4 weeks
Category :	◦ Computer Science and Engineering
Credit Points :	1
Level :	Undergraduate
Start Date :	21 Aug 2023
End Date :	15 Sep 2023
Enrollment Ends :	21 Aug 2023
Exam Registration Ends :	15 Sep 2023
Exam Date :	28 Oct 2023 IST



PREREQUISITE: Any Interested Learners

PREREQUISITES: Students are expected to have done a course on C programming and Microprocessors

INDUSTRY SUPPORT: Almost all software companies and many hardware companies

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Note: This exam date is subjected to change based on your hall ticket.

This is an AICTE approved FDP course

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Course layout

WEEK 1: Introduction to Microprocessors and Assembly language Programming

- Microprocessor Architecture
- Machine Language Execution sequence in a MuP
- Memory in a microprocessor
- Instruction Set
- ADDRESSING SCHEMES
- MOV
- ARITHMETIC AND LOGICAL INSTRUCTIONS
- FLAG REGISTER
- STACK INSTRUCTIONS
- CALL and RET
- HARDWARE LOOPS

WEEK 2: Introduction to C and Inline Assembly

- Data types and their sizes
- Simple examples of Inline assembly
- ALU operations
- String length
- Multiplication using repeated addition
- Swap two variables in C

variables in inline Assembly
 swap two variable in C
 write code to swap the two variables using a function
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WEEK3: Compiling C to Assembly Language
 Compiling a simple program to Assembly – first order
 (https://swayam.gov.in/c_details/NPTEL)

Prologue
 Epilogue
 Local variables

WEEK4: C++ and Some special Functions
 C and C++ at assembly language level
 Recursion vs Loops with factorial as example
 Special functions
 memcpy
 strlen

Books and references

1. "The C Programming Language" by BRIAN W. KERNIGHAN and DENNIS M. RITCHIE, Second Edition
2. "The INTEL Microprocessors – Architecture, Programming and Interfacing", by Barry B. Brey 8th Edition

Instructor bio



**Prof.
 Janakiraman**

IIT Madras

Prof. Janakiraman Viraraghavan is an Assistant Professor at the Department of Electrical Engineering, IIT Madras and is part of the Integrated Circuits and Systems (iCS) group. His research interests include porting machine-learning algorithms on to hardware and statistical analysis in VLSI. He also has a keen interest in Microprocessors and Programming in general.



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learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.

The exam is optional for a fee of Rs.1000/- (Rupees one thousand only).

Date and Time of Exams: **28 October 2023** Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.

Registration url: Announcements will be made when the registration form is open for registrations.

The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.

Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE

Average assignment score = 25% of average of best 3 assignments out of the total 4 assignments given in the course.

Exam score = 75% of the proctored certification exam score out of 100

Final score = Average assignment score + Exam score

YOU WILL BE ELIGIBLE FOR A CERTIFICATE ONLY IF AVERAGE ASSIGNMENT SCORE $\geq 10/25$ AND EXAM SCORE $\geq 30/75$. If one of the 2 criteria is not met, you will not get the certificate even if the Final score $\geq 40/100$.

Certificate will have your name, photograph and the score in the final exam with the breakup. It will have the logos of NPTEL and IIT Madras. It will be e-verifiable at nptel.ac.in/noc (<http://nptel.ac.in/noc>).

Only the e-certificate will be made available. Hard copies will not be dispatched.

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Cloud computing

Week 1: Introduction to Cloud Computing

Week 2: Cloud Computing Architecture

Week 3: Service Management in Cloud Computing

Week 4: Data Management in Cloud Computing

Week 5: Resource Management in Cloud

Week 6: Cloud Security

Week 7: Open Source and Commercial Clouds, Cloud Simulator

Week 8: Research trend in Cloud Computing, Fog Computing

Week 9: VM Resource Allocation, Management and Monitoring

Week 10: Cloud-Fog-Edge enabled Analytics

Week 11: Serverless Computing and FaaS Model

Week 12: Case Studies and Recent Advancements



CONTROL SYSTEMS

PROF. C.S. SHANKAR RAM

Department of Design Engineering
IIT Madras

INTENDED AUDIENCE : Undergraduate engineering students (electrical engineering, electronics engineering, mechanical engineering, aerospace engineering, chemical engineering, automobile engineering)

PRE-REQUISITES : 2nd year undergraduate students in engineering. Prefer that they have completed a course on engineering mathematics that teaches complex variables and Laplace transform.

INDUSTRIES APPLICABLE TO : Automotive companies

COURSE OUTLINE :

Course Objective: To provide a basic understanding of the concepts and techniques involved in designing control schemes for dynamic systems. Learning Outcomes: At the end of this course, one should possess in-depth knowledge of concepts from classical control theory, understand the concept of transfer function and use it for obtaining system response, analyze dynamic systems for their stability and performance, and design controllers (such as Proportional-Integral-Derivative) based on stability and performance requirements.

ABOUT INSTRUCTOR :

Prof. C. S. Shankar Ram is currently a professor in the Department of Engineering Design, Indian Institute of Technology Madras, Chennai, India. He received his Bachelor of Engineering (B. E.) in Mechanical Engineering from Motilal Nehru Regional Engineering College, Allahabad, India, and his M. S. and Ph. D. from Texas A&M University, USA. His research interests are in the areas of dynamics and control with applications to automotive and transportation systems. He teaches courses on Control Systems, Fundamentals of Automotive Systems and Control of Automotive Systems at IIT Madras.

More details can be found at: <https://ed.iitm.ac.in/~shankarram/>

COURSE PLAN :

Week 01 : Introduction to Control, Classification of Dynamic Systems, Closed Loop Control System with Feedback, Mathematical Preliminaries – Complex Variables, Laplace Transform.

Week 02 : Standard Inputs, Free and Forced Response, Transfer Function, Poles and Zeros.

Week 03 : Response to various Inputs, Effect of Poles, Notion of Bounded Input Bounded Output (BIBO) stability.

Week 04 : Effect of Zeros, Closed Loop Transfer Function, Dynamic Performance Specification, First Order Systems.

Week 05 : Second Order Systems, Unit Step Response of Underdamped Second Order Systems, Concepts of Rise Time, Peak Time, Maximum Peak Overshoot and Settling Time.

Week 06 : Controllers – Proportional (P), Integral (I) and Derivative (D) Blocks, Examples of PID controller design.

Week 07 : Routh's Stability Criterion, Use in Control Design, Incorporation of Performance Specifications in Controller Design, Analysis of Steady State Errors.

Week 08 : Root Locus and its Application in Control Design.

Week 09 : Frequency Response, Bode Plots, Nyquist Plots.

Week 10 : Nyquist Stability Criterion, Relative Stability – Gain and Phase Margins.

Week 11 : Control System Design via Frequency Response – Lead, Lag and Lag-Lead Compensation.

Week 12 : Case Studies.



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Data Base Management System

By Prof. Partha Pratim Das, Prof. Samiran Chattopadhyay | IIT Kharagpur

Learners enrolled: 23746



Databases form the backbone of all major applications today – tightly or loosely coupled, intranet or internet based, financial, social, administrative, and so on. Structured Database Management Systems (DBMS) based on relational and other models have long formed the basis for such databases. Consequently, Oracle, Microsoft SQL Server, Sybase etc. have emerged as leading commercial systems while MySQL, PostgreSQL etc. lead in open source and free domain.

Summary

Course Status :	Completed
Course Type :	Core
Duration :	8 weeks
Category :	<ul style="list-style-type: none"> ◦ Computer Science and Engineering ◦ Programming
Credit Points :	2
Level :	Undergraduate/Postgraduate
Start Date :	24 Jan 2022
End Date :	18 Mar 2022
Enrollment	07 Feb 2022
Ends :	
Exam Date :	27 Mar 2022 IST



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in the details, they share a common set of models, design paradigms and Query Language (SQL). In this background, the course covers the structure, the organizations, concepts and principles of DBMS's, data analysis, database design, data modeling, database management, data & query optimization, and database implementation. More specifically, the course introduces relational data models; entity-relationship modeling, SQL, data normalization, and database design. Further it introduces query coding practices using MySQL (or any other open system) through various assignments. Design of simple multi-tier client / server architectures based and Web-based database applications is also introduced.

INTENDED AUDIENCE : Students from all disciplines can enroll for this course.

PRE-REQUISITES :1. Procedural and / or Object-Oriented Programming (C / C++ / Java / Python)

2. Data Structures
3. Algorithms

INDUSTRY SUPPORT : DBMS is so fundamental that all companies dealing with systems as well as application development (including web, IoT, embedded systems, data mining, machine learning) have a need for the same. These include – Microsoft, Samsung, Xerox, Yahoo, Google, IBM, TCS, Infosys, Amazon, Flipkart, etc.

Course layout

Week 1: Course Overview. Introduction to RDBMS

Week 2: Structured Query Language (SQL)

Week 3: Relational Algebra. Entity-Relationship Model

Week 4: Relational Database Design

Week 5: Application Development. Case Studies. Storage and File Structure

Week 6: Indexing and Hashing. Query Processing

Week 7: Query Optimization. Transactions (Serializability and Recoverability)

Week 8: Concurrency Control. Recovery Systems. Course Summarization.

Books and references

Text Books / Basic Material

- Database System Concepts by Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, 6th Edition, McGraw-Hill Education, 2010.
- Presentations used in the Course

Note: This exam date is subjected to change based on All Courses Searchability. You can check final exam date on your hall ticket.

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Read Material



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(https://swayam.gov.in/nc_details/NPTEL)



**Prof. Partha
Pratim Das**

IIT Kharagpur

Prof. Partha Pratim Das received his BTech, MTech and PhD degrees in 1984, 1985 and 1988 respectively from IIT Kharagpur. He served as a faculty in Department of Computer Science and Engineering, IIT Kharagpur from 1988 to 1998. In 1998, he joined Alumnus Software Ltd as a Business Development Manager. From 2001 to 2011, he worked for Interra Systems, Inc. as a Senior Director and headed its Kolkata Center. In 2011, he joined back to Department of Computer Science and Engineering, IIT Kharagpur as Professor. Dr. Das has also served as a Visiting Professor with Institute of Radio Physics and Electronics, Calcutta University from 2003 to 2013.

Dr. Das is currently the Head of Rajendra Mishra School of Engineering Entrepreneurship, the Professor-inCharge of the upcoming Research Park of IIT Kharagpur at Rajarhat, Kolkata, and the Joint Principal Investigator of National Digital Library of India project of MHRD.

Dr. Das has taught several courses in Computer Science including Software Engineering, Object-Oriented Systems, Programming and Data Structure, Compiler Design, Design and Analysis of Algorithms, Information System Design, Database Management Systems, Computational Geometry, Principles of Programming Languages, Embedded Systems, and Image Processing. Jointly with 2 others, he has also offered a course on Introduction to Design of Algorithms under the T10KT program of NME-ICT, MHRD (<https://www.facebook.com/t10kt.algorithms/>) to nearly 7000 teachers. Further, Dr. Das has been offering Programming in C++ and Object-Oriented Analysis and Design in NPTEL-NOC. Both courses are regularly attended by thousands of students.

Dr. Das has published over 40 technical papers in international journals in areas of Digital Geometry, Image Processing, Parallel Computing and Knowledge-based Systems. In 2013 he has co-authored a research monograph titled Digital Geometry in Image

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Artificial Intelligence (IUPRAI).

'ress). His current interests include Human-

ons, Computer Analysis of Indian Classical About Swayam (<https://swayam.gov.in/about>) | All Courses |

Engineering, Compiler Technology, and Technology Enabled

Learning. Dr. Das is a member of Association of Computing

Machinery (ACM), The Institute of Electrical and Electronics

Engineers (IETE), and Indian Unit for Pattern Recognition and

Artificial Intelligence (IUPRAI).



**Prof. Samiran
Chattopadhyay**

Samiran Chattopadhyay obtained his B Tech and M Tech degree in 1987 and 1989 respectively from IIT Kharagpur. He obtained his PhD degree from Jadavpur University in 1993. He served as a faculty in the Department of Computer Science and Engineering, Jadavpur University from 1989 to 1993. In 1993, he moved to industry and joined back the same department in Jadavpur University as an Associate Professor in 1997. Since 2001, he is a Professor of Information Technology in Jadavpur University.

Dr. Chattopadhyay is also a visiting fellow of the University of Northumbria, Newcastle upon Tyne UK. He was an adjunct faculty at IIT Kharagpur for the Distributed Systems course and a visiting faculty member for the MTech course by IIT Kharagpur which was offered in distance learning mode.

Dr. Chattopadhyay has more than two decades of experience of serving reputed Industry houses including Mindware, Computer Associates TCG Software, Interra Systems India Ltd. He is also a project consultant of the prestigious National Digital Library Mission of Government of India.

Dr. Chattopadhyay has taught several courses in Computer Science including Software Engineering, Object-Oriented Systems, Programming and Data Structure, Compiler Design, Design and Analysis of Algorithms, Information System Design, Database Management Systems, Ad hoc Wireless Networks, Cloud Computing. Dr. Chattopadhyay has been a co-faculty in Database Management Systems in NPTEL-NOC.

Dr. Chattopadhyay has published over 60 technical papers in international journals in the areas of Wireless Networks, Network Security, Machine learning applications. He has co-authored a

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 h titled 'Digital Geometry in Image
 book titled 'Data Structures through C' and
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Course certificate

The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.

The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).

Date and Time of Exams: **27 March 2022** Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.

Registration url: Announcements will be made when the registration form is open for registrations.

The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.

Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE

Average assignment score = 25% of average of best 6 assignments out of the total 8 assignments given in the course.

Exam score = 75% of the proctored certification exam score out of 100

Final score = Average assignment score + Exam score

YOU WILL BE ELIGIBLE FOR A CERTIFICATE ONLY IF AVERAGE ASSIGNMENT SCORE $\geq 10/25$ AND EXAM SCORE $\geq 30/75$. If one of the 2 criteria is not met, you will not get the certificate even if the Final score $\geq 40/100$.

Certificate will have your name, photograph and the score in the final exam with the breakup. It will have the logos of NPTEL and IIT Kharagpur. It will be e-verifiable at nptel.ac.in/noc (<http://nptel.ac.in/noc>).

Only the e-certificate will be made available. Hard copies will not be dispatched.

Once again, thanks for your interest in our online courses and certification. Happy learning.



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Initiative by : Ministry of Education (Govt of India)



DESIGN FOR QUALITY, MANUFACTURING AND ASSEMBLY

PROF. SARAVANA KUMAR

Department of Mechanical Engineering
IIT Madras

PROF. PALANIAPPAN RAMU

Department of Mechanical Engineering
IIT Madras

TYPE OF COURSE : New | Elective | UG/PG

COURSE DURATION : 8 weeks (29 Jul'19 - 20 Sep'19)

INTENDED AUDIENCE : B.E/B.Tech, M.E/M.Tech,
M.S, B.Sc, M.Sc, PhD

EXAM DATE : 29 Sep 2019

INDUSTRIES APPLICABLE TO : Fiat Chrysler Automotive, Daimler India, Cyient, Saint Gobain

COURSE OUTLINE :

In the context of product design, it is very important to appreciate the limitations of a design from manufacturing and assembly perspective and to produce high quality products at low cost. This course will introduce methods that can provide guidance to design teams in simplifying product structure to reduce manufacturing and assembly costs, quantify improvements and how robust design concepts can be used for ensuring quality. This course aims at introducing the need to account for variability, mathematically represent it, formulate it and control it. Concepts such as quality, robustness, six sigma and orthogonal array will be discussed.

ABOUT INSTRUCTOR :

Prof. Saravana Kumar is interested in development of representational and computational tools for virtual and physical prototyping applied to arrive at solutions to design problems. Some of the specific research areas include CAD and 3D data acquisition technologies: geometrical modelling schemes, X-ray tomography, photogrammetry and image-based modelling systems, and rapid prototyping.

Prof. Palaniappan Ramu research interest revolves around optimization and treating uncertainties in product and process design to obtain reliable, robust and quality designs. Most of his work is focused on reduction of computer or physical experiments, building better metamodels, intelligently explore design space and enable better predictions and optimal designs under uncertainties.

COURSE PLAN :

Week 01 : Introduction, course expected outcomes, discussion on quality

Week 02 : Measuring quality: Quality loss function. Discussion on robustness, six sigma concepts

Week 03 : Quantifying robustness: Signal to Noise Ratio, problem formulation using SNR. Design of experiment discussions

Week 04 : Orthogonal array, linear graphs, triangular tables, finding optimum combinations. Case studies

Week 05 : Design for Manufacturing: over the wall design, most influential phase in design, best practices in injection molding and sheet metal working

Week 06 : Design for additive manufacturing, single point and multipoint tools

Week 07 : Design for Assembly: Boothroyd Dewhurst method, theoretical minimum number of parts, Xerox producibility index (XPI) method

Week 08 : Do's and don't's in manual assembly, assembly time estimation, design for robotic assembly considerations. Design for sustainability



DESIGN OF FIXED WING UNMANNED AERIAL VEHICLES

PROF. SADERLA SUBRAHMANYAM

Department of Aerospace Engineering
IIT Kanpur

PRE-REQUISITES : Introduction to Aerodynamics

INTENDED AUDIENCE : Undergraduate and postgraduate students

INDUSTRIES APPLICABLE TO : DRDO, HAL, Boeing, Airbus, Bell, McDonnell Douglas, UAV Factory, Lockheed Martin

COURSE OUTLINE :

This course introduces the initial designing and sizing process for rapidly growing fixed – wing UAV technology, integrated with its performance and stability analysis and prototype testing.

ABOUT INSTRUCTOR :

Prof. Subrahmanyam Saderla obtained his B.Tech (Aeronautical Engineering) from JNTU, Hyderabad in 2008, M.Tech and Ph.D (Aerospace Engineering) from IIT Kanpur during 2010 and 2015 respectively. Later he joined as a postdoctoral fellow in the department of aerospace and software engineering at Gyeongsang National University (GNU), South Korea. At present he is working as an Assistant Professor in the Department of Aerospace Engineering at Indian Institute of Technology Kanpur. His current area of interest lies in real time system identification of unmanned aerial vehicles. His research interests also include design, flight tests and parameter estimation, high angle of attack aerodynamic modelling and dynamic wind tunnel testing as well as experimental flight dynamics, chaotic modelling (of cancer cell growth, seismic data & material properties etc.) using Artificial Neural Networks.

COURSE PLAN :

Week 01 : Introduction to fixed-wing UAVs, Introduction to Design, Basic Design Parameters.

Week 02 : Basic Design Parameters contd., Design Algorithm: Case Study, Design Algorithm: Mission Requirements.

Week 03 : Design Algorithm: Feasible Design Parameters, Configuration Layout: Airfoil Selection Configuration Layout: Planform Geometry selection

Week 04 : Weight and CG Estimation Analytical Parameter Estimation Analytical Parameter Estimation contd.

Week 05 : Performance and Stability Analysis Performance and Stability Analysis contd. Performance and Stability Analysis contd.

Week 06 : Simulation, Simulation contd..., Detailed Sizing

Week 07 : Estimation of inertial properties using 3D modelling, Prototype Fabrication

Week 08 : Wind Tunnel Testing, Aerodynamic Characterization through Wind Tunnel Testing



DESIGN OF REINFORCED CONCRETE STRUCTURES

PROF. NIRJHAR DHANG

Department of Civil Engineering
IIT Kharagpur

INTENDED AUDIENCE : Students of Civil Engineering and Architecture

INDUSTRIES APPLICABLE TO : This course will be recognized by design consultancy firms and construction industries.

COURSE OUTLINE :

Design of reinforced concrete structures is an introductory design course in civil engineering. In this course, basic elements governed by bending, shear, axial forces or combination of them are identified and are considered as building blocks of the whole structure. Different methods of design will be briefly described before introducing the limit states of collapse and serviceability. The design will be done as per IS 456:2000

ABOUT INSTRUCTOR :

Prof. Nirjhar Dhang (born 1962) is currently Professor of the Department of Civil Engineering, Indian Institute of Technology, Kharagpur, where he teaches Bridge Engineering, Structural Health Monitoring & Control, Design of Reinforced Concrete Structures. He works in the field of structural engineering particularly in the area of concrete, structural health monitoring & control and railway bridges applicable for high speed rail. He has done many consultancy and research project work.

COURSE PLAN :

Week 01 : Introduction, Different methods of design of reinforced concrete structures

Week 02 : Working stress method

Week 03 : Limit state of collapse - flexure

Week 04 : Design of singly reinforced beam

Week 05 : Design of doubly reinforced beam

Week 06 : Limit state of collapse - shear

Week 07 : Design for shear

Week 08 : Design of slab

Week 09 : Design of compression members

Week 10 : Design of footing

Week 11 : Design of staircase

Week 12 : Limit state of serviceability



DEVELOPING SOFT SKILLS AND PERSONALITY

PROF. T. RAVICHANDRAN

Department of Humanities and Social Sciences
IIT Kanpur

INTENDED AUDIENCE : Students, Teachers, Professionals, Trainers, Leaders, Employers

INDUSTRIES APPLICABLE TO : All industries/companies/organisations will recognize and value this course and recommend this for their employees and trainee programs.

COURSE OUTLINE :

The course aims to cause a basic awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality. Hard or technical skills help securing a basic position in one's life and career. But only soft skills can ensure a person retain it, climb further, reach a pinnacle, achieve excellence, and derive fulfillment and supreme joy. Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills.

ABOUT INSTRUCTOR :

Prof. T. RAVICHANDRAN is presently a Professor of English in the Department of Humanities and Social Sciences at the Indian Institute of Technology Kanpur, Uttar Pradesh, India. He has written about fifty research articles/book chapters, supervised six doctoral theses, edited a special issue on Cyberpunk Literature for the Creative Forum Journal, and published a book on Postmodern Identity. He is a recipient of the Fulbright-Nehru Academic and Professional Excellence Fellowship (2014-15) for his research/teaching at Duke University, North Carolina, USA. He is honored with Champa Devi Gangwal Chair Professorship at IIT Kanpur. In his distinguished twenty-five years of teaching career, he has taught various courses in English Language and Literature. His NPTEL Video and Web courses on Communication Skills are well-acclaimed nationally and internationally. His NPTEL MOOC on Developing Soft Skills and Personality became hugely popular and well-received by about fifteen thousand participants from India and abroad

COURSE PLAN:

Week 1: Lecture 1: Introduction: A New Approach To Learning

Lecture 2: Planning And Goal-Setting

Lecture 3: Human Perceptions: Understanding People

Lecture 4: Types Of Soft Skills: Self-Management Skills

Lecture 5: Aiming For Excellence: Developing Potential And Self-Actualisation

Lecture 6: Need Achievement And Spiritual Intelligence

Week 2: Lecture 7: Conflict Resolution Skills: Seeking Win-Win Solution

Lecture 8: Inter-Personal Conflicts: Two Examples

Lecture 9: Inter-Personal Conflicts: Two Solutions

Lecture 10: Types Of Conflicts: Becoming A Conflict Resolution Expert

Lecture 11: Types Of Stress: Self-Awareness About Stress

Lecture 12: Regulating Stress: Making The Best Out Of Stress

- Week 3:** **Lecture 13:** Habits: Guiding Principles
Lecture 14: Habits: Identifying Good And Bad Habits
Lecture 15: Habits: Habit Cycle
Lecture 16: Breaking Bad Habits
Lecture 17: Using The Zeigarnik Effect For Productivity And Personal Growth
Lecture 18: Forming Habits Of Success
- Week 4:** **Lecture 19:** Communication: Significance Of Listening
Lecture 20: Communication: Active Listening
Lecture 21: Communication: Barriers To Active Listening
Lecture 22: Telephone Communication: Basic Telephone Skills
Lecture 23: Telephone Communication: Advanced Telephone Skills
Lecture 24: Telephone Communication: Essential Telephone Skills
- Week 5:** **Lecture 25:** Technology And Communication: Technological Personality
Lecture 26: Technology And Communication: Mobile Personality?
Lecture 27: Topic: Technology And Communication: E-Mail Principles
Lecture 28: Technology And Communication: How Not To Send E-Mails!
Lecture 29: Technology And Communication: Netiquette
Lecture 30: Technology And Communication: E-Mail Etiquette
- Week 6:** **Lecture 31:** Communication Skills: Effective Communication
Lecture 32: Barriers To Communication: Arising Out Of Sender/Receiver's Personality
Lecture 33: Barriers To Communication: Interpersonal Transactions
Lecture 34: Barriers To Communication: Miscommunication
Lecture 35: Non-Verbal Communication: Pre-Thinking Assessment-1
Lecture 36: Non-Verbal Communication: Pre-Thinking Assessment-2
- Week 7:** **Lecture 37:** Nonverbal Communication: Introduction And Importance
Lecture 38: Non-Verbal Communication: Issues And Types
Lecture 39: Non-Verbal Communication: Basics And Universals
Lecture 40: Non-Verbal Communication: Interpreting Non-Verbal Cues
Lecture 41: Body Language: For Interviews
Lecture 42: Body Language: For Group Discussions
- Week 8:** **Lecture 43:** Presentation Skills: Overcoming Fear
Lecture 44: Presentation Skills: Becoming A Professional
Lecture 45: Presentation Skills: The Role Of Body Language
Lecture 46: Presentation Skills: Using Visuals
Lecture 47: Reading Skills: Effective Reading
Lecture 48: Human Relations: Developing Trust And Integrity



ECOLOGY AND ENVIRONMENT

Prof. Abhijit P Deshpande

Department of Multidisciplinary
IIT Madras

Prof. Ravi Krishna R

Department of Multidisciplinary
IIT Madras

INTENDED AUDIENCE : Any interested Learners

COURSE OUTLINE :

The objectives of the course is to introduce and sensitize all BTech students to the issue of ecology, environment and sustainability. The lectures are aimed at posing various questions that are relevant for all students of engineering and management to incorporate sustainability and a sensitivity to ecology and environment in their design of products, processes and systems.

ABOUT INSTRUCTOR :

Prof. Abhijit P. Deshpande is a Professor of Chemical Engineering at IIT Madras. His research focus is on polymeric systems, more specifically their aggregation and gelation behaviour. In his group, polymeric materials such as hydrogels and membranes are being investigated for applications in electrical, electromechanical and electrochemical devices. His teaching interests include specialized courses in polymers, fluid mechanics, rheology and continuum mechanics; and core chemical engineering courses such as mass transfer and thermodynamics

Prof. R. Ravikrishna Professor(2018 Current) Indian Institute of Technology Madras Associate Professor (2013-2018) Indian Institute of Technology Madras Assistant Professor (2006-2013) Indian Institute of Technology Madras Research Associate (2000-2006) Louisiana State University, Baton Rouge, USA

COURSE PLAN :

- Week 01** : Dr. B.S. Murty: Introduction (1), Sustainability Definition / Goals, Climate Change (2), Case Studies (3)
(Eg: Dams, Chemicals, e-waste, IOT, Landfill siting etc)
- Week 02** : Dr. Sudhir Chella Rajan: Sustainability and Economics (3), Sustainability and Ethics (3)
- Week 03** : Dr. Ligy Philip (Water Quality/ Waste Management): Water Quality and Treatment (3), Waste Management and Treatment (3)
- Week 04** : Dr. B. S. Murty (Water Management/ Resources): Urban Drainage, Water Resource Management, Impact of Climate Change
- Week 05** : Dr. Srinivas Jayanti (Energy):Energy Demand / Resources (1), Pollution from Energy generation (1), Energy and Climate Change (Global Warming) (1), Energy and Sustainability (1), Long Range and Short Range Solutions (1), (Global vs. India)
- Week 06** : Dr. R. Ravi Krishna: Risk Assessment Definition (1), Pollutant Pathways / Safety/ Exposure (1), Liability /Examples (1), Life Cycle Assessment (2), Environmental Management and LCA (1).
- Week 07** : Dr. Sudhir Chella Rajan: Urban Planning / Sprawl (1), Challenges in Urban Planning,Transport (1), Energy (Smart Grid) (1), Water (1), Waste (1), Governance (1).
- Week 08** : Dr. Susy Varughese / Dr. Parag Ravindran: Ecology – definitions / Systems (1), Biodiversity (1), Examples of Historical Impact of economy on Ecology, Restoration / Ecological Engineering.
- Week 09** : Dr. Ligy Philip / Dr. Ravi Krishna: Solid Waste Management, Hazardous Waste Management



ENERGY CONSERVATION AND WASTE HEAT RECOVERY

PROF. PRASANTA KUMAR DAS

Department of Mechanical Engineering
IIT Kharagpur

PROF. ANANDAROOP BHATTACHARYA

Department of Mechanical Engineering
IIT Kharagpur

INTENDED AUDIENCE : Energy Science and Engineering, Mechanical Engineering, Electrical Engineering students

PRE-REQUISITES : Basic Thermodynamics

INDUSTRIES APPLICABLE TO : BHEL, NTPC, CESC, WBSEB, DVC and other power companies, GE, Siemens, Alstom

COURSE OUTLINE :

Estimates from analyses and audits from various industries suggest that 20 to 50% of industrial energy input is lost as waste heat. This waste heat can be in the form of hot exhaust gases, water/fluid streams (from condensers in power plants) or heat lost from hot equipment and surfaces. As the world strives for higher energy efficiencies, it is imperative that along with better equipment we focus on recovering the energy stored in this “waste heat” and utilize it for useful purposes. The proposed course introduces us to various methods of Waste Heat Recovery that has been employed by the industry to harness the energy stored in waste heat and use it for generation of additional electric power.

ABOUT INSTRUCTOR :

Prof. Prasanta Kumar Das is a Professor of Mechanical Engineering and presently the Dean Post Graduate Studies and Research at IIT Kharagpur. He possesses a vast experience in teaching and research. His research interests lie in the broad area of thermal engineering with a special emphasis on two phase flow. Apart from teaching many fundamental subjects he offered applied courses like Power Plant Engineering, Thermal System Design, Waste Heat Recovery etc. He has also conducted tailor-made courses for industries. He contributed actively in sponsored research and offered consultancy to different Government and private industries. He contributed more than 190 publications in international journals, a vast number of publications in national and international conferences and 10 patents. He has supervised more than 20 scholars for their doctoral degree. He is fellows of Indian National Academy of Engineering and National Academy of Sciences India.

Prof. Anandaroop Bhattacharya is an Associate Professor of Mechanical Engineering at IIT Kharagpur. His research interests lie in the areas of electronics cooling, transport in porous media and gas turbine heat transfer. Prior to joining IIT, Anandaroop spent 12 years in the industry in USA and India working at Intel, General Motors and General Electric Research Centers.

COURSE PLAN :

Week 1 : Introduction to Waste Heat, Importance of Waste Heat Recovery, Review of Thermodynamics – Introduction to First and Second Laws

Week 2 : Review of Thermodynamics – Entropy, Entropy Generation, First and Second Law efficiency

Week 3 : Power Plant Cycles - Energy Cascading, Rankine Cycle, modification of Rankine cycle, examples

Week 4 : Gas Turbine Cycle, Combined Cycle, Combined Gas Turbine-Steam Turbine Power Plant, Heat Recovery Steam Generators

Week 5 : Thermodynamic cycles for low temperature application, Cogenerations, Introduction to Heat Exchangers, Analysis – LMTD and ϵ -NTU method

Week 6 : Analysis of Heat Exchanger – continued, Problem solving, Special Heat Exchangers for Waste Heat Recovery, Synthesis of Heat Exchanger Network

Week 7 : Heat pipes & Vapor Chambers, Direct conversion technologies –Thermoelectric Generators.

Week 8 : Direct conversion technologies – Thermoelectric Generators (contd.), Thermoionic conversion, Thermo-PV, MHD

Week 9 : Heat Pump; Heat Recovery from Incinerators, Energy Storage – Introduction.

Week 10 : Energy Storage Techniques – Pumped hydro, Compressed Air, Flywheel, Superconducting Magnetic storage

Week 11 : Energy Storage Techniques – Thermal storage (Sensible & Latent), Battery, Chemical Energy Storage, Fuel cells.

Week 12 : Energy Economics



ETHICAL HACKING

PROF. INDRANIL SENGUPTA

Dept. of Computer Science and Engineering
IIT Kharagpur

INTENDED AUDIENCE : Computer Science and Engineering / Information Technology / Electronics and Communication Engineering / Electrical Engineering

PREREQUISITES : Basic concepts in programming and networking

INDUSTRIES APPLICABLE TO : TCS, Wipro, CTS, Google, Microsoft, Qualcomm

COURSE OUTLINE

Ethical hacking is a subject that has become very important in present-day context, and can help individuals and organizations to adopt safe practices and usage of their IT infrastructure. Starting from the basic topics like networking, network security and cryptography, the course will cover various attacks and vulnerabilities and ways to secure them. There will be hands-on demonstrations that will be helpful to the participants. The participants are encouraged to try and replicate the demonstration experiments that will be discussed as part of the course.

ABOUT INSTRUCTOR

Prof. Indranil Sengupta has obtained his B.Tech., M.Tech. and Ph.D. degrees in Computer Science and Engineering from the University of Calcutta. He joined the Indian Institute of Technology, Kharagpur, as a faculty member in 1988, in the Department of Computer Science and Engineering, where he is presently a full Professor. He had been the former Heads of the Department of Computer Science and Engineering and also the School of Information Technology of the Institute. He has over 28 years of teaching and research experience. He has guided 22 PhD students, and has more than 200 publications to his credit in international journals and conferences. His research interests include cryptography and network security, VLSI design and testing, and mobile computing.

He is a Senior Member of IEEE. He had been the General Chairs of Asian Test Symposium (ATS-2005), International Conference on Cryptology in India (INDOCRYPT-2008), International Symposium on VLSI Design and Test (VDAT-2012), International Symposium on Electronic System Design (ISED-2012), and the upcoming Conference on reversible Computation (RC-2017). He had delivered invited and tutorial talks in several conferences in the areas of VLSI design and testing, and network security.

COURSE PLAN

Week 1: Introduction to ethical hacking. Fundamentals of computer networking. TCP/IP protocol stack.

Week 2: IP addressing and routing. TCP and UDP. IP subnets.

Week 3: Routing protocols. IP version 6.

Week 4: Installation of attacker and victim system. Information gathering using advanced google search, archive.org, netcraft, whois, host, dig, dnsenum and NMAP tool.

Week 5: Vulnerability scanning using NMAP and Nessus. Creating a secure hacking environment. System Hacking: password cracking, privilege escalation, application execution. Malware and Virus. ARP spoofing and MAC attack.

Week 6: Introduction to cryptography, private-key encryption, public-key encryption.

Week 7: Cryptographic hash functions, digital signature and certificate, applications.

Week 8: Steganography, biometric authentication, network-based attacks, DNS and Email security.

Week 9: Packet sniffing using Wireshark and Burpsuite, password attack using Burp Suite. Social engineering attacks and Denial of service attacks.

Week 10: Elements of hardware security: side-channel attacks, physical ineliminable functions, hardware trojans.

Week 11: Different types of attacks using Metasploit framework: password cracking, privilege escalation, remote code execution, etc. Attack on web servers: password attack, SQL injection, cross-site scripting.

Week 12: Case studies: various attack scenarios and their remedies.

Fluid Mechanics - Video course

COURSE OUTLINE

Properties of fluids and fundamental concepts, Fluid statics and its applications, Kinematics of fluids, Conservation equations in fluid flow and its applications, Incompressible viscous flow with applications to pipe flow in practice, Principles of similarity, Flow of ideal fluids, Flow with free surface, Few unsteady flow phenomena in practice, Introduction to laminar boundary layer, Introduction to turbulent flow,

The course coverage is balanced with analytical treatments, physical concepts and practical applications.

COURSE DETAIL

Modules	Lecture Topics
Module: 1	Lecture 1: Introduction and Fundamental Concepts Part-I Lecture 2: Introduction and Fundamental Concepts Part-II Lecture 3: Introduction and Fundamental Concepts Part-III
Module: 2	Lecture 4: Fluid Statics Part-I Lecture 5: Fluid Statics Part-II Lecture 6: Fluid Statics Part-III Lecture 7: Fluid Statics Part-IV Lecture 8: Fluid Statics Part-V Lecture 9: Fluid Statics Part-VI
Module: 3	Lecture 10: Kinematics of Fluid Part-I Lecture 11: Kinematics of Fluid Part-II Lecture 12: Kinematics of Fluid Part-III
Module: 4	Lecture 13: Conservation Equations in Fluid Flow Part-I Lecture 14: Conservation Equations in Fluid Flow Part-II
Module: 5	Lecture 15: Conservation Equations in Fluid Flow Part-III Lecture 16: Conservation Equations in Fluid Flow Part-IV Lecture 17: Conservation Equations in Fluid Flow Part-V Lecture 18: Conservation Equations in Fluid Flow Part-VI Lecture 19: Conservation Equations in Fluid Flow Part-VII Lecture 20: Conservation Equations in Fluid Flow Part-VIII Lecture 21: Conservation Equations in Fluid Flow Part-IX
Module: 6	Lecture 22: Fluid Flow Applications Part-I Lecture 23: Fluid Flow Applications Part-II Lecture 24: Fluid Flow Applications Part-III Lecture 25: Fluid Flow Applications Part-IV Lecture 26: Fluid Flow Applications Part-V



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Mechanical Engineering

Coordinators:

Prof. S.K. Som

Department of
Mechanical
Engineering IIT Kharagpur

	Lecture 27: Fluid Flow Applications Part-VI Lecture 28: Fluid Flow Applications Part-VII
Module: 7	Lecture 29: Incompressible Viscous Flows Part-I Lecture 30: Incompressible Viscous Flows Part-II Lecture 31: Incompressible Viscous Flows Part-III Lecture 32: Incompressible Viscous Flows Part-IV
Module: 8	Lecture 33: Application of Viscous Flow through Pipes Part-I Lecture 34: Application of Viscous Flow through Pipes Part-II Lecture 35: Application of Viscous Flow through Pipes Part-III
Module: 9	Lecture 36: Principles of Similarity Part-I Lecture 37: Principles of Similarity Part-I Lecture 38: Principles of Similarity Part-I
Module: 10	Lecture 39: Flow of Ideal Fluids Part-I Lecture 40: Flow of Ideal Fluids Part-II
Module: 11	Lecture 41: Flows with a Free Surface Part-I Lecture 42: Flows with a Free Surface Part-II Lecture 43: Flows with a Free Surface Part-III
Module: 12	Lecture 44: A Few unsteady Flow Phenomena Part-I Lecture 45: A Few unsteady Flow Phenomena Part-II
Module: 13	Lecture 46: Introduction to Laminar Boundary Layer Part-I Lecture 47: Introduction to Laminar Boundary Layer Part-II
Module: 14	Lecture 48: Introduction to Turbulent Flow Part-I Lecture 49: Introduction to Turbulent Flow Part-II

References:

1. S K Som, G Biswas, Suman Chakraborty, Introduction to Fluid Mechanics and Fluid machines, Tata McGraw Hill Education.
2. R. W. Fox, P. J. Pritchard, A. T McDonald, Introduction to Fluid Mechanics, John Wiley
3. F. M White, Fluid Mechanics, Tata McGraw Hill Education.



FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

PROF. SHYAMANTA M. HAZARIKA

Department of Mechanical Engineering
IIT Guwahati

PRE-REQUISITES : Basic Course in Probability and Linear Algebra

INTENDED AUDIENCE : Final Year B.Tech/M.Tech and PhD students

COURSE OUTLINE :

What does automatic scheduling or autonomous driving have in common with web search, speech recognition, and machine translation? These are complex real-world problems that span across various practices of engineering! Aim of artificial intelligence (AI) is to tackle these problems with rigorous mathematical tools. The objective of this course is to present an overview of the principles and practices of AI to address such complex real-world problems. The course is designed to develop a basic understanding of problem solving, knowledge representation, reasoning and learning methods of AI.

ABOUT INSTRUCTOR :

Prof. Shyamanta M Hazarika is a Professor of Mechanical Engineering at IIT Guwahati and leads the Biomimetic Robotics and Artificial Intelligence Lab. His research interest is in Rehabilitation Robotics. This translates into interest in Artificial Intelligence, Biomimetic Robotics and Robotic Neurorehabilitation. Prior to joining IIT Guwahati, he was with the Department of Computer Science and Engineering, Tezpur University. He has been a Vertretungsprofessur of Cognitive Systems and Neuroinformatics, University of Bremen, Germany. Prof. Hazarika holds a B.E. in Mechanical Engineering from Assam Engineering College, Guwahati, India; M.Tech. in Robotics from Center for Robotics, IIT Kanpur, India. He completed his PhD in Artificial Intelligence (Knowledge Representation and Reasoning) from School of Computing, University of Leeds, England.

COURSE PLAN :

Week 1: AI and Problem Solving by Search

Week 2: Problem Solving by search

Week 3: Problem Solving by search (contd)

Week 4: Knowledge Representation and Reasoning

Week 5: Knowledge Representation and Reasoning (Contd)

Week 6: Knowledge Representation and Reasoning (contd)

Week 7: Reasoning under uncertainty

Week 8: Planning

Week 9: Planning and Decision Making

Week 10: Machine Learning

Week 11: Machine Learning (contd)

Week 12: Machine Learning (contd)



FUNDAMENTALS OF MANUFACTURING PROCESSES

PROF. D.K. DWIVEDI

Department of Mechanical and Industrial Engineering
IIT Roorkee

INTENDED AUDIENCE : Any interested learners

COURSE OUTLINE :

It is proposed to include fundamental of following aspects of manufacturing technology

A) Understanding Manufacturing: concept of manufacturing, need, scope, advantages, limitation, application, materials and manufacturing, classification of manufacturing, process capabilities, selection, break even analysis of manufacturing processes

B) Casting: approach, steps, pattern, molding, gate and riser, melt treatment, solidification, casting processes: sand mould, shell mould, permanent mould casting, casting defect and their remedy

C) Forming: approach, hot and cold forming, rolling, forging, extrusion, drawing, sheet metal forming, press, dies, types of dies and die set sheet metal operations punching, blanking, notching, nibbling

D) Joining: approach, need, principle of fusion welding, gas welding, thermit welding, arc welding common arc welding processes, resistance welding, weldability of metals, solidification of weld, weld discontinuities and their remedy

E) Machining: approach, mechanism, classification, cutting tool, tool material, heat generation, cutting fluid, grinding, internal and external surface grinding, centerless grinding designation and selection of grinding wheel, trueing and balancing, honing, reaming, lapping, polishing etc.

F) Improving properties: heat treatment of steel and aluminum alloys, Fe-C diagram, TTT diagram, and CCT diagram, heat treatment processes annealing, normalizing, quenching tempering, surface modification methods namely without change chemistry, changing chemical composition and development of coating and cladding.

ABOUT INSTRUCTOR :

Prof. D K Dwivedi obtained BE (mechanical engineering), in 1993 from GEC Rewa, ME (welding engineering) from Univ. of Roorkee in 1997 and PhD in Met. Engineering from MNIT, Jaipur in 2003. He has about 9 years teaching experience at NIT Hamirpur and 14 years at IIT Roorkee in subjects related with manufacturing at UG level and welding engineering related subjects at PG level. He has published more than 120 research papers in SCI/SCIE indexed journals and undertaken 20 sponsored research and 50 industrial consultancy projects. He has authored two books entitled Production and Properties of Cast Al-Si Alloys with New Age International, New Delhi (2013) and Surface Engineering with Springer, New Delhi (2018).

COURSE PLAN :

- Week 1 :** Understanding Manufacturing
Fundamental approaches of manufacturing
Manufacturing process specific advantages and limitation
Materials and manufacturing processes
Classification of manufacturing processes
- Week 2 :** Selection of manufacturing processes
Application of manufacturing processes
Effect of manufacturing processes on properties of metals
Break-even point analysis in manufacturing processes
Metal Casting: Introduction & Suitability
- Week 3 :** Metal Casting: Steps of casting processes
Metal Casting: Terminology
Metal Casting: Pattern allowances I
Metal Casting: Pattern allowances II
Metal Casting: Sand Moulding I

- Week 4 :** Metal Casting: Sand Moulding II
Metal Casting: Core & Core Prints
Metal Casting: Gating System
Metal Casting: Yield
Metal Casting: Riser Design
- Week 5 :** Metal Casting: Cleaning of casting
Metal Casting: Casting defects & their prevention
Metal Casting: Shell molding
Metal Casting: Investment and permanent mould casting
Metal working processes: Hot and cold working
- Week 6 :** Metal working processes: Rolling
Metal working processes: Forging
Metal working processes: Extrusion
Metal working processes: Wire Drawing
Metal working processes: Press
- Week 7 :** Metal working processing: Sheet metal operations (Shearing)
Metal working processing: Sheet metal operations II
Metal working processing: Sheet metal operations III
Metal working processing: Dies and die set
Material removal processes: Machining
- Week 8 :** Material removal processes: Mechanism of the metal cutting
Material removal processes: Chip Formation
Material removal processes: Types of chips and power consumption
Material removal processes: Heat generation
Material removal processes: Tool failure and tool life
- Week 9 :** Material removal processes: Tool materials
Material removal processes: Cutting fluids
Material removal processes: Grinding I
Material removal processes: Grinding II
Material removal processes: Grinding III
- Week 10 :** Material removal processes: Grinding operations
Joining of metals: Fundamentals I
Joining of metals: Fundamentals II
Joining of metals: Welding processes I
Joining of metals: Brazing, soldering and weldability
- Week 11 :** Joining of metals: Weldability and welding defects
Heat treatment: Fundamentals
Heat treatment: Fundamentals II
Heat treatment: Fundamentals III
Heat treatment: Normalizing and hardening
- Week 12 :** Heat treatment: Tempering
Improving surface properties: Introduction
Improving surface properties: Surface modification processes I
Improving surface properties: Changing chemical composition
Improving surface properties: Coating



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Heat Exchangers: Fundamentals and Design Analysis

By Prof. Prasanta Kumar Das & Prof. Indranil Ghosh | IIT Kharagpur

Learners enrolled: 1445

Heat Exchangers Fundamentals and Design Analysis by Pr...



Heat exchangers are extensively used in diverse industries covering power generation, refrigeration and air conditioning, cryogenics, oil refineries and chemical processes, automobiles and other transport devices. The performance of a heat exchanger is very important for the conservation of energy, assurance of product quality, process viability and environmental protection. The present course aims at developing a familiarity with various types of heat exchangers, their construction and applications. Conventional methods of heat exchanger analysis; brief design methodology of typical heat exchangers and synthesis of heat exchanger network. It is planned to develop an

Summary

Course Status :	Completed
Course Type :	Core
Duration :	12 weeks
Category :	◦ Mechanical Engineering
Credit Points :	3
Level :	Postgraduate
Start Date :	29 Jul 2019
End Date :	18 Oct 2019
Exam Date :	16 Nov 2019 IST

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

This is an AICTE approved FDP course

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(/#x)



basic expertise in heat exchanger through description, mathematical
 rical examples.

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INTENDED AUDIENCE : Mechanical Engineering, Chemical Engineering, Energy
 Engineering, Biotechnology Engineering, Aerospace Engineering etc.

PREREQUISITES : Thermodynamics, Fluid Mechanics and Heat Transfer (at a
 very basic level).

INDUSTRY SUPPORT : All the companies generating coal based and nuclear based
 power (NTPC, different state electricity boards, CPRI, BARC, and
 NPCL etc.). Companies dealing with the design and
 fabrication of heat exchangers, auto mobile industries, process industries,
 oil refineries. Companies dealing with waste heat recovery and
 renewable. Some specific companies could be BHEL, ALSTOM,
 HP, HPCL, IOCL, THERMAX, BPCL, GAIL, Reliance, TATA
 Chemicals etc.

(https://www.addtoany.com/share?url=https%3A%2F%2Fonlinecourses.nptel.ac.in%2Fnoc19_me62%2Fpreview&title=%20Course)

Course layout

- Week 1 :** Background, Application, Classification, Common terminologies.
- Week 2 :** Introduction to Thermal and hydraulic aspects, pressure drop and heat transfer, sizing and rating. F-LMTD and -NTU method.
- Week 3 :** Tubular Heat Exchangers: different designs, brief description of Shell and Tube Heat Exchangers, Special types.
- Week 4 :** Compact heat exchangers, enhancement of heat transfer, extended surface or Fin, fundamental of extended surface heat transfer, Fin tube heat exchanger.
- Week 5 :** Plate Fin Heat Exchangers (PFHE), types, construction, fabrication, design, application. Multistream PFHE.
- Week 6 :** Multistream PFHE continued. Direct contact heat exchangers, types, application, simple analysis.
- Week 7 :** Regenerators, types of regenerators, construction, application. Theory of Regenerator, -NTU and -method..
- Week 8 :** Heat pipes, construction, working principle, application, analysis. Special heat pipes.
- Week 9 :** Microscale Heat Exchangers and heat sinks; heat transfer and fluid flow through narrow conduits, special design considerations
- Week 10 :** Phase change HEX; phase change heat transfer, introduction to evaporators and condensers.
- Week 11 :** Phase change HEX; phase change heat transfer, introduction to evaporators



Exchanger testing, steady state and dynamic About Swayam (<https://swayam.gov.in/about>) | All Courses |

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(<https://swayam.gov.in/>)



Books and references

(https://swayam.gov.in/nc_details/NPTEL)

- 1) Fundamentals of Heat Exchanger Design by R. K. Shah, Dusan P. Sekulic, John Wiley & Sons, 11-Aug-2003.
- (2) Heat Exchanger Design Handbook by Kuppan Thulukkanam, Taylor & Francis, 23-Feb-2000.
- (3) Heat Exchangers: Selection, Rating, and Thermal Design, Third Edition by Sadik Kakac, Hongtan Liu, CRC-Press, 01-Feb-1998.
- (4) Cryogenic Heat Transfer, Second Edition by Randall F. Barron, Gregory F. Nellis, CRC Press, May 23, 2016.

Instructor bio



Prof. Prasanta Kumar Das is a Professor of Mechanical Engineering and presently the Dean Post Graduate Studies and Research at IIT Kharagpur. He possesses a vast experience in teaching and research. His research interests lie in the broad area of thermal engineering with a special emphasis on two phase flow. Apart from teaching many fundamental subjects he offered applied courses like Power Plant Engineering, Thermal System Design, Waste Heat Recovery etc. He has also conducted tailor-made courses for industries. He contributed actively in sponsored research and offered consultancy to different Government and private industries. He contributed more than 190 publications in international journals, a vast number of publications in national and international conferences and 10 patents. He has supervised more than 20 scholars for their doctoral degree. He is fellows of Indian National Academy of Engineering and National Academy of Sciences India.



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Prof. Indranil Ghosh received his B. Sc. and M. Sc. in Physics from Jadavpur University in 1990 and 1992 respectively, M.Tech and Ph.D. from the Cryogenic Engineering Centre, Indian Institute of Technology, Kharagpur in 1995 and 2005 respectively. With the experience of being an engineer, R&D of Bharat Heavy Plates and Vessel Ltd., Visakhapatnam and Post-Doctoral researcher in Hydrogen Research Institute, University of Quebec at Trois Rivieres, he joined Indian Institute of Technology, Kharagpur as an Assistant Professor in 2006. His research interests include heat transfer in cryogenic systems, heat transfer in metal foam, compact heat exchangers, sorption cooling techniques etc. He has carried out some sponsored projects (on-going) with MHRD and CSIR. He has published 22 research papers in peer reviewed international journals, 15 papers in national and international conferences.

Course certificate

- The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.
- The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).
- **Date and Time of Exams: 16 November 2019**, Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.
- Registration url: Announcements will be made when the registration form is open for registrations.
- The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.
- Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE

- Average assignment score = 25% of average of best 8 assignments out of the total 12 assignments given in the course.
- Exam score = 75% of the proctored certification exam score out of 100
- Final score = Average assignment score + Exam score



ELIGIBLE FOR A CERTIFICATE ONLY IF AVERAGE ASSIGNMENT SCORE $\geq 30/75$ | swayam.gov.in/about | All Courses |

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FINAL EXAM SCORE $\geq 30/75$.

If one of the 2 criteria is not met, you will not get the certificate even if the Final Score $\geq 40/100$.

The certificate will have your name, photograph and the score in the final exam with the logos of NPTEL and IIT Kharagpur. It will be e-verifiable at nptel.ac.in/noc (<http://nptel.ac.in/noc>).

- Only the e-certificate will be made available. Hard copies are being discontinued from July 2019 semester and will not be dispatched



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Initiative by : Ministry of Education (Govt of India)

Human-Computer Interaction - Web course

COURSE SYLLABUS

HCI foundation and history; Usability life cycle and methods; Design rules and guidelines; Empirical research methods; Models in HCI - GOMS, Fitts' law and Hick-Hyman's law; Task analysis; Dialogue design; Cognitive architecture and HCI ; Graphic User Interfaces & aesthetics; Usability Testing; UML, OOP, OOM; Design Case Studies.

COURSE DETAILS

Module		Lecture Details			
SL.No	Topic	No	Topic	No of Lectures	Remarks Author
M1	Introduction	L1	Course objective and overview	1	SB
		L2	Historical evolution of the field	1	SB
M2	Interactive system design (theory and practice)	L1	Concept of usability - definition and elaboration	1	PY
		L2	HCI and software engineering	1	SB
		L3	GUI design and aesthetics	1	PY
		L4	Prototyping techniques	1	SB
M3	Model-based Design and evaluation	L1-L4	Basic idea, introduction to different types of models, GOMS family of models (KLM and CMN-GOMS)	4	SB
		L5, L6	Fitts' law and Hick-Hyman's law	2	SB



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Computer Science and Engineering

Additional Reading:

- Yvonne Rogers, Helen Sharp, Jennifer Preece; Interaction Design 3rd Edition Wiley 2011
- Frank Bentley, Edward Barrett Building Mobile Experiences MIP Press Cambridge 2012
- Selected research papers (details will be provided at the end of relevant materials).
- Jacob Nielsen; *Useability Engineering*; Morgan Kaufmann, Academic Press, London, 1993.

Coordinators:

Dr.Samit Bhattacharya
Department of Computer Science and Engineering IIT Guwahati

Pradeep P Yammiyavar
Department of Computer Science and Engineering IIT Guwahati

		L7, L8	Model-based design case studies	2	SB
M4	Guidelines in HCI	L1	Shneiderman's eight golden rules	1	PY
		L2	Norman's seven principles	2	PY
		L3	Norman's model of interaction		
		L4	Nielsen's ten heuristics with example of its use	2	PY
		L5	Heuristic evaluation		
		L6	Contextual inquiry	1	PY
		L7	Cognitive walkthrough	1	PY
M5	Empirical research methods in HCI	L1, L2	Introduction (motivation, issues, research question formulation techniques)	2	SB
		L3, L4	Experiment design and data analysis (with explanation of one-way ANOVA)	2	SB
M6	Task modeling and analysis	L1	Hierarchical task analysis (HTA)	1	PY
		L2, L3	Engineering task models and Concur Task Tree (CTT)	2	SB
M7	Dialog Design	L1	Introduction to formalism in dialog design, design using FSM (finite state machines)	1	SB
		L2 – L4	State charts and (classical) Petri Nets in dialog design	3	SB
M8	Cognitive architecture	L1	Introduction to CA, CA types, relevance of CA in IS design	1	SB

		L2, L3	Model Human Processor (MHP)	2	SB
M9	Object Oriented Programming	L1	OOP- Introduction	1	PY
		L2	OOM- Object Oriented Modeling of User Interface Design	1	PY
M10	Design -Case Studies	L1	Case Study 1- Multi-Key press Hindi Text Input Method on a Mobile Phone	3	PY
		L2	Case Study 2 - GUI design for a mobile phone based Matrimonial application.		
		L3	Case Study 3 - Employment Information System for unorganised construction workers on a Mobile Phone.		
Total Modules	10	Total Lectures		40	SB = 25 PY = 15

References:

- Dix A., Finlay J., Abowd G. D. and Beale R. *Human Computer Interaction*, 3rd edition, Pearson Education, 2005.
- Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. *Human Computer Interaction*, Addison-Wesley, 1994.
- B. Shneiderman; *Designing the User Interface*, Addison Wesley 2000 (Indian Reprint).



INTERPERSONAL SKILLS

PROF. SMITA JHA

Department of Humanities and Social Sciences
IIT Roorkee

TYPE OF COURSE : New | Core_Elective | PG/UG

COURSE DURATION : 8 weeks (29 Jul'19 - 23 Aug'19)

EXAM DATE : 29 Sep 2019

INTENDED AUDIENCE : Under graduate and post graduate engineering students and post graduate science students

INDUSTRIES APPLICABLE TO : Almost all corporate sector employee will value this course including sales professionals, business leaders and educators. This course is useful for students as well as for housewives.

COURSE OUTLINE :

The proposed course is a program to enhance personality to deal with the various problems of a professional world. Soft skills are becoming increasingly vital to employers as it has become very competitive to survive in a business world. Be it team spirit, communication skills or being a quick-thinker, expressing and demonstrating the right soft skills can make hopeful applicants stand out from the crowd. This course will also focus on pronunciation so as to make one's speech impressive. To excel in a job one surely needs a repertoire of technical skills. This course has been designed to meet all the requirements.

ABOUT INSTRUCTOR :

Prof. Smita Jha is currently working as faculty of English language and literature in the Department of Humanities & Social Sciences, Indian Institute of Technology, Roorkee. She has done M.A. in English (Gold Medalist) from Bihar University, Bihar. She has done Post graduate diploma in teaching English from CIEFL, Hyderabad. Prof. Smita Jha has more than 23 years of teaching experience both at UG and PG level. She has developed course on Neurolinguistics for the first year B.Tech students, She is running Linguistics as elective for the 3rd and the 4th year B.Tech students. She has published more than 50 papers in refereed journals. She has also written books on divers topics like nativization of English prose, partition literature etc. Her research areas are Linguistics, Indian writing in English, World Literature, Contemporary Literary Theory, ELT. She has supervised seven research scholars on various aspects of literature.

COURSE PLAN :

Week 1 : Introduction to Interpersonal skills with pronunciation and communicative skills

Week 2 : Introduction to Body language as part of communicative skills

Week 3 : Introduction to group dynamics and group effectiveness and leadership

Week 4 : Various steps to give a successful oral presentation

Week 5 : Time Management with Negotiation

Week 6 : Creativity and Problem Solving Skills

Week 7 : Stage Freight & Death by PowerPoint

Week 8 : Making Decision & Emotional Intelligence with Group Discussion



INTRODUCTION TO ABSTRACT AND LINEAR ALGEBRA

PROF. SOURAV MUKHOPADHYAY

Department of Mathematics
IIT Kharagpur

INTENDED AUDIENCE : Mathematics

COURSE OUTLINE :

Abstract and Linear Algebra are applicable to every discipline, be it engineering and technology, economics or social sciences. It is essential for the students to get acquainted with the subject of Abstract and Linear Algebra at an early stage. The present course has been designed to introduce the subject to undergraduate/postgraduate students in science and engineering. The course contains a good introduction to each topic and an advance treatment of theory at a fairly understandable level to the students at this stage.

ABOUT INSTRUCTOR :

Prof. Sourav Mukhopadhyay is an Associate Professor at Indian Institute of Technology Kharagpur. He has completed his B.Sc (Honours in Mathematics) in 1997 from University of Calcutta, India. He has done M.Stat (in statistics) and M.Tech (in computer science) from Indian Statistical Institute, India, in 1999 and 2001 respectively. He worked with Cryptology Research Group at Indian Statistical Institute as a PhD student and received his Ph.D. degree in Computer Science from there in 2007. He was a Research Assistant at the Computer Science department of School of Computing, National University of Singapore (NUS). He visited InriaRocquencourt, project CODES, France and worked as a post-doctoral research fellows at the School of Computer Engineering, Nanyang Technological University (NTU), Singapore. He was a post-doctoral research fellow and a part time Lecturer with School of Electronic Engineering, Dublin City University (DCU), Ireland.

COURSE PLAN :

Week 1 : Basic set theory

Week 2 : Group Theory

Week 3 : Rings and Polynomial rings

Week 4 : Field and finite fields

Week 5 : Matrices and determinants

Week 6 : Vector spaces over fields

Week 7 : Linear transformations and their matrices

Week 8 : Linear equations



INTRODUCTION TO INTERNET OF THINGS

PROF. SUDIP MISRA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Basic programming knowledge

INTENDED AUDIENCE : CSE, IT, ECE, EE, Instrumentation Engineering, Industrial Engineering

COURSE OUTLINE :

Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

ABOUT INSTRUCTOR :

Prof. Sudip Misra is a Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Kharagpur. Prior to this he was associated with Cornell University (USA), Yale University (USA), Nortel Networks (Canada) and the Government of Ontario (Canada). He received his Ph.D. degree in Computer Science from Carleton University, in Ottawa, Canada. He has several years of experience working in the academia, government, and the private sectors in research, teaching, consulting, project management, architecture, software design and product engineering roles. His current research interests include Wireless Ad Hoc and Sensor Networks, Internet of Things (IoT), Computer Networks, Learning Systems, and algorithm design for emerging communication networks. Dr. Misra is the author of over 260 scholarly research papers, including 140+ reputed journal papers. He has won seven research paper awards in different conferences. Recently, he and his students won Samsung Innovation Award and the IEEE ComSoc Student Competition. He was awarded the fellow of NASI. He was also awarded the IEEE ComSoc Asia Pacific Outstanding Young Researcher Award at IEEE GLOBECOM 2012, Anaheim, California, USA. He was also the recipient of several academic awards and fellowships such as the Young Scientist Award (National Academy of Sciences, India), Young Systems Scientist Award (Systems Society of India), Young Engineers Award (Institution of Engineers, India), (Canadian) Governor General's Academic Gold Medal at Carleton University, the University Outstanding Graduate Student Award in the Doctoral level at Carleton University and the National Academy of Sciences, India - Swarna Jayanti Puraskar (Golden Jubilee Award). Dr. Misra was also awarded the Canadian Government's prestigious NSERC Post-Doctoral Fellowship and the Humboldt Research Fellowship in Germany. Dr. Misra has been serving the editorial boards of distinguished journals such as the Transactions on Vehicular Technology, Transactions on Mobile Computing, International Journal of Communication Systems (Wiley) and the IET Wireless Sensor Systems (UK). In the past, he served as the Associate Editor/Editorial Board Member of the Telecommunication Systems Journal (Springer), Security and Communication Networks Journal (Wiley), and the EURASIP Journal of Wireless Communications and Networking, IET Communications Journal, and the Computers and Electrical Engineering Journal (Elsevier). Dr. Misra has published 10 books in the areas of wireless ad hoc networks, wireless sensor networks, wireless mesh networks, communication networks and distributed systems, network reliability and fault tolerance, and information and coding theory, published by reputed publishers such as Cambridge University Press, Springer, Wiley, and World Scientific.

COURSE PLAN :

Week 1: Introduction to IoT: Part I, Part II, Sensing, Actuation, Basics of Networking: Part-I

Week 2: Basics of Networking: Part-II, Part III, Part IV, Communication Protocols: Part I, Part II

Week 3: Communication Protocols: Part III, Part IV, Part V, Sensor Networks: Part I, Part II

Week 4: Sensor Networks: Part III, Part IV, Part V, Part VI, Machine-to-Machine Communications

Week 5: Interoperability in IoT, Introduction to Arduino Programming: Part I, Part II, Integration of Sensors and Actuators with Arduino: Part I, Part II

Week 6: Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi

Week 7: Implementation of IoT with Raspberry Pi (contd), Introduction to SDN, SDN for IoT

Week 8: SDN for IoT (contd), Data Handling and Analytics, Cloud Computing

Week 9: Cloud Computing(contd), Sensor-Cloud

Week 10: Fog Computing, Smart Cities and Smart Homes

Week 11: Connected Vehicles, Smart Grid, Industrial IoT

Week 12: Industrial IoT (contd), Case Study: Agriculture, Healthcare, Activity Monitoring



INTRODUCTION TO MACHINE LEARNING (TAMIL)

PROF. ARUN RAJKUMAR

Department of Computer Science
IIT Madras

INTENDED AUDIENCE: Native Tamil speaking audience (Teachers/ Undergraduate Students)

PREREQUISITES: A basic course in linear algebra/probability/programming/algorithms would be a big plus. These are not strong pre-requisites.

INDUSTRY SUPPORT: All Data centric companies including those that have core business in search/e-commerce/social-media

COURSE OUTLINE:

A short course introducing the main ideas and algorithms of Machine Learning. The goal of the course is to cover the topics at a high level so that it would act as a first course for a full fledged Machine Learning course. The course will be delivered in spoken Tamil while the technical terms discussed/exams/assignments will be in English.

ABOUT INSTRUCTOR:

Prof.Arun Rajkumar is currently an assistant professor in the department of CSE at IIT Madras. His PhD thesis was in the area of Machine Learning and his broad research interests are in the areas of Machine Learning, sequential decision making.

COURSE PLAN:

Week 1: Basics of Linear Algebra, Probability, Optimization

Week 2: Introduction to Supervised Learning - Regression; Topics - Linear Regression; Ridge Regression; LASSO

Week 3: Supervised Learning - Classification; Topics: K-NN, Decision Tree.

Week 4: Supervised Learning - Classification; Topics: Naive Bayes.

Week 5: Supervised Learning - Logistic Regression ,Perceptron.

Week 6: Supervised Learning - Support Vector Machines

Week 7: Supervised Learning - Ensemble Methods

Week 8: Unsupervised Learning - K-means Clustering, PCA



INTRODUCTION TO R SOFTWARE

PROF. SHALABH

Department of Mathematics
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG**COURSE DURATION** : 8 weeks (26 Jul'21 - 17 Sep'21)**EXAM DATE** : 26 Sep 2021**PREREQUISITES** : Mathematics background up to class 12 is needed.

Having some preliminary knowledge will be helpful but not necessarily mandatory.

INTENDED AUDIENCE : UG students of Science and Engineering. Students of humanities with basic mathematical background can also do it. Working professionals in analytics and anyone involved in programming, mathematical and statistical computations, simulations and data analysis can also do it.**INDUSTRIES APPLICABLE TO** : All industries involved in mathematical and statistical computations, programming and simulations and having R & D set up will use this course.

COURSE OUTLINE

Any scientific task without the knowledge of software is difficult to imagine and complete in the current scenario. R is a free software that is capable of handling mathematical and statistical manipulations. It has its own programming language as well as built in functions to perform any specialized task. We intend to learn the basics of R software in this course.

ABOUT INSTRUCTOR

Prof. Shalabh is a Professor of Statistics at IIT Kanpur. His research areas of interest are linear models, regression analysis and econometrics. He has more than 22 years of experience in teaching and research. He has developed several web based NPTEL courses including on regression analysis and has conducted several workshops on statistics for teachers, researchers and practitioners. He has received several national and international award and fellowships. He has authored more than 70 research papers in national and international journals. He has written four books and one of the book on linear models is coauthored with Prof. C.R. Rao.

COURSE PLAN

Week 1: Basic fundamentals, installation and use of software, data editing, use of R as a calculator, functions and assignments.

Week 2: Use of R as a calculator, functions and matrix operations, missing data and logical operators.

Week 3: conditional executions and loops, data management with sequences.

Week 4: Data management with repeats, sorting, ordering, and lists.

Week 5: Vector indexing, factors, Data management with strings, display and formatting.

Week 6: Data management with display paste, split, find and replacement, manipulations with alphabets, evaluation of strings, data frames.

Week 7: Data frames, import of external data in various file formats, statistical functions, compilation of data.

Week 8: Graphics and plots, statistical functions for central tendency, variation, skewness and kurtosis, handling of bivariate data through graphics, correlations, programming and illustration with examples.



INTRODUCTION TO ROCKET PROPULSION

PROF. D. P. MISHRA

Department of Aerospace Engineering
IIT Kanpur

TYPE OF COURSE : New | Core&Elective | UG/PG

COURSE DURATION : 12 weeks (29 Jul'19 - 18th Oct'19)

EXAM DATE : 16 Nov 2019

PRE-REQUISITES : +2 Science

COURSE OUTLINE :

This is an introductory course on rocket propulsion. The objective of this course is to impart knowledge about rocket propulsion to both UG and PG students. In this course, fundamentals aspects of rocket propulsion namely Solid, Liquid and Hydride rocket engines are to be covered extensively. Besides this, performance of rocket engine and heat transfer aspects of various components are to be covered briefly.

ABOUT INSTRUCTOR :

Prof. Debi Prasad Mishra is a Professor in the Department of Aerospace Engineering at Indian Institute of Technology (IIT) Kanpur, India. His areas of research interest include combustion, computational fluid dynamics, atomization, etc. He was conferred with the Indian Oil Golden Jubilee Professional Chair in IIT Kanpur. He has authored five textbooks and has delivered several lectures on ancient Indian Science and Technology and culture and tradition to more than 45, 000 students across India.

COURSE PLAN :

Week 1: Introduction, Types of Rocket Engines, Applications of Rocket Engines

Week 2: Aerothermodynamics of Rocket Engines, Fundamentals of Aerodynamics, Elements of thermodynamics

Week 3: Combustion, Ideal Rocket Engine

Week 4: Thrust Equation, Rocket Engine parameters, Rocket Engine Nozzles

Week 5: Space Flight Performance, Rocket Propellant

Week 6: Introduction to Solid Propellant Rocket Engine, Components of SPRE, Regression rate relation

Week 7: Liquid Propellant Rocket Engine, Injector, Feed system

Week 8: Hybrid rocket Engine, Rocket Heat transfer

Week 9: Liquid Propellant Rocket Engine, Types of liquid rocket engines, Combustion of liquid propellant

Week 10: Combustion Chamber Geometry, Types of liquid rocket engines, Injectors, Feed system

Week 11: Combustion Instability, Ignition System, Hybrid rocket Engine

Week 12: Rocket Heat transfer, Types of Cooling System



MANUFACTURING AUTOMATION

PROF. SOUNAK KUMAR CHOUDHURY

Department of Mechanical Engineering
IIT Kanpur

PRE-REQUISITES : Basic Engineering Courses

INTENDED AUDIENCE : Mechanical Engineering, Metallurgy, Aerospace Engineering, Production Engineering

INDUSTRIES APPLICABLE TO : All Manufacturing industries, Machine tool manufacturing industries, Automobile Industries and aeronautical assembly industries

COURSE OUTLINE :

The course will basically deal with the following topics: Introduction: Definition; Types of automation; Reasons for automating; Automation strategies. Detroit type automation : Automated flow lines: types and their selection; Methods of workpart transport; Transfer mechanisms; Controlling of automated flow lines. Analysis of automated flow lines: System aspects of designing and running the line; Average production time and production rate; Line efficiency; Analysis of transfer lines without storage – upper bound and lower bound approach; Partial automation. Automated assembly systems: Historical developments of the assembly process; Choice of assembly methods; Design for automated assembly; Transfer systems; Vibratory bowl feeders – its analysis; Non-vibratory feeders and their analysis; Analysis and design of part orienting devices, feed tracks and part placing mechanisms. Orientation of parts in automatic assembly: In-Bowl and Out-of-Bowl Toolings; Typical Orienting Systems: Wiper Blade, Pressure Break, slot in the track; Analysis of Part Orienting Systems; Examples of Out-of-Bowl Toolings; Feed Tracks: Analysis of Horizontal Delivery Feed Track; “ON-OFF” Sensors; Reliability of Feeding.

ABOUT INSTRUCTOR :

Prof. Sounak Kumar Choudhury have completed my Ph.D. in Mechanical Engineering from Moscow, Russia in 1985 followed by post-doctoral at the same university till 1986. From 1986 I am involved in teaching and research in the Mechanical Engineering Department of Indian Institute of Technology Kanpur. My areas of specialization are conventional and non-conventional machining, automatic control, hydraulic control, machine tools and manufacturing automation.

COURSE PLAN :

Week 1 : Definition; Discussion on Pros and Cons of Automation; Benefits of Automation; Types of automation: Fixed automation, programmable automation, and Flexible automation- Typical Features and examples; Reasons for automating; Automation strategies; Automated flow lines: the objectives of the use of flow line automation; General forms of Work Flow – criteria for selection; Methods of work part transport: Continuous, intermittent and asynchronous: types and their selection; Transfer Mechanisms; Examples of transfer mechanisms for linear travel and rotary transfer mechanisms; Buffer Storage;

Week 2 : Flow line Performance Analysis: Average production time and production rate; Mean time per cycle when machine breakdown occurs; Flow line Performance Analysis: Line efficiency; Cost per item produced; Partial automation: Reasons for using, Advantages and drawbacks; Production and Throughput: Examples; Effect of machine Jamming; Component Quality Control; Choice of assembly methods: Cost, Production Rate, Availability of Labour, and Market Life of the Product; Advantages of Automatic Assembly; Design for automated assembly; Components of automatic Assembly Machines;

Week 3 : Transfer systems; Assembly Machines: In-Line, Rotary; Continuous and Intermittent Transfer; Indexing Machines: Factors affecting the choice; Various Indexing Mechanisms; Vibratory bowl feeders: Mechanics of Vibratory Conveying - its analysis; Effect of Frequency, Track Acceleration and Vibration Angle; Effect of Track Angle and Coefficient of Friction; Summary of Bowl Feeder Design; Spiral Elevators; General Requirements of Part Feeders; Non-vibratory feeders : Reciprocating Tube Hopper Feeder – its analysis; General Features. Centerboard Hopper Feeder: Analysis: Maximum Track Inclination, Total Cycle Time, Mean Feed Rate;

Week 4 : Reciprocating Tube Hopper Feeder: Principle of Operation; External Gate Hopper Feeder: Its Analysis: Maximum Peripheral Velocity, Mean Feed rate; Rotary Disk Feeder: Indexing and Rotary Disk Feeder with continuous drive and their analysis: Load sensitivity, Efficiency and Mean Feed Rate; Orientation of Parts in Automatic Assembly: In-Bowl and Out-of-Bowl Tooling's; Typical Orienting Systems: Wiper Blade, Pressure Break, slot in the track; Analysis of Part Orienting Systems; Examples of Out-of-Bowl Toolings; Feed Tracks: Analysis of Horizontal Delivery Feed Track; “ON-OFF” Sensors; Reliability of Feeding.



MANUFACTURING OF COMPOSITES

PROF. J RAMKUMAR

Department of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Core/Elective | UG/PG

COURSE DURATION : 8 weeks (26 Aug'19 - 18 Oct'19)

EXAM DATE : 17 Nov 2019

INTENDED AUDIENCE : Students of all Engineering and Science disciplines.

PRE-REQUISITES : The student should have completed two semesters of UG Engineering or Science program.

INDUSTRIES APPLICABLE TO : HAL, NAL, SAIL, ISRO

COURSE OUTLINE

Selecting manufacturing technique has emerged as one the paramount challenge in the field of composites. Composites are now being used in almost every field of industry, and students working in the area of the composites need to learn the basics, and progressive techniques of composites manufacturing. This course covers the important aspects of composites manufacturing: process selection guidelines, thermoset and thermoplastic Composites manufacturing processes, process parameters and characterizations. Applications and use of each manufacturing process is focused and this is represented separately.

ABOUT INSTRUCTOR

Prof. Janakranjan .Ramkumar is currently a Professor of Mechanical Engineering Department, and Design Program, Indian Institute of Technology, Kanpur. He teaches manufacturing science, micro/nano technology, new product development. He has a bachelors in Production Engineering with his doctorate in Defect quantification in drilling of composites from IIT Madras, India with a best thesis award. Over the years his contribution in teaching and research is remarkable. He has worked for BOSCH group and improved the productivity of the company. His research and teaching focus is on nano technology and inclusive design. He has several international and national patents in his credit and has published more than 100 journal papers.

COURSE PLAN

Week 1: Introduction to Composites; Introduction to Composites; Function of the Matrix and Reinforcement in Composites
Matrices: Thermosets and Thermoplastic; Fiber Reinforcement

Week 2: Properties and testing composites; Properties of Composites; Composites testing; Composites design: Laminate theory, Rule of mixtures, symmetry and balance

Week 3: Thermoset Composites manufacturing processes; Material selection process cont.; Material selection process cont. Design for manufacturing.

Week 4: Thermoset composite manufacturing processes; Thermoset Composite manufacturing:Lay-up processes,Spray up process;Thermoset Composite manufacturing:Fiber placement process;Thermoset Composite manufacturing:Resin transfer moulding

Week 5: Thermoplastic composite manufacturing processes; Thermoset Composite manufacturing:Vaccum assisted resin transfer moulding; Thermoset Composite manufacturing:Compression molding process; Thermoset composites manufacturing:Filament winding

Week 6: Thermoplastic composite manufacturing processes; Thermoplastic Composite manufacturing:Sheet moulding
Thermoplastic Composite manufacturing: Injection moulding, sheet moulding, Calendaring; Thermoplastic Composite manufacturing:Extrusion, Blow molding, rotational molding, Thermoforming

Week 7: Metal and ceramic matrix composites; Metal Matrix Composites: Metal matrix and reinforcement; Manufacturing processes for Metal Matrix Composites:Dispersion hardened and particle composite; Manufacturing processes for Metal matrix composites:Layer composites and infiltration method

Week 8: Prevention of Damage, repair of Composites and selection of processes; Ceramic matrix composites: Hot isostatic processing ; Non – destructive testing of Composites; Manufacturing process selection: Cost, performance, size shape, rate of production. Steps for process selection



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Mathematical Modeling Of Manufacturing Processes

By Prof. Swarup Bag | IIT Guwahati

Learners enrolled: 658 | Exam registration: 73

Mathematical Modeling of Manufacturing Processes [Intr...



ABOUT THE COURSE:

The understanding of the basic mechanism such as heat and mass transport with associated fluid flow including metallurgical transformation, distortion and residual stress generation in different manufacturing processes is the focus of this course. Understanding the complex interaction not only helps to develop mathematical model, it makes the foundation for analysis, numerical simulation at different scale and experimentation for different types of manufacturing processes. The development of computational models for a manufacturing process relies on mathematical expression of

Summary

Course Status :	Completed
Course Type :	Elective
Duration :	12 weeks
Category :	<ul style="list-style-type: none">Mechanical EngineeringManufacturing Processes and Technology
Credit Points :	3
Level :	Undergraduate/Postgraduate
Start Date :	24 Jul 2023
End Date :	13 Oct 2023
Enrollment Ends :	07 Aug 2023



mechanism. It helps to design relevant experiments and drives to find the mechanism. Mutual understanding between About Swayam (<https://swayam.gov.in/about>) leads to better insight of the basic manufacturing processes that impact on the improvement of existing process and directs for the development of new process. However, this course is completely different from statistical or data driven modeling approach. This course emphasized on the understanding of the most general to advanced manufacturing processes based on scientific principle. The complex mechanism is presented in a simplified way to understand the subject at elementary level. The broad impact is that the students will be able to develop physics based computational model of manufacturing process using standard commercial package (However, this course does not intend to cover the learning of the commercial software).

INTENDED AUDIENCE: Bachelor/Master/PhD students having background in Mechanical/Material Science/Metallurgical engineering/Production Engineering/Manufacturing Technology.

Exam
Registration | All Courses | 18 Aug 2023 (0)

Ends :

Exam Date : 28 Oct 2023 IST

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

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Course layout

- Week 1:** Introduction to Manufacturing processes
- Week 2:** Physics of manufacturing processes
- Week 3:** Conventional machining
- Week 4:** Non-conventional machining
- Week 5:** Metal forming
- Week 6:** Welding
- Week 7:** Welding
- Week 8:** Casting and powder metallurgy
- Week 9:** Coating and additive manufacturing
- Week 10:** Heat treatment
- Week 11:** Micro/nano scale manufacturing
- Week 12:** Processing of non-metallic materials





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- (<https://swayam.gov.in/>) Manufacturing Science, East-West Press Pvt Ltd, 2nd Ed., 2010.
1. A Brandt, J C Warner: Metallurgy Fundamentals, Goodheart- Willcox, 2009.
 2. O Lakshmana Rao and Anil P Deshpande: Modelling of Engineering Materials, Ane Books Pvt. Ltd., New Delhi, India, 2010.
 3. J. Chakrabarty: Theory of plasticity, 3rd Eds, Elsevier India, 2009.
 4. Norman Y Zhou: Microjoining and Nanojoining, Woodhead publishing, 2008
 5. R W Messler: Principles of Welding John Wiley and Sons, 1999.
 6. J T Black and Ronald A Kohser: DeGarmo's Materials & processes in Manufacturing Wiley-India, 2010.
 7. V K Jain: Advanced Machining Processes, Allied Publishers, Mumbai, 2002.
 8. Yi Qin: Micromanufacturing Engineering and Technology, Elsevier, 2015.
 9. J Zhang and Yeon-Gil Jung: Additive Manufacturing: Materials, Processes, Quantifications and Applications, Elsevier, 2018.
 10. J A Dantzig and M Rappaz: Solidification, CRS press, 2009.

Instructor bio



Prof. Swarup Bag

IIT Guwahati

The broad area of instructor is teaching and research interest of materials and manufacturing processes through computational models using finite element method and experiments. The instructor completed his Ph.D on "Development of bi-directional heat transfer and fluid flow model for reliable design of GTA and laser welding processes" from Indian Institute of Technology Bombay. Later he has worked at the Center for Material Forming (CEMEF), MINES Paris Tech, France in Metallurgy, Structure and Rheology (MSR) group. Soon after post-doctoral research experience, he joined in the Department of Mechanical Engineering, Indian Institute of Technology Guwahati as a faculty member. His primary area of research is fundamental process modeling of welding and joining technologies, optimization of manufacturing processes and recrystallization in metal forming processes. Dr. Bag has published about 56 journal papers, 45 Conference papers, and 18 book chapters related to welding and joining processes. He is the author of the book 'Computational models for GTA and laser welding processes' and recipient of 'Royal Arc Award 2009' from Indian Institute of Welding for the best PhD thesis in welding. The instructor is involved in teaching the subjects like 'Physics of Manufacturing Processes',





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Initiative by : Ministry of Education (Govt of India)





PROBLEM SOLVING THROUGH PROGRAMMING IN C

PROF. ANUPAM BASU

Department of Computer Science and Engineering
IIT Kharagpur

INTENDED AUDIENCE : BE/BTech in all disciplines BCA/MCA/M. Sc

INDUSTRIES APPLICABLE TO : All IT Industries

COURSE OUTLINE : This course is aimed at enabling the students to

- Formulate simple algorithms for arithmetic and logical problems
- Translate the algorithms to programs (in C language)
- Test and execute the programs and correct syntax and logical errors
- Implement conditional branching, iteration and recursion
- Decompose a problem into functions and synthesize a complete program using divide and conquer approach
- Use arrays, pointers and structures to formulate algorithms and programs
- Apply programming to solve matrix addition and multiplication problems and searching and sorting problems
- Apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration

ABOUT INSTRUCTOR :

Prof. Anupam Basu is Professor in the Dept. of Computer Science Engineering, IIT Kharagpur, and has been an active researcher in the areas of Cognitive and Intelligent Systems, Embedded Systems and Language Processing, Presently he is acting as the Chairman and Head of the Center for Educational Technology, IIT Kharagpur. He has developed several embedded system based tools empowering the physically challenged and has led several national projects in the area. He has taught at the University of California, Irvine at the Center for Embedded Systems. He is an Alexander von Humboldt Fellow and a Fellow of the Indian National Academy of Engineering. The awards won by him include the State Award for the Best Contribution to the Cause of Empowerment of the Disabled (2014), Universal Design Award 2011, for contributions in design for the disabled, by National Council for Promotion of Employment of Disabled Persons, India, the National Award for the Best Technology Innovation for the Physically Disabled (2007) and the Da-Vinci Award 2004 from the Engineering Society of Detroit.

COURSE PLAN :

Week 1: Introduction to Problem Solving through programs, Flowcharts/Pseudo codes, the compilation process, Syntax and Semantic errors, Variables and Data Types

Week 2: Arithmetic expressions, Relational Operations, Logical expressions; Introduction to Conditional Branching

Week 3: Conditional Branching and Iterative Loops

Week 4: Arranging things : Arrays

Week 5: 2-D arrays, Character Arrays and Strings

Week 6: Basic Algorithms including Numerical Algorithms

Week 7: Functions and Parameter Passing by Value

Week 8: Passing Arrays to Functions, Call by Reference

Week 9: Recursion

Week 10: Structures and Pointers

Week 11: Self-Referential Structures and Introduction to Lists

Week 12: Advanced Topics



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Product Design Using Value Engineering

By Prof. Inderdeep Singh | IIT Roorkee

Learners enrolled: 3750

Product Design using Value Engineering



It has been established worldwide that the most successful economies are based on innovation and creativity led entrepreneurship. The government is focusing on putting concerted efforts to produce job creators.

The current MOOC on Product Design using Value Engineering is conceptualized and planned in such a way that it helps both job creators as well as job seekers. The main objective of the course is to acquaint the learners/students with the practical knowledge regarding conceptualization, design and development of a new product with a focused

Summary

Course Status : Completed

Course Type : Elective

Duration : 4 weeks

Category :

- o Mechanical Engineering

Credit Points : 1

Level : Undergraduate

Start Date : 29 Jul 2019

End Date : 23 Aug 2019

Exam Date : 29 Sep 2019 IST

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

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Approach. The need of a new product, the product design process, the Engineering principles in product design process have been discussed in the course. The difference between the concept of Value Engineering and Cost Cutting has been elaborated with examples. The Value Engineering Job Plan (VEJP) has also been discussed, especially in context of the product design process. Different types of product functions, their identification, definition, analysis has been explained with examples. Various concepts, such as function-cost relationship have been explained with relevant and specific examples/ case studies.

INTENDED AUDIENCE: Engineers, Product Designers, Product Management Professionals, UG/PG students.

PREREQUISITES: No-prerequisite, any student enrolled for a UG/PG degree in any discipline of humanities, management, science and engineering can complete the course.

INDUSTRY SUPPORT: All industries where products are being conceptualized, designed and developed in order to satisfy the human needs and requirements.

Course layout

Week 1: Introduction to Product Design and Development, Product Design Steps and Product Analysis, Profit Consideration, Value Engineering (History, Concept and Definitions), Value Engineering vs. Cost Cutting.

Week 2: Creative Thinking, Problem Identification and VEJP, Types of Product Functions, Functional Analysis, Functional Analysis System Technique.

Week 3: Function-Cost Relationship – I, Function-Cost Relationship - II, VE Applications in Product Design, Value Engineering:Case Study -I, Value Engineering: Case Study –II.

Week 4: VE Tools and Techniques – I, VE Tools and Techniques – II, , VE Success Stories –I, VE Success Stories -II .Behavioral Roadblocks

Books and references

1. Lawrence D. Miles; "Techniques of Value Analysis and Engineering", 2nd Edition, McGraw-Hill Book Company, Inc. New York.
2. Larry W. Zimmerman, Glen D. Hart; "Value Engineering", Reprint 1999, CBS Publishers and Distributors, New Delhi
3. A. K. Chitale and R. C. Gupta, "Product Design and Manufacturing", 3rd Edition, Prentice-Hall of India.

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Dr. Inderdeep Singh is currently working as Associate Professor in Department of Mechanical and Industrial Engineering at Indian Institute of Technology Roorkee. He has taught among others, the industrial engineering courses such as Production Planning and Control, Product Design and Development, Work System Design, Industrial Management and Quality Management. He has been actively involved in the National Mission Project on Education Through ICT (NME-ICT) of Government of India. He has completed eight video and one web course under the National Programme on Technology Enhanced Learning (NPTEL, MOOCs). He has developed suitable pedagogical methods for two under-graduate courses of Mechanical Engineering.

Course certificate

- The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.
- The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).
- **Date and Time of Exams: 29 September 2019**, Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.
- Registration url: Announcements will be made when the registration form is open for registrations.
- The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.
- Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE

- Average assignment score = 25% of average of best 3 assignments out of the total 4 assignments given in the course.
- Exam score = 75% of the proctored certification exam score out of 100.
- Final score = Average assignment score + Exam score.



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verifiable at nptel.ac.in/noc (<http://nptel.ac.in/noc>).

- Only the e-certificate will be made available. Hard copies are being discontinued from July 2019 semester and will not be dispatched.



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Initiative by : Ministry of Education (Govt of India)



PROGRAMMING IN JAVA

PROF. DEBASIS SAMANTA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : This course requires that the students are familiar with programming language such as C/C++ and data structures, algorithms.

INTENDED AUDIENCE : The undergraduate students from the engineering disciplines namely CSE, IT, EE, ECE, etc. might be interested for this course.

INDUSTRIES APPLICABLE TO : All IT companies.

COURSE OUTLINE :

With the growth of Information and Communication Technology, there is a need to develop large and complex software. Further, those software should be platform independent, Internet enabled, easy to modify, secure, and robust. To meet this requirement object-oriented paradigm has been developed and based on this paradigm the Java programming language emerges as the best programming environment. Now, Java programming language is being used for mobile programming, Internet programming, and many other applications compatible to distributed systems. This course aims to cover the essential topics of Java programming so that the participants can improve their skills to cope with the current demand of IT industries and solve many problems in their own field of studies.

ABOUT INSTRUCTOR :

Prof. Debasis Samanta holds a Ph.D. in Computer Science and Engineering from Indian Institute of Technology Kharagpur. His research interests and work experience spans the areas of Computational Intelligence, Data Analytics, Human Computer Interaction, Brain Computing and Biometric Systems. Prof. Samanta currently works as a faculty member at the Department of Computer Science Engineering at IIT Kharagpur.

COURSE PLAN :

Week 1: Overview of Object-Oriented Programming and Java

Week 2: Java Programming Elements

Week 3: Input-Output Handling in Java

Week 4: Encapsulation

Week 5: Inheritance

Week 6: Exception Handling

Week 7: Multithreaded Programming

Week 8: Java Applets and Servlets

Week 9: Java Swing and Abstract Windowing Toolkit (AWT)

Week 10: Networking with Java

Week 11: Java Object Database Connectivity (ODBC)

Week 12: Interface and Packages for Software Development



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Programming, Data Structures And Algorithms Using Python

By Prof. Madhavan Mukund | Chennai Mathematical Institute

Learners enrolled: 41331



This course is an introduction to programming and problem solving in Python. It does not assume any prior knowledge of programming. Using some motivating examples, the course quickly builds up basic concepts such as conditionals, loops, functions, lists, strings and tuples. It goes on to cover searching and sorting algorithms, dynamic programming and backtracking, as well as topics such as exception handling and using files. As far as data structures are concerned, the course covers Python dictionaries as well as classes and objects for defining user defined datatypes such as linked lists and binary search trees.

Summary

Course Status :	Completed
Course Type :	Elective
Duration :	8 weeks
Category :	<ul style="list-style-type: none">◦ Computer Science and Engineering◦ Programming◦ Data Science◦ Artificial Intelligence◦ Foundations of Computing
Credit Points :	2
Level :	Undergraduate
Start Date :	24 Jan 2022
End Date :	18 Mar 2022





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INTENDED AUDIENCE: Students in any branch of mathematics/science/engineering, 1st

Exam Date : 27 Mar 2022 IST



PREREQUISITES: School level mathematics.

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

INDUSTRY SUPPORT: This course should be of value to any company requiring programming skills.

This is an AICTE approved FDP course

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Course layout

Week 1

Informal introduction to programmin, algorithms and data structures viagcd
 Downloading and installing Python
 gcd in Python: variables, operations, control flow - assignments, condition-als, loops, functions

Week 2

Python: types, expressions, strings, lists, tuples
 Python memory model: names, mutable and immutable values
 List operations: slices etc
 Binary search
 Inductive function denitions: numerical and structural induction
 Elementary inductive sorting: selection and insertion sort
 In-place sorting





analysis: input size, asymptotic complexity, About Swayam (<https://swayam.gov.in/about>) | All Courses |

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(<https://swayam.gov.in/>)

Merge sort

Quick sort

Stable sorting

(https://swayam.gov.in/nc_details/NPTEL)

Week 4

Dictionaries

More on Python functions: optional arguments, default values

Passing functions as arguments

Higher order functions on lists: map, lter, list comprehension

Week 5

Exception handling

Basic input/output

Handling files

String processing

Week 6

Backtracking: N Queens, recording all solutions

Scope in Python: local, global, nonlocal names

Nested functions

Data structures: stack, queue

Heaps

Week 7

Abstract datatypes

Classes and objects in Python

"Linked" lists: find, insert, delete

Binary search trees: find, insert, delete

Height-balanced binary search trees

Week 8

Efficient evaluation of recursive definitions: memoization

Dynamic programming: examples

Other programming languages: C and manual memory management

Other programming paradigms: functional programming

Books and references

NIL





(<https://swayam.gov.in/>)



Prof. Madhavan Mukund

Chennai
Mathematical
Institute

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Prof. Madhavan Mukund studied at IIT Bombay (BTech) and Aarhus University (PhD). He has been a faculty member at Chennai Mathematical Institute since 1992, where he is presently Professor and Director. His main research area is formal verification. He has active research collaborations within and outside India and serves on international conference programme committees and editorial boards of journals.

He has served as President of both the Indian Association for Research in Computing Science (IARCS) (2011-2017) and the ACM India Council (2016-2018). He has been the National Coordinator of the Indian Computing Olympiad since 2002. He served as the Executive Director of the International Olympiad in Informatics from 2011-2014.

In addition to the NPTEL MOOC programme, he has been involved in organizing IARCS Instructional Courses for college teachers. He is a member of ACM India's Education Committee. He has contributed lectures on algorithms to the Massively Empowered Classroom (MEC) project of Microsoft Research and the QEEE programme of MHRD.

Course certificate

The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.

The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).

Date and Time of Exams: **27 March 2022** Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.

Registration url: Announcements will be made when the registration form is open for registrations.

The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.

Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE




 We have an unproctored programming exam also apart from the Proctored
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 Final score = Assignment score + Unproctored programming exam score + Proctored
 Exam score
https://swayam.gov.in/noc_details/NPTEL

Assignment score = 25% of average of best 6 assignments out of the total 8 assignments given in the course.

- (All assignments in a particular week will be counted towards final scoring - quizzes and programming assignments).
- Unproctored programming exam score = 25% of the average scores obtained as part of Unproctored programming exam - out of 100
- Proctored Exam score =50% of the proctored certification exam score out of 100

YOU WILL BE ELIGIBLE FOR A CERTIFICATE ONLY IF ASSIGNMENT SCORE >=10/25 AND UNPROCTORED PROGRAMMING EXAM SCORE >=10/25 AND PROCTORED EXAM SCORE >= 20/50.

If any one of the 3 criteria is not met, you will not be eligible for the certificate even if the Final score >= 40/100.

Certificate will have your name, photograph and the score in the final exam with the breakup. It will have the logos of NPTEL and IIT Madras .It will be e-verifiable at npTEL.ac.in/noc (<http://npTEL.ac.in/noc>).

Only the e-certificate will be made available. Hard copies will not be dispatched.

Once again, thanks for your interest in our online courses and certification. Happy learning.

- NPTEL team



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Initiative by : Ministry of Education (Govt of India)



Week 1:

BASICS OF PYTHON SPYDER (TOOL)

- Introduction Spyder
- Setting working Directory
- Creating and saving a script file
- File execution, clearing console, removing variables from environment, clearing environment
- Commenting script files
- Variable creation
- Arithmetic and logical operators
- Data types and associated operations

Week 2:

Sequence data types and associated operations

- Strings
- Lists
- Arrays
- Tuples
- Dictionary
- Sets
- Range

NumPy

- ndarray

Week 3:

Pandas dataframe and dataframe related operations on Toyota Corolla dataset

1. Reading files
2. Exploratory data analysis
3. Data preparation and preprocessing

Data visualization on Toyoto Corolla dataset using matplotlib and seaborn libraries

1. Scatter plot
2. Line plot
3. Bar plot
4. Histogram
5. Box plot
6. Pair plot

Control structures using Toyota Corolla dataset

1. if-else family
2. for loop
3. for loop with if break
4. while loop

Week 4: CASE STUDY

Regression

1. Predicting price of pre-owned cars

Classification

1. Classifying personal income



SELECTION OF NANOMATERIALS FOR ENERGY HARVESTING AND STORAGE APPLICATIONS

PROF. KAUSHIK PAL

Department of Mechanical and Industrial Engineering
IIT Roorkee

INTENDED AUDIENCE : UG & PG students of Metallurgy, Nano Science & Nanotechnology, Chemical Engg, Chemistry, Electronics, Electrical, Physics, and Material Science etc. R&D personnels from industries

COURSE OUTLINE :

Selection of nanomaterials for energy harvesting and storage applications is an interdisciplinary course which deals with selection of nanomaterials and key challenges to improve performance of the energy harvesting and storage devices/techniques. In this course we will be covering different energy harvesting and storage techniques and the parameters that are to be considered in selecting the nanomaterials for the same.

ABOUT INSTRUCTOR :

Prof. Kaushik Pal is an Associate Professor in Department of Mechanical and Industrial Engineering, IIT Roorkee since 2012. He has obtained his Ph.D Degree (2009) from IIT, Kharagpur and then joined to Gyeongsang National University, South Korea for pursuing Post-Doc research. His fields of interests are surface modification of nano-materials and use of such materials in different electronic, mechanical and bio-medical applications. Currently, he is acting as reviewer of several internationally known journals and an active member of National Academy of Sciences, American Chemical Society (ACS) and Royal Society of Chemistry (RSC). Also, he is the recipient of Brain Korea (BK-21) fellowship award and DAAD fellowship award.

COURSE PLAN :

Week 1:

Introduction, Criteria for choosing the nanomaterials for energy harvesting and storage applications, Brief discussion about all types of energy harvesting and storage systems, Solar energy, Nanomaterials used for solar energy, Types of solar energy, Solar thermal and heat transfer fluids with example.

Week 2:

Hydrogen energy: Introduction, Nanomaterials used for hydrogen energy generation, Methods to produce hydrogen energy, Hydrogen production from fossil fuels and biomass, thermo-chemical process, electrolysis, solar and biological, Key Challenges for hydrogen energy generation.

Week 3:

Nanogenerators: Introduction, Types of Nanogenerators: Piezoelectric, Thermoelectric, Pyro-electric, Electromagnetic, and Triboelectric, Key challenges for choosing nanomaterials for nanogenerators, Other conventional energy generation techniques: Wind energy, Tidal, Thermal, hydro power generation, Nuclear and geothermal energy production.

Week 4:

Energy storage, Nanomaterials used for energy storage, key challenges for energy storage, Solution of key challenges, Type of energy storages: Electrochemical (Batteries), Supercapacitor, Hydrogen storage, Thermal energy storage.



SMART MATERIALS AND INTELLIGENT SYSTEM DESIGN

PROF. BISHAKH BHATTACHARYA

Department of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 4 weeks (21 Feb'22 - 18 Mar'22)

EXAM DATE : 24 Apr 2021

INTENDED AUDIENCE : People aiming to explore advance areas.

PRE-REQUISITES : Basics of Nature and Properties of Materials, Linear algebra

INDUSTRIES APPLICABLE TO : Aerospace, Automobile, Manufacturing industries

COURSE OUTLINE :

Smart Structures and Intelligent System are becoming an integral part of new aerospace and automobile systems due to high performance and fast response potential. Knowledge in this field is multi-disciplinary in nature involving materials, composites, basic electronics, control system and informatics. In this short course, I intend to convey the core flavor of the field by introducing the basic concepts behind such system along with some industrial applications developed in the SMSS laboratory of IIT Kanpur.

ABOUT INSTRUCTOR :

Prof. Bishakh Bhattacharya is currently Dr. Gurumukh D. Mehta and Veena M. Mehta Chair Professor at the Department of Mechanical Engineering and joint faculty at Cognitive Science and Technology, IIT Kanpur. His research interest primarily lies in vibration control, structural health monitoring, energy harvesting system, intelligent system design and Child-Reconfigurable Robot Interaction. He is the coordinator of Space Technology Cell, IIT Kanpur and head of the SMSS (Smart Materials, Structures and Systems) Laboratory.

<http://home.iitk.ac.in/~bishakh/>

COURSE PLAN :

Week 01 : Introduction to Smart Materials

Week 02 : Mechanics of Composite Materials

Week 03 : Induced Strain Actuation Mechanisms

Week 04 : Intelligent System Design

- Motivation for Computing
- Welcome to Programming!!
- Variables and Expressions : Design your own calculator
- Loops and Conditionals : Hopscotch once again
- Lists, Tuples and Conditionals : Lets go on a trip
- Abstraction Everywhere : Apps in your phone
- Counting Candies : Crowd to the rescue
- Birthday Paradox : Find your twin
- Google Translate : Speak in any Language
- Currency Converter : Count your foreign trip expenses
- Monte Hall : 3 doors and a twist
- Sorting : Arrange the books
- Searching : Find in seconds
- Substitution Cipher : What's the secret !!
- Sentiment Analysis : Analyse your Facebook data
- 20 questions game : I can read your mind

- Permutations : Jumbled Words
- Spot the similarities : Dobble game
- Count the words : Hundreds, Thousands or Millions.
- Rock, Paper and Scissor : Cheating not allowed !!
- Lie detector : No lies, only TRUTH
- Calculation of the Area : Don't measure.
- Six degrees of separation : Meet your favourites
- Image Processing : Fun with images
- Tic tac toe : Let's play
- Snakes and Ladders : Down the memory lane.
- Recursion : Tower of Hanoi
- Page Rank : How Google Works !!



WASTEWATER TREATMENT AND RECYCLING

PROF. MANOJ KUMAR TIWARI

Department of Civil Engineering
IIT Kharagpur

INTENDED AUDIENCE : The course will be beneficial for B.Tech/M.Tech/B.Sc/M.Sc/Research Scholars/Faculty members from different institutions. In addition, we will strongly encourage engineers/professionals working in any area related to waste management should consider taking advantage from this unique application orientated course. Regulators (SPCB, CPCB and MOEF professionals) and policy makers will also benefit from this course.

PRE-REQUISITES : Environmental Sciences, Introduction to Environmental Engineering

INDUSTRIES APPLICABLE TO : Larsen and Turbo, Tata Group of Industries, Ramky Group of Industries, IF&LS Environment

COURSE OUTLINE :

This course has emphasises on Integrated Solid Waste Management aspects within the broad subject area of Integrated Waste Management for a Smart City. The issues of Municipal Solid Waste (MSW) management, Construction and Demolition (C&D) Waste and Electronic Waste Management will be covered in this course. The topics will include: generation rates and waste composition; Integrated waste management issues, collection, recovery, reuse, recycling, energy-from-waste, and landfilling; Biological treatment of the organic waste fraction - direct land application, composting, and anaerobic digestion. The environmental impact of waste management and its relationship on the big picture sustainable development and smart city development will be discussed. A major focus of this course will be the role of MSW management within the various initiatives of the Govt. of India including: Swachh Bharat Mission, Smart Cities as well as Make in India. The challenges of waste management for smart cities will also be discussed taking case studies from the first list of 20 smart cities identified in the first phase for this program. This will be followed by overview of the Construction and Demolition (C&D) Waste and Electronic Waste (E-Waste) management issues in India in general and for the smart cities in particular. The new rules with respect of C&D Waste and E-Waste Management will be covered. The challenges of managing these waste streams effectively will be discussed.

ABOUT INSTRUCTOR :

Prof. Manoj Kumar Tiwari [Ph.D. (IIT Kanpur)] is a civil engg. graduate with specialization in environmental engg. and holds expertise in water and wastewater treatment, water distribution systems, water pricing, and contaminant fate and transport. He is a recipient of prestigious Fulbright Fellowship. Prof. Tiwari has co-authored several papers in apex international journals, and has presented his research in various top ranked conferences across the globe. Prof. Tiwari has over 8 years of teaching experience with both UG as well as PG level course. He has designed several new courses at IIT Kharagpur for Masters programme in Water Engineering and Management. He has delivered several invited lectures at various organizations, and has also conducted short-term course under Technical Education Quality Improvement Programme (TEQIP) with participants ranging from Faculties and Ph.D. students from NITs to field professionals working in government organizations as well as private companies.

COURSE PLAN :

Week 1 : Introduction: General outline; Introduction to wastewater; Various sources and types of wastewater; Need of wastewater management; Concept of wastewater treatment and recycling

Week 2 : Wastewater Generation and Characteristics: Wastewater generation and quantity estimation; Water quality parameters and standards (COD, BOD, DO, Solids, Nutrients, metals and emerging contaminants); Sources specific wastewater physical and chemical characteristics

Week 3 : Natural Attenuation of Pollutants in Wastewater: Concept of natural attenuation; Wastewater discharge in rivers; Attenuation of pollutants on land application.

Week 4 : Treatment Philosophy: Objectives of wastewater treatment; Concept of mass balance; kinetics and equilibrium processes; Reactors tanks; Continuously mixed tank

reactors; Plug-flow reactors Introduction to primary, secondary and tertiary treatment;

Week 5 : Preliminary and Primary Treatment Processes: Screening; Grit removal; Equalization tank; Sedimentation theory; Rectangular and circular sedimentation tanks

Week 6 : Secondary Treatment Processes: Biological treatment of wastewater; Microbial ecology and growth kinetics; Types of microorganisms; Aerobic and anaerobic processes; Suspended and attached growth systems; Activated sludge process; Trickling filters and Rotating biological contactors

Week 7 : Secondary Treatment Processes - Anaerobic: Anaerobic treatment; Anaerobic decomposition of organic matter; Fluidized bed systems; Upflow anaerobic sludge blanket systems; Biogas production and collection; other reactor configurations

Week 8 : Sludge Management: The quantity and characteristics of sewage sludge; Sludge dewatering, drying, and thickening; Sludge digestion; Aerobic and anaerobic sludge stabilization; Composting

Week 9 : Tertiary (Advanced) Treatment Processes: Need and Objectives of advanced treatment; Nutrient (N and P) removal; Chemical treatment processes; Advanced oxidation processes; Adsorption and Ion-exchange; Membrane processes

Week 10 : Current Treatment Approaches: Conventional systems; Integrated treatment systems; Advanced reactor configurations; SBR, MBR and MBBR; Application and case studies

Week 11 : Wastewater Recycling: Scope and demands; Types and stages of recycling; Recycling requirements; Designated reuse criteria; centralized vs decentralized recycling systems.

Week 12 : Technology Selection and Decision Making: Research trends in wastewater treatment and recycling; Choice modelling and decision making; Risks and challenges; Socio-economic perspectives; Case studies



WELDING METALLURGY

PROF. PRADEEP K. JHA

Department of Metallurgy and Material Science
IIT Roorkee

TYPE OF COURSE : Rerun | Core | PG/UG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 24 Apr 2022

PRE-REQUISITES : Introduction to courses such as Welding processes, Materials science etc.

INDUSTRIES APPLICABLE TO : Manufacturing Industries like SAIL, BHEL etc.

COURSE OUTLINE :

The course focuses on understanding the metallurgy and solidification of weldments. The course will make the students aware with the metallurgical aspects of welding. For getting a sound weld, the students are required to be aware of the science behind the welding phenomena, especially in the domain of weld metal solidification, heat transfer, heat treatment processes, strengthening mechanisms etc. The course will be useful for engineering graduates as well as professionals working in the area of welding.

ABOUT INSTRUCTOR :

Prof. Pradeep K. Jha is presently working as Associate Professor in the Department of Mechanical & Industrial Engineering at IIT Roorkee. He has been teaching the courses related to manufacturing technology and theory of production processes to undergraduate and postgraduate students for more than 12 years. He is actively involved in research work related to production processes, especially casting and welding processes.

COURSE PLAN :

Week 1: Introduction to welding metallurgy, phase diagrams

Week 2: Phase transformation, TTT and CCT diagrams

Week 3: Metal strengthening approaches

Week 4: Heat treatment processes for weldments

Week 5: Analysis of heat flow and temperature distribution in welding

Week 6: Concept of solidification in welding, constitutional supercooling

Week 7: Introduction to heat affected zones, Properties of HAZ

Week 8: Residual stresses in welding, Preheat and postweld heat treatment

Week 9: Types of welding distortion and its control

Week 10: Cracks in welds

Week 11: Weldability issues in materials

Week 12: Welding defects, Design considerations in welding



WELDING OF ADVANCED HIGH STRENGTH STEELS FOR AUTOMOTIVE APPLICATIONS

PROF. MURUGAIYAN AMIRTHALINGAM

Department of Metallurgical and Materials Engineering
IIT Madras

INTENDED AUDIENCE : Final year bachelors and masters students in Metallurgy, Mechanical, Automobile and Production Engineering. Industrial personnel working in automotive and steel making industries.

PRE-REQUISITES : Final year B.E/B.Tech students or Graduates of Metallurgical/Mechanical/Automobile/Production Engineering, Basic knowledge of steel physical metallurgy and welding processes.

INDUSTRIES APPLICABLE TO : All automotive manufacturers and their OEMs and Steel plants.

COURSE OUTLINE :

The use of advanced high strength steels (AHSS) is increasingly preferred in automotive applications due to improved crash energy management and enhanced strength-ductility combinations, resulting in greener and safer vehicles. The weldability of AHSS is generally poorer than conventional steels due to the high alloying contents required to obtain multi-phase microstructure. This course is aimed to discuss the (i) role of alloying elements in stabilizing multi-phase microstructures of AHSS, (ii) effect of weld thermal cycles on the evolution of microstructures and (iii) weldability of AHSS.

ABOUT INSTRUCTOR :

Prof. Murugaiyan Amirthalingam is currently working as an Assistant Professor in IIT-Madras. His research interests include welding metallurgy, welding processes development, steel product development and additive manufacturing

COURSE PLAN :

Week 01 : Introduction to physical metallurgy of advanced high strength steels

Week 02 : Introduction to welding processes in automotive industries (Advanced Gas Metal Arc, Resistance Spot and Laser Welding Processes).

Week 03 : Welding metallurgy of advanced high strength steels – Effect of weld thermal cycles on the stability of phases, solidification behaviour, segregation and hot cracking susceptibility.

Week 04 : Mechanical properties of advanced high strength steel weldments – Tensile shear testing, HAZ softening characteristics, role of modified weld thermal cycles (post pulsing and post weld heat treatments) to improve the mechanical properties.