COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

COIMBATORE - 641 014, TAMILNADU, INDIA

DIAMOND JUBILEE

(1956 - 2016)

DEPARTMENT OF COMPUTER APPLICATIONS

MASTER OF COMPUTER APPLICATIONS

Curriculum and Syllabi

Under Choice Based Credit System

(For the students admitted during 2018 - 2019 and onwards)

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COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

VISION AND MISSION OF THE INSTITUTE

VISION

The Institute strives to inculcate a sound knowledge in Engineering along with realized social responsibilities to enable its students to combat the current and impending challenges faced by our country and to extend their expertise to the global arena.

MISSION

The Mission of CIT is to impart high quality education and training to its students to make them World-Class Engineers with a foresight to the changes and problems, and pioneers to offer innovative solutions to benefit the nation and the world at large.

COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

DEPARTMENT OF COMPUTER APPLICATIONS

VISION AND MISSION

VISION

The Department of Computer Applications strives to groom students with diverse backgrounds into competitive software professionals and pioneering leaders in offering innovative solutions to dynamic global challenges in tune with the needs of the society.

MISSION

The Mission of Department of Computer Applications is to :

M1 Provide an environment for students to gain expertise in theoretical foundations of computer applications with emphasis on strong practical training that will enable them to develop real world applications catering to the global needs.

M2 Offer students a quality learning process in a research oriented environment with industrial collaboration that motivates them to innovate and explore.

M3 Develop intellectual curiosity and a commitment to lifelong learning in students, with societal and environmental concerns.

COIMBATORE INSTITUTE OF TECHNOLOGY

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DEPARTMENT OF COMPUTER APPLICATIONS

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs for MCA programme are designed based on the Department Mission.

MCA Graduates will be able to :

PEO 1 : Develop software solutions to problems across a broad range of application domains through analysis and design.

PEO 2 : Contribute to research of their chosen field and function and communicate effectively, to perform both individually and in a multi-disciplinary team.

PEO 3 : Continue the process of life-long learning through professional activities; adapt themselves with ease to new technologies, while exhibiting high ethical and professional standards.

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DEPARTMENT OF COMPUTER APPLICATIONS

PROGRAMME OUTCOMES (POs)

The following are Programme Outcomes for the MCA Programme :

PO1 : Graduates will be able to apply knowledge of computing fundamentals, computing specialization and domain knowledge for the abstraction and conceptualization of computing models from defined problems and requirements.

PO2 : Graduates will have the ability to understand and analyze a given real-world problem and propose feasible computing solutions.

PO3 : Graduates will be able to analyze customer requirements, create high level design, implement and document robust and reliable software systems.

PO4 : Graduates will be able to transform complex business scenarios and contemporary issues into problems, investigate, understand and propose integrated solutions using emerging technologies.

PO5 : Graduates will be able to use the techniques, skills and modern hardware and software tools necessary for innovative software solutions.

PO6 : Graduates will possess leadership and managerial skills with best professional ethical practices and social concern.

PO7 : Graduates will recognize the need for self-motivation to engage in lifelong learning.

PO8 : Graduates will be able to master fundamental project management skills, concepts and techniques, set attainable objectives and ensure positive results, meeting scope, time and budget constraints.

PO9 : Graduates will be able to communicate technical information effectively, both orally and in writing

PO10 : Graduates will be able to recognize the social, professional, cultural, and ethical issues involved in the use of computer technology and give them due consideration in developing software systems.

PO11 : Graduates will be able to work collaboratively as a member or leader in multidisciplinary teams.

PO12 : Graduates will be able to assess the need for innovation and initiate the process through entrepreneurship or otherwise.

COIMBATORE INSTITUTE OF TECHNOLOGY

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MASTER OF COMPUTER APPLICATIONS

UNDER CHOICE BASED CREDIT SYSTEM

Curriculum from the Academic Year 2018 - 2019 onwards

Semester I

Course Code	Course Name	L	T	P	C	Category
	THEORY					
18MCA11	Theory of Computing	3	0	0	3	FC
18MCA12	Data Structures	3	0	0	3	FC
18MCA13	Programming in C	3	0	0	3	PC
18MCA14	Computer Organization	3	0	0	3	FC
18MCA15	Probability and Statistics	3	0	0	3	PC
	PRACTICALS					
18MCA16	C Programming Laboratory	0	0	4	2	PC
18MCA17	User Experience Laboratory	0	0	4	2	FC
18MCA18	Statistics Laboratory	0	0	4	2	FC
18MCA19	Communication Skills	0	0	2	1	EEC
	TOTAL CREDITS				**22**	

Semester II

Course Code	Course Name	L	T	P	C	Category
	THEORY					
18MCA21	Design and Analysis of Algorithms	3	0	0	3	FC
18MCA22	Object Oriented Principles and Programming in JAVA	3	0	0	3	PC
18MCA23	Principles of Operating System	3	0	0	3	PC
18MCA24	Database Management Systems	3	0	0	3	PC
18MCA25	Software Engineering	3	0	0	3	PC
	PRACTICAL					
18MCA26	Algorithms and Operating Systems Laboratory	0	0	4	2	PC
18MCA27	Object Oriented Programming Laboratory	0	0	4	2	PC
18MCA28	RDBMS Laboratory	0	0	4	2	PC
18MCA29	Professional English	0	0	2	1	EEC
	TOTAL CREDITS				**22**	

Semester III

Course Code	Course Name	L	T	P	C	Category
	THEORY					
18MCA31	Numerical Methods and Applied Statistics	4	0	0	4	FC
18MCA32	Computer Networks	3	0	0	3	PC
18MCA33	Artificial Intelligence	3	0	0	3	PC
18MCA34	SOA and Web Services	3	0	0	3	PC
	Elective I	3	0	0	3	PE
	PRACTICAL					
18MCA35	Advanced Programming Laboratory	0	0	4	2	PC
18MCA36	Artificial Intelligence Laboratory	0	0	4	2	PC
18MCA37	Network Programming Laboratory	0	0	4	2	PC
18MCA38*	Personality Development					EEC
	TOTAL CREDITS				**22**	

Semester IV

Course Code	Course Name	L	T	P	C	Category
	THEORY					
18MCA41	Operations Research	4	0	0	4	FC
18MCA42	Data Mining and Warehousing	3	0	0	3	PC
18MCA43	Accounting and Financial Management	4	0	0	4	PC
	Elective II	3	0	0	3	PE
	Elective III	3	0	0	3	PE
	PRACTICAL					
18MCA44	Data Mining Laboratory	0	0	4	2	PC
	Elective Laboratory	0	0	4	2	PE
18MCA45	Mini Project	0	0	4	2	EEC
	TOTAL CREDITS				**23**	

Semester V

Course Code	Course Name	L	T	P	C	Category
	THEORY					
18MCA51	Software Testing and Quality Assurance	3	0	0	3	PC
18MCA52	Cryptography and Network Security	3	0	0	3	PC
	Elective IV	3	0	0	3	PE
	Elective V	3	0	0	3	PE
	Elective VI	3	0	0	3	PE
	PRACTICAL					
18MCA53	Software Testing Laboratory	0	0	4	2	PC
18MCA54	Information Security Laboratory	0	0	4	2	PC
18MCA55*	Professional Ethics					EEC
	TOTAL CREDITS				**19**	

Semester VI

Course Code	Course Name	L	T	P	C	Category
18MCA61	Project work and Viva voce				18	EEC
	TOTAL CREDITS				**18**	

TOTAL = 126

Professional Electives

Course Code	Course Name	L	T	P	C	Category
	INFORMATION TECHNOLOGY ELECTIVES					
18MCAE01	Virtualization and Cloud Computing	3	0	0	3	PE
18MCAE02	Graphics and Multimedia	3	0	0	3	PE
18MCAE03	Advanced Database Management Systems	3	0	0	3	PE
18MCAE04	Distributed Systems	3	0	0	3	PE
18MCAE05	Grid and Cluster Computing	3	0	0	3	PE
18MCAE06	Internet of Things	3	0	0	3	PE
18MCAE07	Software Metrics and Measurement	3	0	0	3	PE
18MCAE08	Agile Methods for Software Development	3	0	0	3	PE
18MCAE09	Open Source Ecosystem	3	0	0	3	PE
18MCAE10	Software Architecture and Design Patterns	3	0	0	3	PE
18MCAE11	Enterprise Management and Computing	3	0	0	3	PE
18MCAE12	Basics of Robotics	3	0	0	3	PE
18MCAE13	GPU and Parallel Programming	3	0	0	3	PE
18MCAE14	Digital Image Processing	3	0	0	3	PE
	MANAGEMENT ELECTIVES					
18MCAE15	Organizational Behavior	3	0	0	3	PE

Course Code	Course Name	L	T	P	C	Category
18MCAE16	Principles of Management	3	0	0	3	PE
18MCAE17	Principles of Environmental Science	3	0	0	3	PE
18MCAE18	E-Commerce	3	0	0	3	PE
18MCAE19	Decision Making	3	0	0	3	PE
18MCAE20	Entrepreneurship Development	3	0	0	3	PE
	FINANCIAL TECHNOLOGY ELECTIVES					
18MCAE21	E-Portfolio Management	3	0	0	3	PE
18MCAE22	Financial Techniques and Analysis	3	0	0	3	PE
	DATA SCIENCE ELECTIVES					
18MCAE23	Machine Learning	3	0	0	3	PE
18MCAE24	Data Analytics	3	0	0	3	PE
18MCAE25	Natural Language Processing	3	0	0	3	PE
18MCAE26	Social Network Analysis	3	0	0	3	PE
18MCAE27	Intelligent Information Retrieval	3	0	0	3	PE
18MCAE28	Big Data Technologies	3	0	0	3	PE
	NETWORKING TECHNOLOGY ELECTIVES					
18MCAE29	Ad Hoc Networks	3	0	0	3	PE
18MCAE30	Internetworking Protocols and Management	3	0	0	3	PE
18MCAE31	Mobile Computing	3	0	0	3	PE
	LANGUAGE ELECTIVES					
18FY22F	Basic French	3	0	0	3	EEC
18FY22G	Basic German	3	0	0	3	EEC

PROFESSIONAL ELECTIVES - Labs

Course Code	Course Name	L	T	P	C	Category
18MCAEL01	Mobile Application Development Laboratory	0	0	4	2	PE
18MCAEL02	Graphics and Multimedia Laboratory	0	0	4	2	PE
18MCAEL03	Internet of Things Laboratory	0	0	4	2	PE
18MCAEL04	Natural Language Processing Laboratory	0	0	4	2	PE
18MCAEL05	Social Network Analysis Laboratory	0	0	4	2	PE
18MCAEL06	Virtualization and Cloud Computing Laboratory	0	0	4	2	PE

OPEN ELECTIVES OFFERED

Course Code	Course Name	L	T	P	C	Category
18MCAOE01	Accounting and Financial Management	3	0	0	3	OE
18MCAOE02	Basics of Java Programming	3	0	0	3	OE
18MCAOE03	C# and Dot Net Programming	3	0	0	3	OE
18MCAOE04	Python Programming	3	0	0	3	OE
18MCAOE05	Data Mining and Warehousing	3	0	0	3	OE
18MCAOE06	Natural Language Processing	3	0	0	3	OE
18MCAOE07	Social Network Analysis	3	0	0	3	OE

* Pass is required

FC - Foundation Course, PC - Professional Core, PE - Professional Elective, EEC - Employability Enhancement Course.

18MCA11 - THEORY OF COMPUTING

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to :

CO1 *: Understand different types of grammars and develop grammars to produce specific solutions*

CO2 *: Understand and develop designs for different machine types: finite automata, pushdown automata and Turing machines.*

CO3 *: Relate Partial recursive functions and Programming language design.*

CO4 *: Identify the paradigms of programming languages.*

CO5 *: Analyze the concepts of various components of programming languages and their interactions.*

GRAMMARS, FINITE STATE MACHINES, PUSH DOWN AUTOMATA

Chomsky Hierarchy of Grammars - Deterministic Finite State Machine - Non Deterministic Finite State Machine - Pumping Lemma for Regular Grammar. Deterministic Push Down Automata. Recognizing Context Free Grammars - Non Deterministic Push Down Automata and Ambiguous Context Free Grammars. **(9)**

TURING MACHINES AND COMPUTABILITY

Turing Machines - Recognizing Context Sensitive Grammars - Types of Turing machines - Halting problem - Partial and Primitive Recursive Functions-Computability - McCarthy's formalism - Properties of an Algorithm - Types of Algorithms. **(9)**

IMPERATIVE PROGRAMMING

Programming Paradigms - Statements: Structured Programming - Syntax - Directed Control Flow. Design Considerations: Syntax. Special Cases in Loops. Invariants. Partial Correctness. Control flow. Types: Data Representation - Role of Types - Basic Types Arrays - Records - Sets - Pointers - String Tables - Types and Error Checking-Procedure Activations - Activation Records - Parameter - Passing Methods - Scope Rules for Names - Nested Scopes in Source Text - Lexical Scope. **(9)**

OBJECT-ORIENTED PROGRAMMING

Groupings of Data and Operations-Constructs for Program Structuring-Information Hiding- Design with Modules-Modules and Defined Types-Class Declarations-Dynamic Allocation. Templates: Parameterized Types - Object - Oriented Programming-Object-Oriented Thinking- Inheritance-Derived Classes and Information Hiding-Objects in Smalltalk **(9)**

FUNCTIONAL PROGRAMMING

Elements of Functional Programming. Types: Values-Operations-Function Declarations. Approaches to Expression Evaluation-Lexical Scope-Type Checking- Functional Programming in a Typed Language - Exploring a List -Functions as First-Class Values-Exception handling - Functional Programming with Lists - Structure of Lists - List Manipulation- Storage Allocation for Lists.**(6)**

OTHER PARADIGMS

Logic Programming - Computing with Relations - Prolog:Data Structures - Programming Techniques - Control. **(3)**

TOTAL : 45

REFERENCE BOOKS

1. *EV Krishnamoorthy, "Introduction to Theory of Computation", East West Press,1983. (Sections 1 to 4)*
2. *Ravi Sethi , "Programming languages: Concepts and Constructs", 2nd Edition, Addison Wesley 1995. (Chapters 1, 3 to 11)*
3. *John E Hopcroft, Jeffrey D Ullman, "Introduction to Automata Theory Languages and Computatiom", Addision Wesley, 2006.*
4. *Michael Sipser, "Introduction to the Theory of Computation", PWS Publishing, 2006.*

5. *Ellis Horowitz, "Fundamentals of Programming Languages", Springer - Verlag, 1983.*
6. *Terrence W Pratt, Marvin Zelkowitz, "Programming Languages Design and Implementation", Pearson Education, 4th edition, 2003.*
7. *Peter Van Roy, Seif Haridi, "Theory of Computing: Concepts Techniques and Models of Computer Programming", MIT* Press, 2004.

MOOCs

1. *http://nptel.ac.in/courses/106104028/*
2. *http://nptel.ac.in/courses/106104148/*

18MCA12 - DATA STRUCTURES

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Choose and design data structures such as array, linked list, stack, queue, trees and graphs to effectively model information in a problem.*

CO2 : *Choose and apply operations like insertion, deletion, traversal and searching mechanism on various data structures relevant to a problem.*

CO3 : *Judge efficiency trade-offs between data structures.*

CO4 : *Apply standard algorithms for searching and sorting based on given problem.*

CO5 : *Apply algorithm analysis techniques to evaluate performance of an algorithm.*

BASIC CONCEPTS

System Life Cycle - Algorithm Specification - Data Abstraction - Primitive Data Structures - Iterative and Recursive algorithms - Performance Analysis - best case - worst case - average case complexities - Notations. **(5)**

ARRAYS

Array as an Abstract Data Type (ADT) - Polynomial ADT - Sparse Matrix ADT - Representation of Multidimensional Arrays - String ADT. **(8)**

STACKS AND QUEUES

Stack ADT - Queue ADT - Mazing Problem - Evaluation of Expressions - Multiple Stacks and Queues. **(6)**

LINKED LISTS

Pointers - Singly Linked Lists - Dynamically Linked Stacks and Queues - Polynomials - Additional List Operations - Equivalence Relations - Sparse Matrices - Doubly Linked Lists. **(8)**

TREES

Introduction - Binary Trees - Binary Tree Traversals - Additional Binary Tree Operations - Threaded Binary Trees - Heaps - Binary Search Trees. **(6)**

GRAPHS

Introduction - Elementary Graph Operations - Graph Traversal - Minimum Cost Spanning Trees - Shortest Paths. **(6)**

SEARCHING AND SORTING

Searching and List Verification - Insertion Sort - Quick Sort. **(6)**

TOTAL : 45

REFERENCE BOOKS

1. *Ellis Horowitz, Sartaj Sahni, Anderson Freed, "Fundamentals of Data Structures in C", Universities Press, 2nd Edition, 2008.*
2. *Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures - A Pseudocode Approach with C", Cengage Learning, 2nd Edition, 2007.*

3. *Yashavant P. Kanetkar, "Data Structures through C", BPB Publications, 2nd Edition, 2003.*
4. *Seymour Lipschutz, "Data Structures with C", Schaum's Outline Series, McGraw Hill Publications, 2nd Edition, 2014.*

MOOCs

1. *http://nptel.ac.in/courses/106102064/*
2. *http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html*

18MCA13 - PROGRAMMING IN C

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Analyze the given problem statement and develop an algorithm with the properties of finiteness, completeness and correctness.*

CO2 : *Understand the constructs of C programming language and apply them to develop simple C programs.*

CO3 : *Choose the suitable data type among Arrays, Pointers, Structure, Union, File to store and manipulate the data.*

CO4 : *Analyze the given problem, divide it into modules and represent them using functions.*

CO5 : *Design and develop programs based on given user requirements.*

ALGORITHMS

Introduction to problem solving - Problem solving Aspect - Top-down Design - Implementation of Algorithms - Program Verification - Modular Design - Programming Language - Types of Programming Language - Flowcharts - Development of Algorithm for simple problems: Exchanging the values of Two Variables - Summation of a set of numbers - Factorial Computation - Generation of Fibonacci Sequence - Reversing the digits of an Integer - Base Conversion - Character to Number Conversion - Greatest Common Divisor of Two Integers. **(8)**

C LANGUAGE

Overview of C - Basic data types - Identifier Names - Variables and Initialization - Constants - Operators - Expressions - Character based I/O - Line based I/O - Formatted I/O.

CONTROL STATEMENTS

Selection statements - Iteration statements - Branch statements - Expression statements - Preprocessor phase - Storage classes: Auto - Static - Extern and Register. **(7)**

FUNCTIONS

General form of a function - Accessing a function - Scope of a function - Passing Arguments to function - function prototype - Call by value - Call by reference - Recursion. **(8)**

ARRAYS AND POINTERS

Single Dimensional arrays - Multi Dimensional arrays - Passing arrays to a function - Arrays and Strings - Pointers: Definition - Pointer type declaration - Pointer assignment - Pointer initialization - Pointer variables - Pointer operators - Pointer Expressions - Pointer to an array - Array of pointers - Function pointers. **(8)**

STRUCTURES, UNION, ENUMERATIONS AND TYPEDEF

Structures - Array of Structures - Passing Structures to Function - Structure pointer - Self Referential Structures - Unions - Enumerations - Typedef. **(8)**

FILE AND PREPROCESSOR DIRECTIVES

File concept - File opening in various modes and closing of a file - Reading from a file - Writing onto a file. Preprocessor: Conditional Compilation directives - Macros - Command Line Arguments. **(6)**

TOTAL : 45

REFERENCE BOOKS

1. *Herbert Schildt, "C - The Complete Reference, McGraw Hill", 4h edition, 2009.*
2. *R.G. Dromey, "How to solve it by Computer", Pearson Education, 5th Edition, 2007.*
3. *Kernighan B.W. and Ritchie D.M., "C Programming Language (ANSI C)", Pearson Education, 2004*
4. *Yashawant Kanetkar, "Working with C", BPB, 5th Edition, 2008.*
5. *Terrence W Pratt, "Programming language: Design and Implementation", Prentice Hall of India, 4th Edition, 2001.*

MOOCs

1. *http://nptel.ac.in/courses/106104128/*
2. *https://www.edx.org/course/introductioncomputer-programming-part-1-iitbombayx-cs101- 1x-0*
3. *https://www.coursera.org/course/cplusplus4c*

18MCA14 - COMPUTER ORGANIZATION

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Demonstrate how to add and multiply integers and floating-point numbers using two's complement and IEEE floating point representation*

CO2 : *Equipped with the knowledge of register level computer operations , working of control memory and micro program*

CO3 : *Analyze and model the structure and functional units of digital computer, including overall system architecture, register requirements and digital components.*

CO4 : *Analyze different ways of communicating with I/O devices and standard I/O interfaces.*

CO5 : *Given a CPU organization, design a memory module for a given specification*

DATA REPRESENTATION

Data types - Fixed Point and Floating Point Representation - Representation of Signed Numbers, Arithmetic Operations on Signed numbers. **(6)**

REGISTER TRANSFER AND MICRO OPERATIONS

Register Transfer Language - Inter Register Transfer - Arithmetic Micro Operations - Logic Micro Operations - Shift Micro Operations - Control Functions. **(5)**

BASIC COMPUTER ORGANIZATION AND DESIGN

Instruction codes - Computer Registers - Computer Instructions - Timing and Control - Instruction cycle - Memory reference instructions - Input-output and Interrupts - Design of Basic Computer. **(7)**

MICROPROGRAMMED CONTROL

Control Memory - Address Sequencing - Micro Program Example. **(6)**

CENTRAL PROCESSING UNIT

Processor Bus Organization - Stack Organization - Instruction Formats - Addressing Modes - Data Transfer and Manipulation - Program Control - Multiprocessor Organization - RISC and CISC Machine Characteristics - Control Unit Design - Hardwired and Micro Programmed Control **(8)**

INPUT - OUTPUT ORGANIZATION

Peripheral Devices - Input -Output Interface - Asynchronous Data Transfer- Interrupt - Direct Memory Access **(7)**

MEMORY ORGANIZATION

Memory Hierarchy - Main Memory - Auxiliary Memory - Associative Memory - Cache Memory - Virtual Memory **(6)**

TOTAL : 45

REFERENCE BOOKS

1. *M.Morris Mano, “Computer System Architecture”, Third Edition, Pearson Education Inc, 2009*
2. *W. Stallings, "Computer Organization and Architecture - Designing for Performance", Prentice Hall of India, 2002.*
3. *Ravi Sethi, C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization", McGrawHill, 2002.*

MOOCs

1. *http://nptel.ac.in/courses/106106092/*
2. *http://nptel.ac.in/courses/106103068/*

18MCA15 - PROBABILITY AND STATISTICS

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Understand basic statistical concepts and measures.*

CO2 : *Apply the concepts of probability, distributions and sampling to different problems.*

CO3 : *Formulate and test the hypothesis about means, variances and proportions and draw conclusions based on the results of statistical tests.*

CO4 : *Associate random variables and distributions and to apply the principles of regression and correlation.*

CO5 : *Categorize and define sampling methods.*

SUMMARY STATISTICS

a) Measures of Central Tendency-arithmetic mean, median,mode,geometric mean and harmonic mean Merits and demerits-Relationship between mean, median and mode-Relationship AM, GM and HM, computation of the measures for grouped and ungrouped data-weighted arithmetic mean b) Measures of dispersion-range, mean deviation and standard deviation - coefficient of variation and its use- quartiles and inter quartile range-quintiles deciles and percentiles- moving averages -Skewness and Kurtosis and their uses. **(9)**

PROBABILITY

Deterministic and random experiments -Definition of sample space and events- classical and axiomatic definitions- Properties of probability- addition theorem- conditional probability and multiplication theorem of probability- Definition of independent events - Random variables and their probability distributions-Discrete and continuous random variables Probability mass function and cumulative distribution functions -definition - Mathematical expectation-mean and variance - Mean and variances of linear combination of random variables - Chebyshev's theorem- -Important discrete distributions-Discrete Uniform Distribution, Binomial, Poisson, -Continuous distributions: probability density functions and cumulative probability distributions-Normal distribution and its properties and applications-Partition of sample spaces-Total Probability theorem-Prior and Posterior probabilities-Bayesian theorem-Sample applications. **(11)**

SAMPLING

Population and sample- sampling and its need -sampling vs complete enumeration -parameter and statistics-Probability sampling and -random sampling- simple random sampling , lottery method and random number table method- stratified random sampling-sampling distribution and standard error of a statistic. **(5)**

CORRELATION AND REGRESSION

Definition of correlation - Scatter plot -Karl Pearson's correlation coefficient its properties- Definition of Regression - Simple regression and Multiple Regression- Fitting of equations--properties. **(6)**

TESTS OF HYPOTHESIS

Test of significance - Basic concepts - null hypothesis - alternative hypothesis - level of significance - Standard error and its importance - steps in testing-One and two tailed tests-The use of p-values for Decision making - Large sample tests and Small sample tests for : Single sample: Testing on a single mean with variance known and variance unknown-Two samples-tests on means -One sample test on a single proportion-two sample tests of two proportions-Goodness of Fit tests, One and two sample tests concerning variances-Tests of independence for categorical data, tests for homogeneity. **(14)**

TOTAL : 45

REFERENCE BOOKS

1. *S.C. Gupta - "Fundamentals of Statistics" - Sultan Chand & Sons, Delhi, 2005.*
2. *Ronald E.Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, "Probability and Statistics for Engineers and Scientists", 7th Edition, Pearson Education, Inc., Delhi, India, 2002.*
3. *Richard J.Larsen and Morris L.Marx, "An Introduction to Mathematical Statistics and Its Applications", 5th Edition, Prentice Hall, 2012.*
4. *Michael Baron, "Probability and Statistics for Computer Scientists", 2nd Edition, CRC Press, 2014.*
5. *Sheldon Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 4th Edition, Elsevier Inc., 2009.*

MOOCs

1. http://nptel.ac.in/courses/111105041/
2. http://nptel.ac.in/courses/111105090/

18MCA16 - C PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to :

CO1 *: Solve the given problem by devising an algorithm and implement using C.*

CO2 *: Write, compile and debug programs in C.*

CO3 *: Develop reusable and efficient solutions using appropriate operators, control structures, functions and/or recursive functions in C.*

CO4 *: Design and implement basic operations on data structures.*

CO5 *: Develop a simple project in application or system domain using C.*

CONCEPTS TO BE COVERED

1. Simple programs to understand the concepts of data types and using conditional, control and repetition statements.
2. Operations on one dimensional and multi-dimensional arrays.
3. Declaring and defining functions by passing arguments of value type and pointer type.
4. String operations.
5. Implementation of pointers, operations on pointers.
6. Stack and Queue implementation using arrays.
7. Linked list implementation.
8. Stack and Queue implementation using linked list.
9. Use dynamic memory allocation functions for storage allocation.
10. Defining and handling structures, array of structures, structure pointers, union and enumeration type.
11. Application programs using file operations.
12. Implementation of Binary Search Tree, Operations on BST (insertion, deletion, search, findmin, findmax) and Graph Traversal.

MOOCs

1. *https://www.coursera.org/learn/programming-fundamentals*
2. *https://www.coursera.org/learn/writing-running-fixing-code*
3. *https://www.coursera.org/learn/intro-programming*

18MCA17 - USER EXPERIENCE LABORATORY

L	T	P	C
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PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Design web pages using HTML/DHTML and style sheets.*

CO2 *: Develop and enhance static and dynamic web pages using CSS,JSP and PHP.*

CO3 *: Design and add functionalities to client and server side web pages with cookies, database connectivity and ActiveX control.*

CO4 *: Design and develop interfaces and apply techniques for navigation.*

CO5 *: Understand the differences between usability and user experience.*

CONCEPTS/ TOOLS TO BE COVERED

WEB SITE DEVELOPMENT

1. Using HTML, XHTML, XML
2. Using the features of CSS, JSP, PHP

WEB APPLICATION DEVELOPMENT

1. Client and server side scripting
2. Database connectivity concepts
3. Communication through JSP pages

INTERFACE AND NAVIGATION DESIGN

Exercises on designing interfaces and techniques for navigation.

USABILITY

Compare multiple user interfaces to evaluate usability criteria

MOOCs

1. *https://www.youtube.com/watch?v=EPrxCdeZPsA*
2. *https://www.youtube.com/watch?v=-SHXUwpVgXU*
3. *https://www.youtube.com/watch?v=7OSkB4BCx00*

18MCA18 - STATISTICS LABORATORY

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Understand and apply various statistical functions in Excel.*

CO2 *: Use SCILAB/R for solving mathematical problems.*

CO3 *: Perform data analysis for real world problems by applying statistical techiniques.*

CO4 *: Understand commands in EXCEL and SCILAB/R to perform matrix operations.*

CO5 *: Present data using graphs and charts and interpreting them.*

CONCEPTS TO BE COVERED

1. Introducing the features of EXCEL.
2. Arranging and formatting the set of elements using EXCEL.
3. Performing simple arithmetic and logical calculations using EXCEL.
4. Creating graphical charts using EXCEL.
5. Solving numerical problems using SCILAB/*R* tool.
6. Solving linear equations using SCILAB/*R* tool.
7. Matrix operations using EXCEL and SCILAB/*R* tool.

MOOCs

1. *http://nptel.ac.in/courses/111105041/*
2. *http://nptel.ac.in/courses/111105090/*

18MCA19 - COMMUNICATION SKILLS

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Apply each of the Syllable, Stress, Accent and Intonation Rules and all of the phonetic patterns and use appropriate patterns in a given situation or passage. Reconstruct a given sentence into a phonetic transcription.*

CO2 : *Apply the rules of grammar viz., Parts of Speech, Idioms, Phrasal Verbs, Concord, Cause and Effect and Purpose and Function and rewrite the given technical passage correcting the errors.*

CO3 : *Categorize the barriers to communication, formulate solutions and justify, plan, structure and present a 15 minutes presentation on technical topic given a communication context.*

CO4 : *Interpret the given graphical representation and compose passages. Summarize a technical text of 300 to 400 words into one third, write the process of working of an equipment, and given a social context compose appropriate dialogues using functional words.*

CO5 : *Specify appropriate responses and construct a summary, given short monologues and conversations.*

COMMUNICATION SKILLS

Introduction - Code and Content - Stimulus and Response: Source - The Encoding Process - The Channel - The Decoding Process - The Receiver - Speaking Skills - Effective Speaking Guidelines - Communicating Soft Skills: A Self-assessment - Closing Tips on Improving Speaking Skills.

INTRODUCTION TO SPEECH SOUNDS

Pronunciation Etiquette - Phonetics: Phonetic Chart - Exercise - Syllabus - Stress - Accent - Rhythm - Intonation

FOCUS ON LANGUAGE

Synonyms and Antonyms - Idioms - Phrasal Verbs - Nouns-Compound Nouns & Noun Phrases - Gerunds & Infinitives - Subject Verb Agreement- Tenses - Adjectives and Adverbs - Active Passive voice - Cause and Effect Sentences - Purpose and Function.

READING & WRITING

Reading Comprehension - Techniques for Good Comprehension - Skimming & Scanning -Sequencing of Sentences - Paragraph Construction - Paragraph Patterns - Kinds of Paragraph - Writing a First Draft, Revising & Finalizing - Steps to Effective Précis Writing - Process Description - Dialogue Writing

LISTENING & SPEAKING

Importance of Listening & Empathy in Communication - Reasons for Poor Listening - Traits of a Good listener - Listening Modes - Short Dialogues - Short Conversation Achieving Confidence, Clarity & Fluency - Paralinguistic Features - Barriers to Speaking - Types of Speaking - Persuasive Speaking - Public Speaking-Conversations - Telephonic Conversations & Etiquette - Effective Presentation Strategies - Planning - Outlining & Structuring - Nuances of Delivery.

REFERENCE BOOKS

1. *Meenakshi Raman, Sangeeta Sharma, "Technical Communication - English Skills for Engineers", Oxford University Press, New Delhi, 2015.*
2. *Kiranmani Dutt P., "A Course in Communication Skills", Cambridge University Press, 2011.*
3. *Samson T, "Innovate with English", Cambridge University Press, 2012.*
4. *Michael Mc Carthy and Felicity O'Dell, "English Vocabulary in Use", Cambridge University Press, 2012.*

18MCA21 - DESIGN AND ANALYSIS OF ALGORITHMS

L	T	P	C
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PRE-REQUISITES
18MCA12

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Understand the performance of a problem by using different algorithmic design techniques.*

CO2 *: Relate new data structures by augmenting existing data structures, and design algorithms that employ data structures.*

CO3 *: Identify the problem given and design the algorithm using various algorithm design techniques like Divide and Conquer, Greedy method, Dynamic Programming, Backtracking and Branch and Bound Technique*

CO4 *: Understand and implement a variety of advanced data structures (AVL Tree, Multiway Tree, B Tree, B+ Tree, Red Black Tree).*

CO5 *: Analyze and apply design techniques and make judgments about which particular design technique will improve performance of a problem*

TREES

AVL Trees - Properties - Rotations - Operations - Multiway Trees - Definition - m-way Search Tree- B-Trees **(8)**

ALGORITHM DESIGN TECHNIQUES

Divide & Conquer: General Method - Binary Search - Merge Sort - Insertion Sort - Quick Sort **(9)**

GREEDY METHOD

General Method - Knapsack Problem - Minimum Cost Spanning Trees-Prim's & Kruskal's Algorithm - Single Source Shortest Paths **(10)**

DYNAMIC PROGRAMMING

General Method - Multistage Graph- All Pairs Shortest Paths, Single Source Shortest Paths-General Weights-Traveling Sales Person Problem **(8)**

BACK TRACKING

General Method - Eight Queen's Problem-Graph Coloring -Branch & Bound - LC Search- Bounding Dunctions-0/1 Knapsack Problem-Traveling Sales Person Problem **(10)**

TOTAL: 45

REFERENCE BOOKS

1. *Richard F. Gilbery, Behrouz A.Forouzan, "Data structures - A Pseudocode Approach with C", 2002 Edition, Thomson Asia Pvt Ltd. (AVL Trees and Multiway trees)*
2. *Ellis Horowitz, Sartaj Sahni- Sanguthevar Rajasekaran, "Fundamental of Computer Algorithms", 2nd Edition, Universities Press, Hyderabad, 2008. (Algorithm Design Techniques)*
3. *Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivert, Clifford Stein, "Introduction to Algorithms", 2nd Edition, Prentice Hall of India, Publications, New Delhi, 2007. (Red Black Trees) Michael Sipser Introduction to the theory of computation PWS Publishing, 2006*
4. *Anany Levitin, "Introduction: The Design & Analysis of Algorithm", Pearson Education Inc., 2003.*

MOOCs

1. *https://onlinecourses.nptel.ac.in/noc17_cs09/preview*
2. *https://onlinecourses.nptel.ac.in/noc17_cs09/announcements*

18MCA22 - OBJECT ORIENTED PRINCIPLES AND PROGRAMMING IN JAVA

L	T	P	C
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PRE-REQUISITES

18MCA11

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Express in-depth knowledge on the basic features of Java Language like identifiers, keywords, operators, control structures and classes*

CO2 : *Apply all the object oriented concepts using language feature like classes, inheritance, packages, exception handling and interfaces.*

CO3 : *Implement concurrent programming techniques using Multi-Threading concept*

CO4 : *Create applications with efficient GUI programming and Event Handling*

CO5 : *Develop applications supported with back end programming in support with conventional databases*

INTRODUCTION AND JAVA ENVIRONMENT

How Computer Architecture Affects a Language ? - Why Java ? - Features of Java Language, JVM -The heart of Java - Java's Magic Bytecode. Installing Java - Java Program Development - Java Source File Structure - Compilation - Executions. **(3)**

BASIC LANGUAGE ELEMENTS

Variables - Keywords - Constants - Comments - Primitive Datatypes - Operators -Assignments. **(3)**

OBJECT ORIENTED PROGRAMMING

Class Fundamentals - Object & Object reference - Object Life time & Garbage Collection, Creating and Operating Objects - Constructors and initialization, Access Control, Modifiers, Design of Accessors and Mutator Methods - methods Nested - Argument Passing Mechanism, Method Overloading - Recursion - Dealing with Static Members - Finalize() Method -Native Method. Use of "this" reference - Use of Modifiers with Classes & Methods - Cloning Objects -shallow and deep cloning - Generic Class Types. **(6)**

EXTENDING CLASSES AND INHERITANCE

Use and Benefits of Inheritance in OOP - Types of Inheritance in Java - Inheriting Data members and Methods - Role of Constructors in inheritance - Overriding Super Class Methods - Use of "super" keyword - Polymorphism in inheritance - Type Compatibility and Conversion - Inner Class & Anonymous Classes -Abstract Class & Interfaces - Implementing interfaces **(6)**

PACKAGES AND EXCEPTION HANDLING

Organizing Classes and Interfaces in Packages - Package as Access Protection - Defining Package - CLASSPATH Setting for Packages - Making JAR Files for Library Packages Import and Static Import Naming Convention For Packages. Exceptions Hierarchy -Types of Exception - Control Flow In Exceptions, - Exception Handling : try - catch - finally - throw - throws. In-built and User Defined Exceptions. **(5)**

ARRAYS AND STRINGS

Defining an Array - Initializing & Accessing Array - Multi -Dimensional Array, Operation on String, Mutable & Immutable String - Using Collection Bases Loop for String - Tokenizing a String - Creating Strings using StringBuffer. **(4)**

THREAD

Definition - Need for Concurrent Programming - Thread Life-Cycle - Thread Priorities - Synchronizing Threads - Inter Communication of Threads - Mutual Exclusions and Deadlock. **(5)**

UTILITY FUNCTIONS AND INPUT/OUTPUT STREAMS

Utility Methods for Arrays - Observable and Observer Objects - Date & Times - Using Scanner Regular Expression - Input/Output Operation in Java(java.io Package) - Streams and the new I/O Capabilities: Understanding Streams -The Classes for Input and Output - The Standard Streams - File I/O Basics - Reading and Writing to Files - Buffer and Buffer Management - Read/Write Operations with File Channel - Serializing Objects **(5)**

GUI/EVENT HANDLING PROGRAMMING

JAVA SWING - Introduction - Container / Component Classes - Layouts - Aligning Components in Layouts. Event Handling: Listeners - MouseListeners and KeyListener - WindowListener - AWT: Introduction - Creating & Running an Applet page. **(6)**

DATABASE PROGRAMMING

Database Programming using JDBC - Introduction to JDBC - JDBC Drivers & Architecture - CURD operation Using JDBC - Connecting to conventional Databases **(2)**

TOTAL : 45

REFERENCE BOOKS

1. *Herbert Schildt, "Java The Complete Reference", Tata MCGraw Hill Publishing Company Limited, 9th Edition, 2014.*
2. *E. Balagurusamy, "Programming with Java:A Primer", Tata MCGrawHill Publishing Company Limited, 5th Edition, 2015.*
3. *Cay S. Horstmann, Gray Cornell, "Core Java Volume I - Fundamentals", Pearson Education, 9th Edition, 2013.*
4. *Herbert Schildt, "Java: A Beginners Guide", Tata MCGraw Hill Publishing Company Limited, 6th Edition, 2014*

MOOCs

1. *https://www.javaworld.com/article/2076075/learn-java/core-java-learn-java-from-the-ground-up.html*
2. *https://docs.oracle.com/javase/tutorial/java/index.html*

18MCA23 - PRINCIPLES OF OPERATING SYSTEM

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PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Demonstrate the structure of operating system, batch programming, system calls and virtual machines*

CO2 *: Demonstration of Kernel Management specific to concurrent process for Inter Process Communication systems*

CO3 *: Estimate system performance through scheduling algorithms - FIFO, round robin, priority, shortest job first*

CO4 *: Recognize memory allocation and de-allocation for both static and dynamic storage*

CO5 *: Design and develop a new simple File System using Disk and File System Management*

INTRODUCTION

Abstract view of an Operating system - extended view of resource manager - Over view: Simple batch system - multi programmed batch systems - time sharing systems - parallel systems - distributed systems - real time systems - system structure: IO structure- memory- CPU-Kernals and micro kernels - dual-mode operation - operating - system services - system calls - Structure of Operating system- Various components of Operating system **(8)**

PROCESS MANAGEMENT

Process Concepts - Process creation - Process Termination - Process states - Process Description - Process control - Relationship between process and threads - Thread State - Thread Scheduling- Thread Synchronization-Multithreading model - Concurrent Process -process synchronization: critical section problem - mutual exclusion - Dekker's algorithm -synchronization hardware - semaphore - classical problem of synchronization - critical regions - monitors - atomic transaction - race condition. Dead lock characterization - handling dead locks - prevention - avoidance - detection and recovery - combined approach **(10)**

PROCESSOR MANAGEMENT

Basic Concepts - scheduling criteria - preemptive versus non-preemptive scheduling - scheduling algorithms: FIFO - Shortest job first, priority, round robin, multi level queue - multi level feedback queue - multiprocessor scheduling **(9)**

MEMORY MANAGEMENT

Basic Concepts - logical versus physical address - swapping - Fixed partition and Dynamic partition - Simple paging - multi level paging - Inverted paging - simple segmentation-combined paging and segmentation - virtual memory - demand paging - thrashing - Working set model -demand segmentation. **(9)**

rel/O AND FILE MANAGEMENT

I/O: hardware - application I/O interface - Logical structure of I/O functions -I/O Buffering - Disk I/O - disk scheduling . File management: file concepts - access methods - directory structure - file system structure - allocation methods - free space management. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Abraham Silberschatz. A, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", John Wiley, 2013.*
2. *William Stallings, "Operating Systems: Internals and Design Principles", Prentice-Hall, 2008.*
3. *H.M.Dietel, "An Introduction to Operating Systems", Addison Wesley, 2nd Edition,2007.*
4. *Andrew S. Tanenbaum, "Modern Operating Systems", Prentice Hall of India Pvt. Ltd, 2008.*

MOOCs

1. *nptel.ac.in/courses/106106144/*
2. *nptel.ac.in/courses/Webcourse-contents/IISc.../Operating%20Systems/New_index1.html*

18MCA24 - DATABASE MANAGEMENT SYSTEMS

L	T	P	C
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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Consent of the Instructor

CO1 : *Identify the components of RDMS software and its significance.*

CO2 : *Analyze the data requirements and create conceptual design of the database using Entity Relationship model.*

CO3 : *Identify functional dependencies and apply normalization techniques to optimize the data design.*

CO4 : *Write SQL queries based on the functional requirements of any real world database applications.*

CO5 : *Implement different concurrency control techniques in transactions and recovery mechanisms used in database.*

DATABASES AND DATABASE USERS

Introduction - Characteristics of the database approach - Actors - Advantages- Database system, Concepts and Architecture: Data models, schemas and instances - Three schema architecture - Data Independence - DBMS Languages and Interfaces - DBMS component modules - Centralized DBMS architecture - Basic Client/Server Architecture. **(6)**

DATA MODELING

Using high-level conceptual data models - Entity types, Entity sets, Attributes and Keys, Relationship types, Relationship sets, roles and structural constraints, Weak entity types - ER Naming conventions-Examples of ER design - Relationship types of degree higher than two- EER Model: Subclasses, Super classes and Inheritance-Specialization and Generalization **(7)**

RELATIONAL DATA MODEL

Relational Model Concepts - Relational Model Constraints - Relational Database Schemas - Update Operations, Transaction and Dealing with Constraint Violations. Relational Algebra and Calculus - Unary Operations - Set Operations - Binary Operations - Additional Relation Operations. ER and EER to Relational Mapping. **(6)**

BASIC SQL

SQL Data Definition - Specifying Basic Constraints in SQL- Basic Retrieval Queries in SQL- Insert, Delete, Update Statements in SQL- Complex Queries: Views -Schema Change Statements in SQL- PL/SQL Programming. **(7)**

NORMALIZATION

Informal Design Guidelines for Relational Schema- Functional Dependencies - Normal Forms Based on Primary Keys - General Definitions of Second and Third Normal Forms- Boyce Codd Normal Form-Multi-Valued Dependency and Fourth Normal Form-Join Dependencies and Fifth Normal Form. **(7)**

TRANSACTION PROCESSING CONCEPTS

Introduction-Transaction and System Concepts - Desirable Properties of Transactions- Characterizing Schedules Based on Recoverability and Conflict Serializability. **(6)**

CONCURRENCY AND RECOVERY

Concurrency Control Techniques: Two Phase Locking-Concurrency Based on Time Stamp Ordering. Recovery: Database Recovery Concepts - Recovery Techniques Based on Deferred Update and Immediate Update-Shadow Paging. **(6)**

TOTAL : 45

REFERENCE BOOKS

1. *Ramez Elmasri, Shamkant B. Navathe Durvasula, V.L.N. Somayajulu, Shyam K. Gupta, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2015.*
2. *Abraham Silberscatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 6th Edition, Mc Graw Hill International Edition, 2011.*
3 *Christopher Allen, Simon Chatwin, Catherine A. Creary, "Introduction to Relational Databases and SQL Programming", Tata McGraw-Hill, 2010.*

MOOCs

1. *http://nptel.ac.in/courses/IIT-MADRAS/Intro_to_Database_Systems_Design*
2. *www.w3schools.com/sql/*

18MCA25 - SOFTWARE ENGINEERING

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Choose applicable software life-cycle model to develop software for given customer need and justify choice with reference to complexity, cost and time.*

CO2 : *Determine software requirements based on customer need and develop industry standard Software Requirement Specification (SRS) document*

CO3 : *Construct models using functional and object oriented design principles, concepts and tools based on SRS document.*

CO4 : *Prepare suitable structural and behavioural analysis models based on SRS document.*

CO5 : *Formulate test cases and test data using white box and black box techniques to deliver defect free software.*

INTRODUCTION TO SOFTWARE ENGINEERING

The Evolving Role of Software - Software - The changing nature of software - Legacy software - Software Myths - Software Engineering: A Layered Technology Process Framework - The Capability Maturity Model - Process Patterns - Process Assessment - Software Process Models.

Agile Development : Agility - Agility and Cost of Change - Agile Process - Extreme Programming - Other Agile Process Models. **(8)**

SOFTWARE ENGINEERING PRACTICE

System Engineering : Computer Based Systems - The System Engineering Hierarchy - Business Process Engineering - Product Engineering - Requirements Engineering. **(7)**

BUILDING THE ANALYSIS MODEL

Requirements Analysis - Analysis Modeling Approaches - Scenario Based Modeling - Flow Oriented Modeling - Creating a Behavioral Model. **(8)**

DESIGN ENGINEERING

Design within the context of Software Engineering - The Design Process and Design quality - Design Principles - Design Concepts - Effective Modular Design - Design Heuristics for Effective Modularity - The Design model - Design Documentation. **(8)**

TESTING STRATEGIES

A Strategic Approach to Software Testing - Strategic Issues - Test Strategies for Conventional Software - Test Strategies for Object Oriented Software - Validation Testing - System Testing - The Art of Debugging. **(7)**

TESTING TACTICS

White Box Testing-Basis Path Testing-Control Structure Testing-Black Box Testing **(7)**

TOTAL : 45

REFERENCE BOOKS

1. *Roger S. Pressman "Software Engineering - A Practitioner's approach", McGraw Hill International, 7th Edition, 2009.*

2. *Ian Somerville, "Software Engineering", Addison - Wesley, 9th Edition, 2010.*
3. *Pankaj Jalote, "An Integrated Approach to Software Engineering", Narosa Publishing House, 3rd Edition, 2011.*

MOOCs

1. *http://nptel.ac.in/courses/106101061/*
2. *http://nptel.ac.in/courses/106101061/5*

18MCA26 - ALGORITHMS AND OPERATING SYSTEMS LABORATORY

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PRE-REQUISITES
18MCA12, 18MCA16

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Choose appropriate data structure, design and analyze based on time and space complexity for a given problem.*

CO2 *: Design and implement recursive algorithms*

CO3 *: Apply appropriate sorting and searching techniques with respect to given problem.*

CO4 *: Use command line argument and interactive inputs for implementing shell scripts and the use of system calls in a Linux/Unix environment.*

CO5 *: Understand and appreciate OS principles in the design and implementation of process management, inter-process communication,*

CONCEPTS TO BE COVERED

1. Compute time and space complexity for simple programs
2. Recursion - Towers of Hanoi, Fibonacci series
3. Building Binary Search Tree, Operations on BST, Operations on AVL trees and Threaded Trees
4. Operation on Heap, Hash Table
5. Sorting and Searching : Applying techniques
6. Implement 0/1 Knapsack problem using Dynamic Programming
7. Find Minimum Cost Spanning Tree of a given undirected graph.
8. Implement N Queen's problem using Back Tracking.
9. Write programs using the following system calls of UNIX OS : Open, Close, Fork, exec, getpid, exit, wait, stat, opendir, readdir
10. Simulate system calls of UNIX OS (read, write,ls, grep)
11. Shell program for process creation using FORK, Execute, Getpid and sleep command. Program for parent and child process using FORK and JOIN construct.
12. Write a program that, given the name of a file of directory on the command line, reports the following information from the corresponding inode

    a) Mode(permission) b) number of links c) owner's name d) group name e) size in bytes f) size in blocks g) last modification time
13. Simulate Bankers Algorithm for Dead lock Avoidance and Dead lock prevention algorithm
14. Implement bounded buffer problem using semaphores.

MOOCs

1. *nptel.ac.in/courses/106106144/2*
2. *nptel.ac.in/courses/106106144/*
3. *nptel.ac.in/courses/106108101/*

18MCA27 - OBJECT ORIENTED PROGRAMMING LABORATORY

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PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Determine the object entities, their data members and relate them in various forms for achieving the objectives of the given scenario.*

CO2 *: Create the concept of hierarchy among objects and the various ways of implementing them*

CO3 *: Design applications which decides on the data members at runtime using polymorphic features*

CO4 *: Model the application with concurrent features for effective faster performance*

CO5 *: Develop efficient interactive forms for user interaction using language specific components and communicate with databases to store and extract data from them*

CONCEPTS TO BE COVERED

1. Identify entities and their attributes to represent as objects and define the operations the object has to perform for a given scenario.
2. Create objects of initialization and facilitate various type of initialization of the same object and writing mutator and accessor methods for accessing the members.
3. Develop program to inherit the properties of base classes and demonstrating the access to various data members in the base class.
4. Demonstrating the polymorphism in inheritance and the dynamic polymorphism using object assignments.
5. Create packages to hold the java class files and restricting their access.
6. Generating Immutable and mutable Strings using basic string class and Stringtokenizer.
7. Write abstract and interfaces for communicating with the external classes.
8. Identify the errors in the program and handle the errors as exceptions.
9. Write user defined exceptions, catch and handle it at runtime.
10. Demonstrate concurrent programming methods using various aspects of threads.
11. Write Efficient GUI codes to interact with applications.
12. Create a complete application with GUI, Processing and Back End Databases.

MOOCs

1. *https://www.javaworld.com/article/2076075/learn-java/core-java-learn-java-from-the-ground-up.html*
2. *https://docs.oracle.com/javase/tutorial/java/index.html.*

18MCA28 - RDBMS LABORATORY

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PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Design the conceptual data model as Entity Relationship diagram and create the database using DDL statements for a given application*

CO2 : *Formulate simple DML SQL queries to retrieve the required data for real world applications*

CO3 : *Generate DML queries using Sub Queries, Joins, Group By, Order By and Aggregate functions to filter and aggregate the data of the real world applications*

CO4 : *Construct reusable PL/SQL blocks with Functions, Procedures, Packages, Triggers, Exception Handling, and Cursors as required by OLTP applications*

CO5 : *Develop a database project by constructing ER model, Creating Tables and write SQL and PL/SQL blocks using RDBMS software.*

CONCEPTS TO BE COVERED

1. Creating and managing tables
2. Basic SQL SELECT statements
3. Restricting and sorting data
4. In-built functions
5. Queries using multiple tables, Join.
6. Aggregating data using Group functions, Use of Group by/Having clause
7. Sub queries
8. Constraints
9. Views, Sequence, Index, Synonym
10. SET operators, Date time functions
11. PL/SQL Programming Basics, Exercises
12. Procedures, Functions
13. Exception Handling, Cursors, Package
14. Triggers
15. Embedded SQL within a programming language like VB.NET/Java

MOOCs

1. *https://www.tutorialspoint.com/sql/sql_tutorial.pdf*
2. *https://www.mooc-list.com/course/database-management-essentials-coursera*
3. *https://docs.oracle.com/cd/E11882_01/server.112/e41084.pdf*

18MCA29 - PROFESSIONAL ENGLISH

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PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will achieve the following:

CO1 : *Given a Business Communication context, compose business letters, reports and emails with suitable format. Given a job requirement, prepare a job application letter with a Resume or a CV.*

CO2 : *For a given organizational conflict task, asses the problem, analyze the approaches of team members and devise solutions to resolve the conflict. For a given workplace situation or problem, generate ideas, express and exhibit communication and interpersonal skills.*

CO3 : *For a given scenario, generative creative ideas and give a 5 minute presentation. For a given HR topic, generate valid points for and against the topic and present them with appropriate group behaviour. For any job requirement, plan and prepare for a 20 minute mock interview.*

CO4 : *Construct appropriate responses to greet, transfer, place the caller on hold, inquiries, call backs, unintentional disconnects, interruptions, using suitable telephoning etiquette. Given a business communication scenario, construct a suitable strategy and action plan using specific negotiation tactics consistent with the objectives of the negotiator.*

CO5 : *Apply the rules of grammar viz Tenses, Phrasal verbs, Idioms and phrases, Preposition, and Pronoun and correct the errors in a given passage.*

TECHNICAL WRITING

Introduction to Technical Writing - Formal, Informal and Technical Reports - Formal and Informal Letters, Business Letters - Quotations, Complaint Letters and Enquiry Letters - E-Communication - Job Applications: Writing Resume or Curriculum Vitae: Introduction - Difference between a Resume and a CV - The Strategy of Resume Writing - A Favourable First Impression - The Main Body of the Resume - A Fresher's Resume - A Few Helpful Tips - E-mails.

SOFT SKILLS

Introduction to Soft Skills - Lessons from the Three Case Studies - Change in Today's Workplace: Soft Skills as a Competitive Weapon - Antiquity of Soft Skills - Classification of Soft Skills: Time Management - Attitude - Responsibility - Ethics, Integrity, Values and Trust - Self-confidence and Courage - Consistency and Predictability - Teamwork and Interpersonal Skills - Communication and Networking - Empathy and Listening Skills - Problem Solving, Troubleshooting and Speed Reading - Leadership.

TELEPHONING SKILLS & NEGOTIATIONS

Preparing to make a telephone call - Receiving calls - Taking and leaving messages - Asking for and giving repetition - The secretarial barrier - Cross-cultural communication on the telephone - Setting up appointments - Changing arrangements - Ending a call - Cross-cultural communication on the telephone - Problem-solving on the telephone - Complaints - Negotiations: Types of negotiation - Preparation for a negotiation - Making an opening statement - Bargaining and making concessions - Accepting and confirming - Summarizing and looking ahead - Types of negotiator - Dealing with conflict - Rejecting - Ending the negotiation

SPEAKING

Job Interviews: Introduction - Types of Interviews - Groundwork before the Interview -Importance of body Language in Interview - Need for proper Articulation - Concluding an Interview - Telephonic or Video Interview - A Mock Interview - Group Discussion: Introduction - Ability to Work as a Team - Communication Skills - Active Listening - Non-verbal Communication - Leadership and Assertiveness - Reasoning - Ability to Influence - Innovation. Creativity, and Lateral Thinking - Flexibility - Key Steps to Succeed in a Group Discussion - The Responsibility of the First Speaker - Concluding the Discussion - Dos and Don'ts during a Group Discussion

COMMON ERRORS IN ENGLISH

Errors in Tenses - Phrasal Verbs - Idioms and Phrases - Prepositional Errors and Pronoun Errors.

REFERENCES

1. *Meenakshi Raman, Sangeeta Sharma, "Technical Communication - Principles and Practice", 2nd edition, Oxford University Press, New Delhi, 2015.*
2. *Simon Sweeney, "English for Business Communication", Cambridge University Press, 2013.*
3. *Mukhopadhyay Lina, "Poly Skills: A Course in Communication Skills and Life Skills", Cambridge University Press, 2012.*
4. *Krishna Mohan & Merra Banerji, "Developing Communication Skills", 2nd Edition. Macmillan Publishers India Ltd. 2012.*

18MCA31 - NUMERICAL METHODS AND APPLIED STATISTICS

L	T	P	C
4	0	0	4

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Familiarize with application of numerical methods in solving equations occurring in business modeling and good understanding of empirical modeling by using various numerical methods for data analysis.*

CO2 : *Interpret basic principles of experimental design.*

CO3 : *Understand basic components of time series data and use them for forecasting.*

CO4 : *Construct control charts for statistical quality control and be able to use reliability concepts to calculate reliability parameters and estimate the system reliability.*

CO5 : *Apply non-parametric tests in analyzing data.*

SOLUTION OF EQUATIONS AND EMPRICAL DATA ANALYSIS

Algebraic and transcendental equations - Bisection Method and Newton Raphson method. Solution of Linear System of Equations: Gauss elimination method - Gauss Jordan method and Gauss Seidel iterative method. Curve Fitting by Least Square Method - Fitting linear, parabolic and exponential curves.

Numerical Differentiation : Interpolation - Newton's Forward and Backward Interpolation - Lagrangaian Interpolation. Numerical Integration : Trapezoidal and Simpson's 1/3 Rule. **(15)**

ANALYSIS OF VARIANCE

Basic principles of experimental design - analysis of variance for one way classification - completely randomized design - Latin square design. **(9)**

TIME SERIES FORECASTING

Definition - Time Series Components - Time series decomposition models: multiplicative and additive models -Forecasting error-measurement using Mean Absolute Deviation (MAD) and Mean Squared Error(MSE)- Smoothing Techniques: Naïve forecasting, moving averages and weighted moving averages-Exponential smoothing -Simple Exponential Smoothing- Trend analysis- linear, quadratic and exponential trend-Seasonal Effects-Decomposition methods: method of simple averages, ratio to trend method and ratio to moving average method-Measurement of cyclic and irregular variations-Auto Regressive Models. **(12)**

STATISTICAL QUALITY CONTROL AND RELIABILITY

Statistical Quality Control : Nature of Control Limits - Purpose of Control Charts - Control Charts for Variables - Control Charts for Attributes

Realiability : Concept of reliability - Hazard rate - Mean time to failure - Standard reliability models - Series and parallel system reliability - Simple problems **(15)**

NON - PARAMETRIC STATISTICS

Introduction to Nonparametric tests - Sign test - Signed Rank test - Rank-Sum test - Wilcoxon-Mann-Whitmey test (U test), Kruskal Wallis test-Runs test. **(9)**

TOTAL : 60

REFERENCE BOOKS

1. *S.S.Sastry, "Introductory Methods of Numerical Analysis", PHI Learning Private Limited, New Delhi-1, 2012.*
2. *Ronald E.Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, "Probability and Statistics for Engineers and Scientists", 9th Edition, Prentice Hall, 2012 (Para 3, 4 and 5)*
3. *M.K.Venkataraman, "Numerical Methods in Science and Engineering", The National Publishing Company, Chennai-1, 1999.*
4. *Kandasamy, P. et al., "Probability Statistics and Queuing Theory", S. Chand & Co., 2004.*
5. *Veerarajan, T. "Probability, Statistics and Random Process" Tata McGraw - Hill, 3rd Edition, 2008.*
6. *Grant, E.L. "Statistical Quality Control", 7th Edition, McGraw Hill Book Company, 2005.*
7. *Gupta, S.C. and Prof. Kapoor, V.K. "Fundamentals of Applied Statistics", 4th Edition, reprint, S. Chand & Co., 2007.*
8. *Murray R. Spiegel, "Theory and problems of probability and statistics", Tata McGraw-Hill, 4th Edition, 2011.*

MOOCs

1. *http://nptel.ac.in/courses/122102009/*
2. *http://nptel.ac.in/courses/105105043/*
3. *http://nptel.ac.in/courses/111105041/1*
4. *http://nptel.ac.in/courses/110105060/14*

18MCA32 - COMPUTER NETWORKS

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students should be able to:

CO1 : *Identify the components required to build different types of networks and have an understanding of network models.*

CO2 : *Analyze the layered functionality and data communication mechanisms used between nodes.*

CO3 : *Identify the protocols involved at the various layers and demonstrate the role of each protocol.*

CO4 : *Analyze and describe the working principles of Internet.*

CO5 : *Apply various routing protocols, demonstrate the best routing between nodes and describe the network functionalities for a given application.*

INTRODUCTION

Uses of computer networks - Network hardware - Network software - Reference models - Example networks: RFID and Sensor Networks. Physical Layer: Theoretical basis for data communication - Guided transmission media: Twisted pairs- Coaxial cable- Fiber Optics - Unguided transmission: The Electromagnetic spectrum - Radio wave transmission- Micro wave transmission - Infrared transmission. **(9)**

DATA LINK LAYER

Design issues - Services provided to the network layer - Framing - Flow Control - Error Control. Error detection and correction - Elementary data link protocols: A Simplex Stop- and-Wait protocol for an Error -Free Channel - Sliding window protocols: A One-Bit Sliding window Protocol. Example Data Link protocols: Packet over SONET. MAC Layer: Channel allocation problem - Multiple access protocols: ALOHA - CSMA. **(9)**

NETWORK LAYER

Design issues - Services provided to the Transport Layer - Routing algorithms: Shortest Path Algorithm - Distance Vector Routing - Link State Routing. Congestion control algorithms: Traffic aware routing - Admission Control. Internetworking: Tunneling - Internetwork Routing - Packet Fragmentation. **(9)**

TRANSPORT LAYER

Transport service - Services provided to upper layer - Transport Service primitives - Elements of transport protocols -Addressing - Connection Establishment and Release - Error Control and Flow Control - Multiplexing - A Simple transport protocol: TCP: Introduction -Service Model - Connection Establishment and Release **(9)**

APPLICATION LAYER

Domain Name System: The DNS Name Space - Domain Resource Records - Name Servers - Electronic mail: Architecture and Services - The User Agents - Message Formats - Message Transfer and Delivery - World Wide Web: Architectural overview - Static and Dynamic Web Pages- HTTP - Mobile Web - Web Search. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Andrew S Tanenbaum and David J. Wetherall, "Computer Networks", Pearson Education, Asia, 5th Edition, 2011.*
2. *Behrouz A.Forouzan, "Data Communications and Networking", McGraw-Hill Science/Engineering/Math Publication, 5th Edition, 2012.*
3. *James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", Addison-Wesley, 6th Edition, 2008.*

4. *Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers, 5th Edition, 2011.*
5. *William Stallings, "Data and Computer Communication", Pearson Education, 8th Edition, 2007.*

MOOCs

1. *http://nptel.ac.in/courses/106105080/*
2. *http://nptel.ac.in/courses/106105082/*

18MCA33 - ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

PRE-REQUISITES

18MCA12

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Apply various heuristic search strategies in optimal decision making*

CO2 : *Understand uncertainty in real world situations.*

CO3 : *Employ first order logic for building knowledge base and demonstrate reasoning on this*

CO4 : *Express different planning strategies to deal with problems, describe and apply various knowledge representation techniques.*

CO5 : *Apply machine learning approaches*

INTRODUCTION

Foundation of AI - Agents and Environments- Concept of Rationality - Nature of Environments - Structure of Agents-Problem-Solving Agents and examples-Uninformed Search Strategies-Searching with Partial Information. **(6)**

INFORMED SEARCH TECHNIQUES

Search Strategies : A* Search -Heuristic Functions -Local Search Algorithms and Optimization Problems -Constraint Satisfaction Problems (CSP) -Backtracking Search for CSPs - Local Search for Constraint Satisfaction Problems - Structure of Problems - Games - Optimal Decisions in Games - Alpha-Beta Pruning. **(8)**

KNOWLEDGE AND REASONING

Logic -Propositional Logic - Syntax and Semantics of First-Order Logic - Using First-Order Logic - Knowledge Engineering in First-Order Logic - Propositional vs. First-Order Inference - Forward Chaining -Backward Chaining -Resolution - Knowledge Representation **(8)**

PLANNING

Definition of classical planning-Algorithms for Planning as State-Space Search - Planning Graphs - Hierarchical Task Network Planning - Planning and Acting in Nondeterministic Domains - Multi agent Planning **(6)**

BAYES NETWORK

Uncertainty : Bayes' Rule and Its Use - Representing Knowledge in an Uncertain Domain : Bayesian Networks - Semantics of - Efficient representation of Conditional distribution - Exact inference in Bayesian networks -Approximate inference - Rational preferences- Utilities- Multi attribute utilities- Decision networks **(5)**

LEARNING

Forms of Learning - Learning from Observation Learning Decision Trees - Artificial Neural Networks -Knowledge in Learning - Explanation -Based Learning -Learning Using Relevance Information - Inductive Logic Programming -Statistical Learning - Learning with Complete Data -EM Algorithm- Passive Reinforcement Learning-Active Reinforcement Learning. **(12)**

TOTAL : 45

REFERENCES

1. *Stuart J Russell and Peter Norvig, "Artificial Intelligence- A Modern Approach", Pearson Education Series, Third Edition, 2010. (Chapters 1 to12,14,16,18,19,20,21).*
2. *Dan W.Patterson, "Introduction to AI and ES", Pearson Education, First Edition , 2007.*
4. *Nilis J Nilsson, "AI A new Synthesis", Morgan Kaufmann Publishers, 1998.*

MOOCs

1. *https://onlinecourses.nptel.ac.in/noc18_cs18/preview*
2. *http://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Artificial%20intelligence/new_index1.html*

18MCA34 - SOA AND WEB SERVICES

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Understand and use the concepts of Service-Oriented Architecture for building platform independent distributed applications.*

CO2 : *Design and develop simple to complex web services by analyzing the requirements of web applications.*

CO3 : *Apply the concepts of RESTful web services and create dynamic web applications*

CO4 : *Determine the security requirements of web services and incorporate them in building web applications.*

CO5 : *Examine the requirements of distributed applications, identify and justify the need for using web services.*

SERVICE OREINTED ARCHITECTURE

Architecture for Enterprise applications-Software platforms for Enterprise applications-Evolution of SOA- Key components of SOA-Considerations for Enterprise-wide SOA- Strawman architecture-Enterprise SOA layers- Solution architecture for Enterprise Applications- SOA Programming Models **(8)**

DISTRIBUTED INFORMATION SYSTEMS

Understanding middleware-RPC-TP Monitors-Object Brokers-Message Oriented Middleware-Technologies for connecting remote clients **(8)**

INTRODUCTION TO WEB SERVICES

Web Services and their Approach to Distributed Computing-Web Service Technologies-Web Services Architecture. **(9)**

WEB SERVICES TECHNOLOGIES

SOAP-WSDL-UDDI-RESTful Web Service: Architecture- RESTful Web Service Design. **(12)**

WEB SERVICE SECURITY AND PERFORMANCE

Securing Web Service-Custom Token Authentication-HTTP Basic Authentication-OAuth-Performance **(8)**

TOTAL : 45

REFERENCE BOOKS

1. *Shankar Kambhampaty, "Service-Oriented Architecture for Enterprise and Cloud Applications", Wiley India, 2nd Edition, 2010.*
2. *Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju, "Web Services: Concepts, Architecture and Applications", Springer Science and Business Media, 2004.*
3. *Jose Sandoval, "RESTful Java Web Services", Packt Publishing, 2009.*
4. *James Mcgovern, Sameer Tyagi, Michael E. Stevens, Sunil Mathew, "Java Web Service Architecture", Morgan Kaufmann Publishers, An Imprint of Elsevier, Indian Reprint 2005.*

MOOCs

1. https://www.mooc-list.com/course/service-oriented-architecture-coursera
2. https://www.class-central.com/mooc/10156/edx-aws-developer-building-on-aws

18MCA35 - ADVANCED PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES
18MCA27

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to :

CO1 *: Identify and define the computing requirements using appropriate Java and web programming tools for a given problem and configure the tools as needed.*

CO2 *: Design, implement, and evaluate integrated modular system using java language specific features*

CO3 *: Demonstrate the effective use of complex data structure utility in Java.*

CO4 *: Implement technologies of abstract and dynamic programming using request and response servlets*

CO5 *: Use methods to connect to unconventional database system and interact with it.*

CONCEPTS/ TOOLS TO BE COVERED

Java language features

1. Using Collection classes for search optimization.
2. Using Collection classes as data objects
3. Creating Applets using interactive forms
4. Applets and Event Driven Programming

Dynamic pages

1. Creating a dynamic server page
2. Sending a Servlet Request
3. Sending a Servlet Response
4. Using XML database for storing and reading data.
5. Creating an Entity and Application Bean
6. Using API's for integration among applications

MOOC's

1. *https://docs.oracle.com/javase/tutorial/java/index.html*
2. *https://www.ntu.edu.sg/home/ehchua/programming/java/JavaServlets.html*

18MCA36 - ARTIFICIAL INTELLIGENCE LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Design and implement heuristic procedures.*

CO2 *: Develop constraint satisfaction solution using a tool.*

CO3 *: Design and implement natural language processing responses to English phrases.*

CO4 *: Design and implement knowledge based system.*

CO5 *: Become familiar with use of AI tool.*

CONCEPTS TO BE COVERED

HEURISTIC SEARCH (USE PYTHON)

Use Hill Climbing Search. Write procedures for games- Compare the power of different heuristics (Tic-Tac-Toe)

CONSTRAINT SATISFACTION

SUDOKU Solving (Opta Planner -DROOLS, Eclipse Rule)

CHAT BOT

Exercises to prepare phrases in the AI Markup language (ATML) and use the built-in parser to

a) Provide answers for questions; (may be in answering queries on a course and curriculum).

b) Use probability values for different answers for a particular phrase, (Use Bayesian Probability).

c) Sum up probability values of answers for all the matched phrases and output the highest probability answer on designing interfaces and techniques for navigation.

d) Implement capability to understand “intent” in sentence, along with user, object and task (verb).

FIRST ORDER LOGIC

Download and use PROLOG :

Write clauses (knowledge base with probability values for diagnostic piece of knowledge) and see the resolution refutation backtracking based reasoning of the PROLOG runtime. Create diagnosis systems for

a) PC trouble shooting b) cell phone trouble shooting c) two wheeler trouble shooting d) a disease

MOOCs

1. https://www.class-central.com/mooc/445/edx-cs188-1x-artificial-intelligence
2. https://www.class-central.com/mooc/7923/nptel-ai-constraint-satisfaction

18MCA37 - NETWORK PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES
18MCA32

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Understand key protocols that support communication.*

CO2 *: Develop and implement connection-oriented and connection-less communication using Socket API for a given set of requirements.*

CO3 *: Develop and implement concurrent and iterative servers and analyze their functionality.*

CO4 *: Apply advanced programming techniques such as Broadcasting and Multicasting.*

CO5 *: Develop and implement simple network applications using NS-2 API for a given set of requirements and demonstrate its working.*

CONCEPTS TO BE COVERED

1. TCP one-way communication
2. TCP two-way communication
3. UDP one-way communication
4. UDP two-way communication
5. Concurrent, Iterative Server Implementation
6. IP header setting by kernel and displaying IP header
7. IP header setting by user and displaying IP header
8. IP Checksum Computation
9. Ping Implementation
10. Broadcasting using UDP
11. Multicast Communication using UDP
12. Simulations using NS-2 tool

MOOCs

http://nptel.ac.in/courses/106105151/

18MCA41 - OPERATIONS RESEARCH

L	T	P	C
4	0	0	4

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Solve Linear programming problem, Transportation and Assignment problem.*

CO2 : *Discuss elementary Inventory models, Price break models and Safety stock problems.*

CO3 : *Categorize Queuing models and also simulate the problems using Monte Carlo technique.*

CO4 : *Analyze network models using CPM and PERT and to discuss the replacement problems.*

CO5 : *Apply sequencing and replacement concepts in solving Resource allocation problems*

LINEAR PROGRAMMING

Development of operations research - modeling - structure of mathematical models - definition and properties of linear programming problems - canonical and standard forms- formulation - graphical solution - simplex method. **(10)**

DUALITY

Dual of LPP, primal - dual relationships. Applications of LPP: Assignment model - Hungarian Techniques. Transportation model - Vogels approximation method - degeneracy, unbalanced problems. **(10)**

SEQUENCING AND REPLACEMENT

Sequencing - Introduction - Flow -Shop sequencing - n jobs through two machines - n jobs through three machines - Job shop sequencing - two jobs through 'm' machines.

Replacement: Introduction - Replacement of items that deteriorate with time - when money value is not counted and counted - Replacement of items that fail completely, Group Replacement. **(10)**

INVENTORY

Need for the inventory - Costs involved in inventory - Concepts of average inventory - Economic order quantity. Deterministic model: Fixed ordering quantity models - EOQ model with uniform demand, finite / infinite replacement with / without shortages. Dynamic ordering quantity model, EOQ with one price break. Inventory control - Buffer stock - Determination of optimum buffer stock - EOQ system of ordering - Multi item order model - ABC analysis. **(10)**

QUEUING THEORY

Characteristics of queuing systems, steady state M/M/1 model. Simulation-Monte Carlo method-Applications to queuing and inventory problems **(10)**

PERT & CPM NETWORKS

Time estimate - earliest expected time, latest allowable occurrence time & slack - Critical path - Probability of meeting a scheduled date of completion of the project. Calculation on the CPM network - Floats - Critical path. Time - Cost analysis-Crashing-Least cost schedule algorithm. **(10)**

TOTAL : 60

REFERENCE BOOKS

1. *Hamdy, A Taha, "Operations Research - An Introduction", Pearson Education India, 2004.*
2. *S. D. Sharma, "Operations Research", Kedar Nath Ram Nath & Co publishers, 2004.*

MOOCs

1. *http://nptel.ac.in/courses/112106134/1*
2. *http://nptel.ac.in/courses/112106131/1*

18MCA42 - DATA MINING AND WAREHOUSING

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Examine a given dataset identify the analysis goals and providing data mining solutions to achieve those goals.*

CO2 *: Choose proper pre-processing techniques by studying the characteristics of the attributes of the dataset and prepare it for data mining.*

CO3 *: Apply association rule mining techniques such as Apriori and FP-Tree to a given dataset and generate association rules from it.*

CO4 *: Analyze the suitability of classification (Decision Tree) and clustering algorithms(K-Means and K-Medoids) for a given data analysis requirement.*

CO5 *: Mine hidden patterns from the dataset after applying pre-processing techniques and derive inference from the results of mining.*

INTRODUCTION

Definition- Need for Data Mining- Kinds of Data and Patterns- Applications and Issues. Types of data: Data objects and Attribute-Types-Measuring Data Similarity and Dissimilarity. Data Preprocessing: Overview- Data Cleaning-Data Integration-Data Reduction-Data Transformation-Data Discretization. **(12)**

DATA WAREHOUSE AND OLAP TECHNOLOGY

Data Warehouse-Basic Concepts-Data Warehouse Modeling-Data Warehouse Implementation. **(7)**

ASSOCIATION AND CLASSIFICATION TECHNIQUES

Mining Frequent Patterns and Associations : Basic Concepts-Frequent Itemset Mining Methods.

Classification : Basic Concepts-Decision Tree Induction- Bayes Classification Methods. **(12)**

CLUSTER AND OUTLIER ANALYSIS

Cluster Analysis Concepts-Partitioning Methods-Hierarchical Methods : Agglomerativeand Divisive Hierarchical Clustering-BIRCH.

Outlier Detection : Outliers and Outlier Analysis-Outlier Detection Methods. **(7)**

MINING COMPLEX DATA TYPES

Mining Sequence Data-Mining Graphs and Networks-Mining Other Kinds of Data- Visual and Audio Data Mining. **(7)**

TOTAL : 45

REFERENCE BOOKS

1. *Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining - Concepts and Techniques", 3rd Edition, Elsevier Publications, 2012.*
2. *Paul C. Zikopoulos, Chris Eaton, Dirk deRoos and George Lapis, "Understanding Big Data", Mc-Graw Hill, 2012.*
3. *Arun K. Pujari, "Data Mining Techniques", Universities Press, 2009.*

MOOCs

1. *https://www.mooc-list.com/course/more-data-mining-weka-futurelearn*
2. *https://www.mooc-list.com/course/computing-data-analysis-edx*
3. *https://www.mooc-list.com/course/big-data-fundamentals-edx*

18MCA43 - ACCOUNTING AND FINANCIAL MANAGEMENT

L	T	P	C
4	0	0	4

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Prepare books of accounts and verify correctness using trial balance, for any business organization.*

CO2 *: Prepare statements of final accounts to ascertain the profit,forany trading or manufacturing organization.*

CO3 *: Perform cost estimation and determine the optimum cost/price/profit for a firm using Cost Sheet, CVP analysis and Marginal Costing Techniques.*

CO4 *: Prepare financial statements using ratio analysis, budgeting, working capital management, capital budgeting and budgetary control techniques and present facts to assist in strategic decision making, given a set of investment options for a business.*

CO5 *: Develop software solutions to automate a given accounting, costing or financial process, using MS-Excel.*

FINANCIAL ACCOUNTING

Introduction : Accounting Concepts, Principles and Conventions - basic accounting procedures - Journal and Ledger, Trial Balance. **(15)**

FINAL ACCOUNTS

Manufacturing and Trading Account - Profit and Loss Account - Balance Sheet. Final accounts with adjustments - Working with excel worksheets for automating Final Accounts. Depreciation. Type - Straight Line Method - Written-Down Value Method, Sinking Fund Method - Preparation of Depreciation Account **(15)**

COST ACCOUNTING

Methods and Techniques of Cost Accounting - Classification of Cost - Material Cost, Labour Cost, Overheads, Fixed and Variable Costs, Cost-Volume-Profit Analysis - Marginal Costing and Decision Makin. **(9)**

FINANCIAL MANAGEMENT

Objective and scope of Financial Management - Analysis and Interpretation of Financial Management - Ratio Analysis - financial system - Working Capital Management - Capital Investment Decision Through Pay-back Period Method - Average Rate of Return - Internal Rate of Return - Cost of Capital - Discounted Cash Flow Analysis by using Spread Sheet. **(12)**

BUDGETING AND BUDGETARY CONTROL

Types of budgets - Preparation of various functional budgets - Preparation of cash budget - Flexible budget - Advantages of Budgeting and budgetary control **(9)**

TOTAL : 60

REFERENCE BOOKS

1. *Grewal T S, "Double entry book keeping - Finanacial Accounting", Sultan Chand & Sons, 2012.*
2. *Sharad K. Maheswari, Maheswari S.N., "Principles of Management Accounting Vol.I & II", Sultan Chand & Sons, 2007.*
3. *Vinayakam N, Mani P.L., Nagarajan K.L., "Principles of Accountancy", S.Chand & Co., Ltd., 2008.*
4. *Jain S.P. & Narang K.L., "Advanced Accountancy Vol 1", Kalyani Publishers, 2012.*
5. *Sashi K. Gupta & Sharma R.K., "Management Accounting", Kalyani Publishers, 2011.*
6. *Khan M.Y. and Jain P.K., "Financial Management", Tata McGraw hill, 2007.*

18MCA44 - DATA MINING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Learn to use open source data mining tools such as Weka and/Rapidminer and build data mining applications using these tools.*

CO2 *: Select appropriate data pre-processing techniques to be applied on standard datasets from various domains such as healthcare, finance, insurance etc and prepare the data for the mining process based on the analysis goal.*

CO3 *: Apply association rule mining techniques to derive useful and new pattern information from the given datasets.*

CO4 *: Apply classification algorithms to classify a given dataset and derive useful and new insights from the dataset.*

CO5 *: Represent the analysis results using different visualization methods such as charts, graphs etc.*

CONCEPTS/TOOLS TO BE USED

1. Apply pre-processing techniques on datasets downloaded from Internet under different domains.
2. Apply core data mining techniques on different datasets like Iris, Cancer, Accidents etc.
   a) Association Rule mining algorithms such as Apriori, FP Tree and other algorithms. Compare the results.
   b) Classification algorithms - Decision Tree
   c) Clustering algorithms - K-Means, K-Medoids
3. Application of text mining algorithms.
4. Use different data visualization techniques to display the mined results and derive inference from them. Shiny tool can be used apart from the usual data mining tools.

MOOCs

1. *https://www.mooc-list.com/course/data-mining-weka-waikato*
2. *https://www.mooc-list.com/course/data-mining-weka-futurelearn*
3. *https://www.ibm.com/developerworks/library/os-weka1/*

18MCA45 - MINI PROJECT

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instruction

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the projects, students will be able to

CO1 *: Analyze different domains, identify problems that require software solutions and justify.*

CO2 *: Choose appropriate problem solving techniques for the identified problem.*

CO3 *: Practice software engineering principles and programming skills in developing software solutions.*

CO4 *: Test the developed software to ensure compliance of requirements.*

CO5 *: Write the project report demonstrating the contribution and complete technical details.*

AREAS FOR PROJECT

1. Application using Android platform
2. Application in Internet of Things
3. Data Analytics / Data Mining applications using latest implementation software.
4. Network based applications
5. Accounting / Commercial / Information Management / Scientific / web applications using latest software.

18MCA51 - SOFTWARE TESTING AND QUALITY ASSURANCE

L	T	P	C
3	0	0	3

PRE-REQUISITES

18MCA25

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Analyze different approaches to test software, and select applicable techniques for different situations and projects.*

CO2 : *Prepare a software quality plan for a software project considering process evaluation models including issues related to change management, configuration management, verification and validation, and measurement.*

CO3 : *Design test plans, create test procedures and design measures to evaluate result of tests.*

CO4 : *Apply black box and white box testing techniques at various testing levels for given requirements to achieve adequacy criteria.*

CO5 : *Use standards, models and techniques aimed at achieving quality assurance in different software development environments*

INTRODUCTION

The Role of Process in Software Quality - Testing as a Process - Overview of the Testing Maturity Model (TMM) - Basic Definitions - Software testing principles - Origins of defects - Defect classes, The defect repository and Test Design - defect example : The coin problem. **(9)**

TESTING STRATEGIES

Test case design strategies - Black box approach - Random testing - Equivalence Class Partitioning - Boundary Value Analysis - Cause and Effect graphing - State Transition testing - Error Guessing- White Box approach - Test adequacy criteria - Coverage and Control Flow Graphs - Covering code logic- Data flow and White box test design - Loop testing - Mutation testing - Evaluating test Adequacy Criteria. **(12)**

LEVELS OF TESTING

Unit test: functions, procedures, classes and methods as units - Unit test planning - Designing the unit tests - The class as a Testable Unit -The test harness - Integration test : Goal- Integration Strategies for Procedures and Functions - Integration Strategies for Classes - Designing Integration Test - System Test : the different types - Regression testing - Alpha, Beta and Acceptance test- Test planning - Test Plan Components - Test Plan Attachments - Reporting Test Results. **(10)**

SOFTWARE QUALITY

Theory of software quality : Defining quality - Importance of Quality - Quality control v/s Quality Assurance - Quality Assurance at each phase of SDLC, Hierarchical Models of Quality : Hierarchical Models of Boehm and McCall, Planning for Software Quality Assurance : Software Quality Assurance Plans, Product Quality and Process Quality: Product Quality - Models for Software Product Quality - Process , Walkthroughs and Inspections **(7)**

SOFTWARE METRICS AND MODELS

Software Measurement and Metrics : Introduction, Classification of Software Metrics, Defect Metrics, Requirement Related Metrics, Earned Value Analysis, Object Oriented Metrics. ISO 9000 series, ISO 9001 : Origins, ISO Standards Development Process, ISO 9000 Family, ISO 9001:2000, ISO Certification, Assessment Process. CMM Model - CMM and ISO Comparative analysis - CMM -I - P-CMM, SPICE, Malcolm Baldrige Award Model - EFQM Excellence Model. **(7)**

TOTAL : 45

REFERENCE BOOKS

1. *Ilene Burnstein, “Practical Software Testing”, Springer International Edition, 1st Indian Reprint, 2004.*
2. *Alan C Gillies, “Software Quality - Theory and Management”, Thomson International Student Edition, 2nd Edition, 2003.*
3. *Nina S Godbole, “Software Quality Assurance, Principles and Practice”, Narosa Publishing House, 2004.*
4. *P.C.Jorgensen, "Software Testing - A Craftman's Approach", CRC Press, 1995.*
5. *Boris Beizer, Van Nostrand Reinhold. "Software Testing Techniques", 2nd edition, 1990*

MOOCs

1. *http://nptel.ac.in/courses/106101163/*
2. *http://nptel.ac.in/courses/106105150/*

18MCA52 - CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C
3	0	0	3

PRE-REQUISITES
18MCA32

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Understand the basic principles of security and develop simple cryptosystems using classical ciphers*

CO2 *: Analyze the adequate basic security required by any computing system and apply cryptography algorithms to protect the confidentiality of information resources across networks*

CO3 *: Analyze security policies and best practices and apply suitable security technique to achieve integrity, and non-repudiation of information*

CO4 *: Demonstrate an understanding of threats and vulnerabilities of network security and apply suitable security controls to protect internal and external networks*

CO5 *: Understand threats against various system components and choose a best technique to control the threat*

CRYPTOGRAPHY : CONCEPTS AND TECHNIQUES

Need for Security - Security Approaches - Principles of Security - Plain Text and Cipher Text - Substitution Ciphers -Transposition Ciphers - Stream and Block Ciphers - Encryption and Decryption - Symmetric and Asymmetric Key Cryptography - Steganography. **(7)**

ENCRYPTION TECHNIQUES

Data Encryption Standard - Advanced Encryption Standard - Confidentiality using Symmetric Encryption - Public-Key Cryptography and RSA - Key Management - Diffie-Hellman Key Exchange - Elliptic Curve Cryptography - Symmetric Key Distribution - Kerberos - X.509 Authentication Service. **(10)**

HASH FUNCTIONS AND SIGNATURES

Message Authentication and Hash Functions - Description of MD Hash Family - Secure Hash Algorithms - SHA-512 - Digital Signatures and Authentication Protocols - Digital Signature Standard - Process - Services - Attacks on Digital Signature - Digital Signature Schemes. **(10)**

NETWORK SECURITY

Threats in Networks: Vulnerability - Categories of Attack - Software Based Packet Sniffing - Impersonation - Message Confidentiality Threats - Message Integrity Threats - Website Vulnerabilities - DoS - DDoS. Network Security Controls: Security Threat Analysis - Architecture - Encryption - Content Integrity - Strong Authentication - Access Controls - Wireless Security - Alarms and Alerts - Honeypots - Firewalls - Intruders - Intrusion Detection Systems - Types - Goals - Strengths and Limitations - Snort. **(9)**

SYSTEM SECURITY

Program Security: Secure Programs - Nonmalicious Program Errors - Targeted Malicious Code - Controls against Program Threats. Database Security: Security Requirements - Reliability and Integrity - Two-Phase Update - Redundancy / Internal Consistency - Recovery - Concurrency / Consistency - Monitors - Case studies on Cryptography and Security - Single Sign On (SSO). **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *William Stallings, "Cryptography and Network Security - Principles and Practices", 7th Edition, Pearson Education, 2017.*
2. *Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", 4th Edition, Pearson Education, 2007.*
3. *Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill, 3rd Edition, 2017.*

4. *Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata McGraw Hill, 2017.*
5. *Joseph Migga Kizza, "A Guide to Computer Network Security", Springer International Edition, 2010.*

MOOCs

1. *https://www.coursera.org/learn/crypto*
2. *https://www.edx.org/course/network-security-ritx-cyber504x*
3. *https://www.coursebuffet.com/course/814/nptel/cryptography-and-network-security-iit-kharagpur*

18MCA53 - SOFTWARE TESTING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES
18MCA25

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Analyze given requirements, identify suitable testing techniques and develop test cases and test data for testing.*

CO2 *: Write test cases for functional testing, execute test cases and interpret results for a given requirement.*

CO3 *: Design and develop test cases for testing web and mobile applications.*

CO4 *: Use CASE tools to develop requirements, design and develop test related artifacts applicable across the SDLC given a business need.*

CO5 *: Use metrics tool to measure software and interpret results.*

CONCEPTS/ TOOLS TO BE COVERED

Functional Testing

- Develop test cases from requirements
- Design test scenarios
- Design and develop test cases
- Test data generation
- Generating Test reports
- Use tools to extract metrics and interpret results

Testing Web and Mobile Application

- Develop test cases from requirements
- Design test scenarios
- Design and develop test cases
- Test data generation
- Generating Test reports
- Evaluate test results

Testing across SDLC and System Testing

- Apply testing in the scope of the SDLC : record requirements, develop design, and test code.
- Use load and Performance testing tools
- Use JUnit, Selenium, Jmeter, CASE Tools, Metrics, EclEmma (other testing tools may also be added, as required)

MOOCs

1. *https://www.youtube.com/watch?v=j6BsoiKDat0&list=PLDB034BC533455720*

18MCA54 - INFORMATION SECURITY LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Analyze the classical crypto systems used for the confidential information exchange and use different ciphers in secure data transfer*

CO2 : *Analyze security best practices and techniques to preserve confidentiality of information at rest, and in transit and apply suitable cryptographic algorithm to preserve the confidentiality of information*

CO3 : *Apply hash and message digest algorithms to preserve the integrity of information*

CO4 : *Apply standard digital signature scheme to verify the authenticity of information and use Steganography to hide secret messages*

CO5 : *Devise suitable defensive measures for securing confidentiality, integrity and authenticity of information resources for different enterprises including Government, Industry, Academia and Society*

CONCEPTS TO BE COVERED

1. Implementing Substitution and Transposition ciphers
2. Applying symmetric encryption algorithms (DES, AES) to protect the confidentiality of users data
3. Applying asymmetric encryption algorithms (RSA) to protect the confidentiality of users data
4. Comparing the performance of symmetric and asymmetric encryption algorithms in terms of computation time and storage space
5. Applying hash and message digest algorithms (MD5, SHA512) to ensure the integrity of users data
6. Using standard digital signature scheme to verify the authenticity of user's document
7. Applying Steganography to hide secret message in a document (image / text)
8. Given a scenario, choose appropriate security mechanisms to ensure confidentiality, integrity and non-repudiation of user's data and apply them to protect the data

MOOCs

1. https://www.coursera.org/learn/crypto
2. https://in.udacity.com/course/network-security--ud199
3. https://www.cyberdegrees.org/resources/free-online-courses/

18MCA55 - PROFESSIONAL ETHICS

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Given a problem scenario, analyse the situation and suggest solutions based on human values like honesty, courage, empathy, character and morality.*

CO2 : *When presented with a moral dilemma, critically analyse and present solutions using theories of moral autonomy and theories of right action.*

CO3 : *Examine a given scenario in the professional life of an Engineer and present a critical note on possible behaviours using professional codes of conduct of Engineers.*

CO4 : *Engage in informed critical reflection on the nature of professionalism and ethical challenges inherent in professionalism in matters relating to collegiality, loyalty, occupational crime, confidentiality and conflicts of interest.*

CO5 : *When presented with case on moral issues relating to weapons development or such matters of conflicting interest, critical evaluation of the case using the various professional codes of conduct and present ethical solutions.*

ETHICS AND PROFESSIONALISM

Profession and Professionalism - Responsibility - Moral Reasoning-EthicalDilemmas - Codes of Ethics - Ethical Relativism - Practical Ethics: Common Morality. Case Study: The Challenger.

MORAL FRAMEWORKS

Utilitarianism - Rights Ethics and Duty Ethics - Virtue Ethics - Self Interest - Self Realization. Social and Value Dimensions of Technology - Intellectual Property Rights. Technological Progress: Cautious Optimism - Moral Leadership

ENGINEER'S RESPONSIBILITIES

Engineers as Responsible Experimenters - Moral Autonomy - Accountability. Commitment to Safety - Case Studies: Bhopal Gas Tragedy, Three Miles Island.

WORK PLACE RESPONSIBILITIES

Team Work - Confidentiality - Conflicts of Interest - Whistle Blowing - Rights of Engineers - Honesty - Forms of Dishonesty - Integrity - Expert Witnessing.

ETHICS

Environmental Ethics - Global Issues: Multinational Corporations - Computer Ethics and Internet - Weapons Development.

REFERENCE BOOKS

1. *Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, 4th Edition, 2005.*
2. *Charles E Harris, Micheal S. Pritchard, Micheal Rabins, "Engineering Ethics - Concepts and Cases", Thompson Learning, 5th Edition, 2013.*
3. *Charles D Fledderman, "Engineering Ethics", Prentice Hall, New Mexico, 4th Edition, 2007.*

MOOCs

1. *http://nptel.ac.in/courses/109104068/30*
2. *http://nptel.ac.in/courses/109104068/38*

18MCA61 - PROJECT WORK AND VIVA VOCE

Credit
18

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the project, students will be able to:

CO1 : *Comprehensively demonstrate understanding of the software development processes and practices.*

CO2 : *Work to a professional standard in a specified role.*

CO3 : *Contribute effectively/co-operatively within a team.*

CO4 : *Exhibit industry-standards of professionalism in their work through knowledge or use of latest techniques and tools.*

CO5 : *Reflect on the work done and own role and present their work through a report and formal viva.*

18MCAE01 - VIRTUALIZATION AND CLOUD COMPUTING

L	T	P	C
3	0	0	3

PRE-REQUISITES
18MCA23

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure.*

CO2 : *Describe various service delivery models of cloud computing architecture.*

CO3 : *Deploy applications over commercial cloud computing infrastructures such as Amazon Web Services and Google AppEngine.*

CO4 : *Describe the virtualization technology behind the working of cloud computing.*

CO5 : *Identify security and privacy issues in cloud computing and devise appropriate security solutions for protecting cloud resources.*

UNDERSTANDING CLOUD COMPUTING

Cloud Computing - Definition and Characteristics - History of Cloud Computing - Cloud Architecture - Benefits and Challenges of Cloud Computing - Cloud Deployment models: private cloud - public cloud - hybrid cloud **(6)**

CLOUD SERVICE MODELS

Software-as-a-Service - Understanding SaaS - Architecture of SaaS - Platform-as-a-Service - Understanding PaaS - Architecture of PaaS - Infrastructure-as-a-Service - Understanding IaaS - Architecture of IaaS - Case Study: Amazon Web Services - Google App Engine. **(8)**

OVERVIEW OF VIRTUALIZATION

Basics of Virtualization - Virtualization Types: Application Virtualization - Desktop Virtualization - Network Virtualization - Server and Machine Virtualization - Storage Virtualization - System-level or Operating System Virtualization - Virtualization Advantages. **(6)**

RESOURCE VIRTUALIZATION

Virtual Machine Basics - Resource Virtualization: Processor - Memory - Input/Output - Hypervisor: Key concepts - Case Study: VMWare - Xen - KVM. **(9)**

CLOUD SECURITY AND TRUST MANAGEMENT

Privacy and Security in Cloud - Security Service Boundary - Securing Data - Encryption - Data Integrity and Auditing - Identity Management and Access Control - Trusted Computing. **(10)**

DISASTER RECOVERY AND SCALING

Disaster Recovery Planning - Disasters in Cloud - Disaster Management - Scaling a Cloud Infrastructure: Capacity planning - Cloud Scale. **(6)**

TOTAL : 45

REFERENCE BOOKS

1. *George Reese, "Cloud Application Architectures", 1st Edition, O'Reilly, 2009.*
2. *Barrie Sosinsky, "Cloud Computing Bible", Wiley India Pvt. Ltd., 2012.*
3. *William von Hagen, "Professional Xen Virtualization", Wrox Publications, 2008.*
4. *James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.*
5. *Danielle Ruest, Nelson Ruest, "Virtualization: A Beginner's Guide", Tata McGraw Hill, 2009.*

6. *David S. Linthicum, "Cloud Computing and SOA Convergence in Your Enterprise", Pearson Education, 2010.*

MOOCs

1. *https://www.mooc-list.com/course/introduction-cloud-computing-edx*
2. *https://www.coursera.org/learn/cloud-computing*
3. *https://www.mooc-list.com/course/comptia-cloud-cybrary*

18MCAE02 - GRAPHICS AND MULTIMEDIA

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Understand the importance and working of the basic graphical I/O devices and their improved versions.*

CO2 : *Employ point, line and circle scan conversion algorithms for drawing outline & filled graphical object.*

CO3 : *Construct a world coordinate scene from its constituent elements (defined in their local coordinate systems) by applying geometric transformations on the constituent elements.*

CO4 : *Determine the clipping operations required to change from the current display to a new display-when interactive operations through keyboard or mouse are performed.*

CO5 : *Analyze the performance of image, video, audio, text and graphics data compression techniques.*

INTRODUCTION

Graphics hardware - Raster and Random scan - Display devices - input devices -hard copy devices. Implementation algorithms for graphic primitives - line- poly line- circle- ellipse- curves - attributes - fill Styles **(8)**

TRANSFORMATIONS AND VIEWING

Two dimensional geometric transformations - Translation - scaling - rotation - reflection - shearing - composite transformations. Two dimensional viewing - window port- viewport - clipping - point - line - Cohen-Sutherland- Liang-Barsky- Nicholl-Lee-Nicholl. Three-Dimensional Geometric Transformations -Translation - Scaling - Rotation - reflection - shearing - affine transforms **(10)**

COMPUTER ANIMATIONS

Raster methods - double buffering - raster operations - morphing - simulating accelerations - motion Specifications - character animations - motion capture - OpenGL animation procedures. **(8)**

INTRODUCTIONS TO MULTIMEDIA

Multimedia Applications - Multimedia Systems Architecture - evolving technologies - defining objects - Compression and Decompression - Binary image compression - Color - gray scale- Still-video images - JPEG compression - video Image Compression. **(10)**

FILE FORMATS AND MULTIMEDIA I/O

Flich - text format - TIFF - RIFF - MIDI file formats- JPEG DIB- MPEG- AVI file formats. TWAIN - architecture - setting up new WAVE type. Pen Input- Video image display systems- Print output- Image Scanners- Digital Video and Audio- Video images and animation- Full-Motion video. **(9)**

TOTAL: 45

REFERENCES

1. *Donald D. Hearn- M. Pauline Baker- Warren, "Computer Graphics with Open GL", Prentice Hall, 4th Edition, 2010.*
2. *Prabhat K. Andleigh- KiranThakrar, "Multimedia Systems Design", Prentice - Hall of India Pvt. Ltd. 2007.*
3. *James D. Foley- Andries Van Dam- Steven K. Feiner- F. Hughes John, "Computer Graphics Principles and Practices, C", Pearsons publications, 2nd Edition, 2007.*
4. *Ralf Steinmetz and KlaraNahrstedt,"Multimedia: Computing- Communications and Applications", Pearson Educations- 2009.*

MOOCs

1. http://www.cse.iitm.ac.in/~vplab/computer_graphics.html
2. http://www.nptelvideos.in/2012/11/computer-graphics.html

18MCAE03 - ADVANCED DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

PRE-REQUISITES
18MCA24

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Analyze the background processes involved in queries and determine their impact on database operations and design.*

CO2 *: Analyze different methods and techniques for parallel and distributed query processing and apply appropriate algorithms for optimizing query execution.*

CO3 *: Demonstrate the usage of different architecture and design strategies for distributed and parallel databases.*

CO4 *: Apply the concepts of NoSQL for enterprise applications.*

CO5 *: Design data models for advanced applications using object oriented and other databases.*

QUERY PROCESSING

Overview - Measures of query Cost - Selection Operations - Sorting - Join Operations - Other Operations -Evaluation of Expressions.

QUERY OPTIMIZATION

Overview - Heuristics in query Optimization **(7)**

PARALLEL DATABASES

Introduction - I/O Parallelism - Interquery Parallelism - Intraquery Parallelism - Intraoperation Parallelism - Interoperation Parallelism.

DISTRIBUTED DATABASES

Homogenous and Heterogenous Databases - Distributed Data Storage - Distributed Transactions - Commit Protocols - Concurrency Control in Distributed Databases - Availability - Distributed Query Processing - Heterogenous Distributed Database - Cloud Based Databases. **(12)**

XML

Structure of XML Data - XML Document Schema - Querying and Transformation - Application Program Interfaces to XML - Storage of XML Data - XML Applications. **(9)**

OBJECT AND OBJECT RELATIONAL DATABASES

Introduction to Complex Objects - Object model of ODMG-ODL - OQL - Object Relational and Extended - Relational Systems - SQL and its Relational Features - Nested Relational Model. **(8)**

NoSQL DATABASES

Introduction to NoSQL - SQL vs NoSQL - Types - MongoDB - CRUD Operations - Advantages and Disadvantages. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 6th Edition, Mc Graw Hill International Edition, 2011.*
2. *Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2006.*
3. *Raghu Ramakrishnan, Johannes Gehrke, "Databases Management Systems", 3rd Edition, Mc Graw Hill, 2003.*

MOOCs

1. *https://www.coursera.org/learn/introduction-mongodb*
2. *https://lagunita.stanford.edu/courses/DB/RDB/SelfPaced/about*
3. *https://www.mooc-list.com/course/introduction-nosql-data-solutions-edx*

18MCAE04 - DISTRIBUTED SYSTEMS

L	T	P	C
3	0	0	3

PRE-REQUISITES

18MCA23, 18MCA24

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Analyze the advantages and disadvantages of various models for a distributed system*

CO2 : *Compare Remote Procedure Call and Remote Method Invocation from the perspective of developing distributed applications*

CO3 : *Describe the role of distributed Operating System and distributed File System in developing distributed systems*

CO4 : *Design the process of discovering and locating distributed objects using Naming and Directory services*

CO5 : *Demonstrate the concurrency control mechanism for distributed transactions*

INTRODUCTION

Characterization of Distributed Systems : Example of Distributed Systems - Resource Sharing and Web - Challenges - System Models: Architectural Models and Fundamental Models - Distributed Objects and Components.

Remote Invocation : Communication between Distributed Objects - Request-reply protocols - RPC -Remote Method Invocation. **(9)**

OPERATING SYSTEM SUPPORT

Introduction - Operating System Layer - Protection - Process and Threads - Communication and Invocation - OS Architecture.

DISTRIBUTED FILE SYSTEMS

Introduction - File Service Architecture - Sun Network File System. **(8)**

NAME SERVICES

Name Services and DNS - Directory and Discovery Services - Global Name Service - X.500 Directory Service.

CLOCK SYNCHRONIZATION

Clocks - Events and Process States - Synchronization - Logical time and Logical Clocks - Global States. **(10)**

DISTRIBUTED TRANSACTION MANAGEMENT

Transaction and Concurrency Control : Transactions - Nested Transactions - Locks - Optimistic Concurrency Control - Time Stamp Ordering - Comparison of Methods for Concurrency Control. Distributed Transactions: Flat and Nested - Atomic Commit Protocols - Concurrency Control - Distributed Deadlock -Transaction Recovery. Replication: System model and Group Communication - Fault Tolerant Services - Highly Available Services - Transactions with Replicated Data. **(12)**

DISTRIBUTED SHARED MEMORY

Design and Implementation Issues - Sequential and Release Consistency - Other Consistency Models. **(6)**

TOTAL : 45

REFERENCE BOOKS

1. *George Colouris, Jean Dollimore and Tim KindBery, "Distributed Systems: Concepts and Design", 5th Edition, Pearson Education, 2017.*
2. *Andrew S Tanenbaum, Maarten Van Steen, "Distributed Systems: Principles and Paradigms", 2nd Edition, Pearson Education, 2017.*
3. *Sloman M Kramer J, "Distributed System and Computer Networks", Prentice Hall of India, 1990.*

MOOCs

1. *https://www.edx.org/course/reliable-distributed-algorithms-part-1-kthx-id2203-1x-0*
2. *https://www.edx.org/course/reliable-distributed-algorithms-part-2-kthx-id2203-2x*

18MCAE05 - GRID AND CLUSTER COMPUTING

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Understand the basics of distributed systems and programming models.*

CO2 *: Examine grid computing architecture and its components.*

CO3 *: Apply concepts of grid computing and build distributed applications.*

CO4 *: Access and Identify the need for cluster computing.*

CO5 *: Design cluster computing based solutions for real world problems by incorporating load balancing.*

GRID COMPUTING

The data centre- Cluster and Grid computing-Meta computing-Different types of Grids-Web services and the grid. **(7)**

TECHNOLOGIES AND ARCHITECTURE FOR GRID

Clustering and grid computing- Issues in data grids-Functional requirements in grid computing-Standards-Trends in large data grids **(8)**

GRID STANDARDS AND TOOLKIT

Standards organization- Toolkit- Frameworks and middleware-Globus toolkit -Standards:OGSA and WSRF-Sample grid projects. **(8)**

CLUSTER COMPUTING

Basic Concepts: Approaches to parallel computing- Architecture and functionality of cluster -Categories of cluster. Cluster middleware-Early cluster architecture and High through put Computing Clusters-Setting up and administering a cluster. **(10)**

PROCESS AND MEMORY IN CLUSTER COMPUTING

Cluster architectures for high availability-Process scheduling: Job Management System-Resource management system- Jobs and Resource-Scheduling parallel jobs - Load sharing and load balancing-Distributed shared memory:Issues-Write synchronization for data consistency. **(12)**

TOTAL : 45

REFERENCE BOOKS

1. *Prabhu C.S.R., "Grid and Cluster Computing" PHI Learning, 2011 Reprint*
2. *Daniel Minoli, "A Networking Approach to Grid Computing" John Wiley and Sons, INC Publications, 2005.*
3. *Hamid R. Arabnia, Fernando G. Tinetti, "Grid, Cloud and Cluster Computing and Applications", Csrea Publishers, 2017.*

MOOCs

1. *https://www.mooc-list.com/course/introduction-grid-computing-uva*
2. *https://www.coursera.org/learn/hadoop*

18MCAE06 - INTERNET OF THINGS

L	T	P	C
3	0	0	3

PRE-REQUISITES
18MCA32

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Assess the different IoT technologies that suits an application.*

CO2 : *Recognize the challenges for smart object.*

CO3 : *Demonstrate knowledge of main architectures and paradigms for the Internet of Things.*

CO4 : *Demonstrate knowledge of MAC and routing protocols developed for Low Power and lossy networks.*

CO5 : *Design simple IoT systems for the given requirements comprising sensors- edge devices- wireless network connections and data analytics capabilities.*

INTRODUCTION

Definition and Characteristics of IoT - Physical Design of IoT - Logical Design of IoT - Enabling Technologies - IoT Levels - Domain specific IoTs **(5)**

DEVELOPING INTERNET OF THINGS

IoT and M2M - IoT System Management with NETCONF-YANG - IoT Design Methodology - Case Study: Weather monitoring - Motivation for using Python- Logical design using Python: Programming constructs - Python packages for IoT **(6)**

IoT PHYSICAL DEVICES AND ENDPOINTS

Building Blocks of an IoT device - Intel Galileo Board - Raspberry pi **(6)**

IoT Cloud based services using the XIVELY- NIMBITS

Cloud storage models and communication API - WAMP-AutoBahn for IoT - Xively cloud for IoT - Django - Designing a RESTful Web API - Amazon Web services for IoT- Data collection-storage-Computing using Xively and Nimbits- Data channels using advanced features-security tokens-Alerts-Jabbing-Subscriptions-Public cloud IoT platforms like Paas and SaaS **(10)**

Data Analytics for IoT : Apache Hadoop - Using map-reduce for batch data analytics **(4)**

Sensors- Participatory sensing- RFIDs and wireless sensor network

Introduction-Sensor technology - Sensing the real world-Analog sensors- Examples of sensors - Reading temperature from Resistance sensor- capacitive sensor-Examples of sensors-Temperature-humidity-distance- light-acceleration-vibrations and shocks-Gyroscope for angular acceleration- Magnetic sensors- Magnetometer-Sound -Sensing the Things-bar code-QR code-Motion sensors-Pressure sensors-Location and LIDAR-Industrial IoT - in bicycle manufacturing process and Automotive IoT - Connected cars technology **(10)**

CASE STUDIES ILLUSTRATING IoT DESIGN

Home Automation - Cities - Environment - Agriculture - Productivity Applications **(4)**

TOTAL: 45

REFERENCE BOOKS

1. Arshdeep Bahga and Vijay Madisetti, “Internet of Things: A Hands on Approach”, Universities Press, 2014.
2. Agus Kuniawa, “Getting started with Intel IoT and Intel Galileo”, Kindle edition, 2015.
3. Raj Kamal, “Internet of Things - Architecture and Design Principles”, McGraw Hill,2017

MOOCs

1. http://nptel.ac.in/courses/106105166/2
2. http://nptel.ac.in/courses/108108098/31
3. http://nptel.ac.in/courses/107106080

18MCAE07 - SOFTWARE METRICS AND MEASUREMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
18MCA25

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Analyse the problem to ascertain the type of software measurement.*

CO2 : *Apply selected statistical methods and enlist the findings of analysis.*

CO3 : *Design and tailor the selected metric to match the informations reliability need.*

CO4 : *Determine a plan to decide what data to collect and who should collect it.*

CO5 : *Interpret and communicate the metric results.*

FUNDAMENTALS OF SOFTWARE MEASUREMENT

Measurement in software engineering - scope of software metrics - measurement and models - measurement scales and scale types - classifying software measures - determining what to measure - software measurement validation. Software metrics data collection - Analyzing software measurement data: Introduction- Analyzing the results of experiments- Simple analysis Techniques- Overview of statistical **(10)**

SOFTWARE METRICS

Product quality metrics - In - Process Quality Metrics - Complexity Metrics and Models - Size Metrics - Effort- Cost and Time Measurement - Object Oriented Metrics - Software Maintenance Metrics **(10)**

SOFTWARE RELIABILITY MEASUREMENT

Basics of reliability theory- software reliability problem- parametric reliability growth models- the recalibration of software reliability growth predictions **(9)**

METRICS TO MANAGE PROJECTS

Tracking Software Progress - Software Project Metrics - Utilization and efficient Project Management **(7)**

MEASUREMENT AND MANAGEMENT

Planning a measurement program - Metrics Plan - Developing Goals- Questions and metrics - Mapping measures to activities - measurement tools - Measurers- Analysts and Audience - Measurement in practice. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Stephen H Kan, "Metrics and Models in Software Quality Engineering", Pearson Education, Second Indian Reprint, New Delhi, 2005.*
2. *Norman Fenton and Shari Lawrence Pfleeger, 'Software Metrics - A Rigorous & Practical Approach', Second Edition, Revised printing, Thomson Asia Pvt Ltd, Singapore, 2002.*
3. *Highsmith, "Agile Software Development Ecosystems", Addison Wesley- 2005.*
4. *Kent Beck, "Junit Pocket Guide", O'Reilly Media, First Edition, 2007.*
5. *Craig Larman, "Agile & Iterative Development, A Manager's Guide"- Pearson Education, 2009.*

MOOCs

1. *nptel.ac.in/courses/106101061/21*
2. *https://www.youtube.com/watch?v=o6rcKNRe3Ho*

18MCAE08 - AGILE METHODS FOR SOFTWARE DEVELOPMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
18MCA22,18MCA25

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Ascertain the need of software development methodologies with agility and self adaptability features to develop the software which meets the user needs.*

CO2 : *Compare the practices followed in different agile methodologies and choose the suitable methodology for a given project*

CO3 : *Synthesize the various agile methodology practices to produce a methodology for a project*

CO4 : *Develop the system by employing test first programming concept using Junit framework*

CO5 : *Develop a simple application using Scrum or XP methodology*

INTRODUCTION TO AGILE DEVELOPMENT

Agile and Self Adapting : The Cooperative Game Principle - Agile Overview-Evolution of Agile - Agile Software Development Ecosystem -Iterative and Evolutionary approach. Evolution of Agile Methodologies - Agile outside Software Development **(9)**

AGILE SOFTWARE DEVELOPMENT ECOSYSTEMS (ASDE)

The Scrum Process - Scrum's Contributions - Dynamic Systems Development Method (DSDM) Principles - The DSDM Process - DSDM's Contributions-Crystal Methodology Design Principles - The Crystal Framework - Crystal Methods - Crystal's Contributions. **(9)**

FEATURE DRIVEN DEVELOPMENT

The Feature Driven Development(FDD) Process Model - Beyond the FDD process Description - Conceptual Similarities and Differences - FDD's Contributions - Extreme Programming(XP) Basics - XP values and Principles - XP's Contributions - Adaptive Software Development Life Cycle - Leadership-Collaboration Management - ASD's Contributions. **(9)**

DEVELOPING AN ASDE

Articulating Ecosystem - Designing Agile Methodology - The Agile Metamorphosis **(8)**

JUNIT FRAMEWORK

I/O : Automatic Tests - Goal -Fixtures-Testing Exceptions - JUnit's Implementation - JUnit API - Test First Programming - Stub - Other Uses for Tests - Extending JUnit - JUnit and Ant - Running JUnit Standalone - JUnit and IDEs-Test Infection. **(10)**

TOTAL : 45

REFERENCE BOOKS

1. *Alistair Cockburn, "Agile Software Development: The Cooperative Game", Addison-Wesley, Second Edition, 2007.*
2. *Jim Highsmith, "Agile Software Development Ecosystems", Addison Wesley, 2005.*
3. *Kent Beck, "JUnit Pocket Guide", O'Reilly Media, First Edition, 2007.*
4. *Craig Larman, "Agile & Iterative Development , A Manager's Guide", Pearson Education,2009*

MOOC

1. *http://nptel.ac.in/courses/106101061/26*

18MCAE09 - OPEN SOURCE ECOSYSTEM

L	T	P	C
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PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course- students will be able to:

CO1 : *Know about the professional management and implementation of Open Source Technologies*

CO2 : *Analyse the differential combination of new technologies with the matured ones*

CO3 : *Decide on the boundaries of business which the web changed from building the business case to doing hands-on experimentation*

CO4 : *Self teach the issues faced in transitioning to the new technologies, ranging from business to social concern.*

CO5 : *Understand roles for open source software in any organization.*

INTRODUCTION

Open Source Software : Definition- History- Successful Areas with Examples. The Good- Bad and the ugly of Open Source Systems. Open Source Opportunities - Create Lab- Migration- Build Applications- Bring the New Desktop Systems Underserved and Migrate Applications and Databases to Open Source. **(7)**

ADVANCED OPEN SOURCE OPPORTUNITIES

Introduction - Directory Services - Email - Complex Web Publishing - Manage User Desktops - Other Possibilities'.Open Source Operating Systems - Linux Distribution Vendors- Enterprise Distribution Vendors- Community Supported Distribution Vendors- International Alternatives **(12)**

SERVER AND DESKTOP APPLICATONS

Server Applications - Infrastructure services - Web Servers - Database Servers - Mail Servers - Systems Management. Desktop Applications - Graphical Desktops - Web Browsers - The Office Suit - Mail and Calendar Clients. **(12)**

IMPLEMENTATION AND ARCHITECTURE

Methodology- Language and Cross Platform Code. System Implementation Process- Principles- Key Documents and integration with Open Source Community. Architecture - Managing Tiered Design - Performance and Scalability - Interoperability - Platform. **(8)**

COST AND LISCENCING

Ownership Costs - Staffing- Hardware- Software and Third Party Applications. Pricing - Types of Costs and Scenarios. Licensing - Types - License in use - Dual Licensing - Intellectual Property Issues **(6)**

TOTAL : 45

REFERENCE BOOKS

1. *Paul Kavanaugh, "Open Source Software, Implementation and Management", Elsevier Digital Press, 2004.*
2. *Stephen Koch, "Free/Open Source Software Development", Idea Group Publishing, 2005.*
3. *Karl Fogel, "Producing Open Source Software: How to Run a Successful FreeSoftware Project", under the Creative Commons Attribution, ShareAlike, 2018.*

MOOCs

1. *https://www.intel.in/content/www/in/en/communications/intel-open-network-platform.html*

18MCAE10 - SOFTWARE ARCHITECTURE AND DESIGN PATTERNS

L	T	P	C
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PRE-REQUISITES

18MCA25

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course- students will be able to:

CO1 *: Ascertain the need for Software Architecture and its features to develop software that meets user needs.*

CO2 *: Choose the suitable architectural style for a given project*

CO3 *: Synthesize the various architectural styles to produce a quality project*

CO4 *: Develop system by employing Design Patterns.*

CO5 *: Develop a simple application using Software Architecture and Design Pattern.*

INTRODUCTION TO SOFTWARE ARCHITECTURE

Introduction Software Architecture Definition Prospects - State of Art Architecture Business Cycle-Importance of Software Architecture - Architectural Structures. **(9)**

SOFTWARE ARCHITECURAL STY LES

Architectural Styles: Pipes and Filters- Layered Systems- Repositories -Process Control- Other familiar Architecture- Heterogeneous Architecture - Organizing Architectural Styles **(9)**

SOFTWARE ARCHITECTURE QUALITY

The Architectures and Quality Attributes Achieving Qualities - Achieving Quality goals with Architectural Styles -Unit Operations - Applying Unit Operations to User Interface - Case Studies- World Wide Web **(9)**

INTRODUCTIO TO DESIGN PATTERN

Introduction - Definition - Making a pattern - Pattern categories - Relationship between patterns - Patterns and software architecture **(9)**

DESIGN PATTERNS

Creational patterns - Structural patterns - Behavioral patterns - frameworks for patterns - Patterns catalogs and writing patterns. Case studies in UML. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Mary Shaw & David Garlan, "Software Architecture Perspectives on an emerging discipline", Prentice Hall of India, 3rd Indian Reprint, 2006.*
2. *Mary Shaw & David Garlan, "Software Architecture Perspectives on an emerging discipline", Prentice Hall of India, 3rd Indian Reprint, 2006.*
3. *Len Bass, Paul Clements & Rick Kazman, "Software Architecture in Practice", Pearson Education Asia, 3rd Indian Reprint, 2009.*
4. *Eric Gamma, Richard Helm, Ralph Johnson, John Vissides, "Grady Booch, Design Patterns", Addision Wesley, 2007.*
5. *Craig Larman, "Applying UML and Patterns", Prentice Hall, 2009.*

MOOCs

1. *www.nptel.ac.in/syllabus/106104027/*
2. *www.nptel.ac.in/syllabus/syllabus_pdf/106104027.pdf*
3. *nptel.ac.in/courses/106101061/15*
4. *nptel.ac.in/courses/106101061/17*

18MCAE11 - ENTERPRISE MANAGEMENT AND COMPUTING

L	T	P	C
3	0	0	3

PRE-REQUISITES
18MCA11

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course- students will be able to:

CO1 : *Make computing available as a utility under internet.*

CO2 : *Understand the fundamentals of enterprise architecture and enterprise computing.*

CO3 : *Implement programming paradigms under cloud like MapReduce.*

CO4 : *Describe the emerging development paradigms and technologies and discuss how these will change the way the enterprise applications should be architected.*

CO5 : *Understand the benefits the open source has on enterprise computing.*

INTRODUCTION

Architecture - Mainframe- Client/Server- 3-tier Architecture with TP monitors- Dev 2.0 Platforms- Cloud Computing. Enterprise Architecture - Data and process- Components- Application Integration and SOA- Data Centre Infra Structure. **(9)**

CLOUD PLATFORMS

Cloud Economics -Virtualization Technology - Multi-tenant Software. Data in the Cloud- Big Table- HBase and Dynamo. Map Reduce and Extensions. Software Architecture- Enterprise software - ERP- SCM & CRM. Custom Enterprise Applications.**(10)**

WORKFLOW AND BUSINESS PROCESS

Implementing work flow- Meta Model using ECA rules- ECA Work Flow Engine- Process Modelling and BPMN. Enterprise Analytics and Search. **(10)**

ENTERPRISE CLOUD COMPUTING

Ecosystem - Cloud Management Platforms and Tools- Tools for Building Private Clouds. Future of Enterprise Cloud Computing. **(8)**

OPEN SOURCE ENTERPRICE COMPUTING

Open Source Licenses- Management of Open Source Software Projects- Open Standards.

Business Strategies - Revenue Streams- Analysis and Critical Success Factors. **(8)**

TOTAL : 45

REFERENCE BOOKS

1. *Gautam Shroff, "Enterprise Cloud Computing, Technology, Architecture and Applications", Cambridge University Press, UK, 2010.*
2. *Gunasekaran- Angappa, "Global Implications of Modern Enterprise Information Systems: Technologies and Applications", IGI Global, 2008*
3. *Wolf Rogner, Allgemeinbeeideter and gerichtlichzertifizierter Sachverstandiger "Open Enterprise Computing", Students Handbook, 2016*

MOOCs

1. *http://www.businessresearchguide.com/faq/what-is-enterprise-computing/*

18MCAE12 - BASICS OF ROBOTICS

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Understand the architecture of robots by learning paradigms and intelligence.*

CO2 : *Apply the Forward and Inverse Kinematics of manipulators and understand the dynamics in locomotion control and trajectory generation.*

CO3 : *Program an application for industrial robots.*

CO4 : *Synthesize the Machine Intelligence in robots by studying the functions of industrial manipulators using AI approach.*

CO5 : *Understand the automation in robotics by using drive system for gripper movement.*

INTRODUCTION TO ROBOTIC PARADIGMS

Robots-Intelligent Robots-Paradigm-Robotic Paradigms-Primitives Sense-Plan-Act-Overview of Three Paradigms-Hierarchical-Reactive and Hybrid Deliberative/Reactive-Architectures **(7)**

BASICS OF MECHANICS AND CONTROL

Description of position and orientation Mechanics-Kinematics-Forward and Inverse kinematics of manipulators-Dynamics. Introduction to Jacobian of the Manipulator-Trajectory generation- Programming Robots-Off-line Programming and simulation **(9)**

ROBOT PROGRAMMING LANGUAGES AND SYSTEMS

Levels of Robot Programming- A Sample Application in industrial robot - Requirements of a Robot Programming Language-Internal world model versus external reality-Context Sensitivity- Error Recovery **(9)**

TELEOPERATION TO AUTONOMY

Overview-Machine Intelligent-Use of Robots-Implications-Brief History-Industrial Manipulators-Space Robotics and the AI approach-Teleoperation-Telepresence-Semi-autonomous control- Seven Areas of Robotic AI **(10)**

BASICS OF ROBOTICS TECHNOLOGY AND AUTOMATION

Introduction - End-Effectors-Drive System for Grippers-Mechanical- Magnetic- Vaccum and Adhesive-Design of Multiple DOF-Sensory Devices-Types of Sensors-Robot Vision Systems-Low Level- Sensing- Digitizing--Preprocessing techniques-Noise reduction-enhancement. **(10)**

TOTAL : 45

REFERENCE BOOKS

1. *Robin R. Murphy, "Introduction to AI Robotics", Prentice, Hall of India, New Delhi, 2007.*
2. *John J. Craig, "Introduction to Robotics, Mechanics and Control", Pearson Education Inc- 3rd Edition, 2013.*
3. *S.R. DEB, S.DEB "Robotics Technology and Flexible Automation", Tata McGraw Hill Education, 2nd Edition, 2011.*
4. *S.K. Saha, "Introduction to Robotics", Tata McGraw Hill Education 4th Edition, 2011.*
5. *Robert J.Schilling, "Fundamentals of Robotics, Analysis & Control", PHI Learning, 2010.*
6. *Mikell P Groover, Mitchel Weiss, Roger N Nagel, Nicholas G Odrey, Ashish Dutta, "Industrial Robotics Technology, Programming and Applications", 2nd Edition, 2012.*

MOOCs

1. *http://nptel.ac.in/courses/112101099/*
2. *https://onlinecourses.nptel.ac.in/noc16_cs02*
3. *http://nptel.ac.in/courses/112103174/39*
4. *http://nptel.ac.in/courses/112101098/download/lecture-1.pdf*
5. *http://nptel.ac.in/courses/106105077/#*

18MCAE13 - GPU AND PARALLEL PROGRAMMING

L	T	P	C
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PRE-REQUISITES
18MCA13, 18MCA14

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Understand the basic concepts of super-computing and parallel programming architecture*

CO2 : *Identify the difference between serial and parallel programming needs to solve real-time problems.*

CO3 : *Demonstrate the ability to use GPUs for parallel programming to solve compute intensive tasks.*

CO4 : *Identify CUDA architecture and its components.*

CO5 : *Apply parallel programming methods and solve problems using CUDA platform*

HISTORY OF SUPER COMPUTING

Von Neumann Architecture - Cray - Connection Machine - Cell Processor - Multinode Computing - The Early Days of GPGPU Coding - The Death of the Single - Core Solution - NVIDIA and CUDA - GPU Hardware Alternatives to CUDA: OpenCL - Direct Compute - CPU alternatives - Directives and libraries. **(8)**

UNDERSTANDING PARALLELISM WITH GPUS

Introduction - Traditional Serial Code - Serial/Parallel Problems Concurrency: Locality - Types of Parallelism: Task - based parallelism - Data-based parallelism - Flynn's Taxonomy - Some Common Parallel Patterns: Loop-based patterns - Fork/join pattern - Tiling/grids - Divide and conquer. **(10)**

CUDA HARDWARE- GRIDS- BLOCKS- AND THREADS

PC Architecture - GPU Hardware-CPUs and GPUs - Setting up CUDA - Threads: Problem decomposition - Task execution model - Threading on GPUs - CUDA kernels - Blocks: Block arrangement - Grids: Stride and offset - X and Y thread indexes. **(10)**

MEMORY HANDLING WITH CUDA

Introduction- Caches : Types of data storage - Register Usage - Shared Memory: Sorting using shared memory - Constant Memory: Constant memory caching - Constant Memory Broadcast - Global Memory - Score boarding - Global memory sorting - Sample sort. **(8)**

CUDA IN PRACTICE

Introduction - Serial and Parallel Code - Design Goals of CPUs and GPUs - Processing Datasets Using ballot and other intrinsic operations - Profiling - Case Study on AES Algorithm. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", Morgan Kaufman, 2012.*
2. *David Kirk, Wen-meiHwu, "Programming Massively Parallel Processors: A Hands-on Approach", Morgan Kaufman, 2010.*

MOOCs

1. *https://www.mooc-list.com/course/parallel-programming-coursera*
2. *http://nptel.ac.in/syllabus/syllabus_pdf/106102114.pdf*
3. *https://www.mooc-list.com/course/intro-parallel-programming-udacity*

18MCAE14 - DIGITAL IMAGE PROCESSING

L	T	P	C
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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Describe different modalities and current techniques in image processing*

CO2 : *Provide mathematical foundations for digital manipulation of image acquisition- preprocessing- enhancement-segmentation and compression.*

CO3 : *Apply image processing techniques in both the spatial and frequency (Fourier) domains*

CO4 : *Develop and compare various Image Compression and Decompression Techniques.*

FUNDAMENTALS OF IMAGE PROCESSING

Introduction - Elements of visual perception- Steps in Image Processing Systems - Image Acquisition - Sampling and Quantization - Pixel Relationships - Colour Fundamentals and Models- File Formats, Introduction to the Mathematical tools. **(8)**

IMAGE ENHANCEMENT AND RESTORATION

Spatial Domain : Gray level Transformations- Histogram Processing- Spatial Filtering - Smoothing andSharpening. Frequency Domain: Filtering in Frequency Domain - DFT- FFT- DCT- Smoothing and Sharpening filters - Homomorphic Filtering- Noise models- Constrained and Unconstrained restoration **(10)**

IMAGE SEGMENTATION AND FEATURE ANALYSIS

Detection of Discontinuities - Edge Operators - Edge Linking and Boundary Detection - Thresholding - Region Based Segmentation - Motion Segmentation- Feature Analysis and Extraction. **(8)**

MULTI RESOLUTION ANALYSIS AND COMPRESSIONS

Multi Resolution Analysis : Image Pyramids - Multi resolution expansion - Wavelet Transforms- FastWavelet transforms- Wavelet Packets. Image Compression: Fundamentals - Models - Elements of Information Theory - Error Free Compression - Lossy Compression - Compression Standards - JPEG/MPEG. **(10)**

APPLICATIONS OF IMAGE PROCESSING

Representation and Description- Image Recognition- Image Understanding - Image Classification - Video Motion Analysis - Image Fusion - Steganography - Colour Image Processing **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Rafael C.Gonzalez and Richard E.Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2008.*
2. *Milan Sonka, Vaclav Hlavac and Roger Boyle, "Image Processing, Analysis and Machine Vision" Third Edition, 3rd, Brooks Cole, 2008.*
3. *Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall India, 2007.*
4. *Madhuri A. Joshi, "Digital Image Processing: An Algorithmic Approach", Prentice Hall India, 2006.*
5. *Rafael C.Gonzalez, Richard E.Woods and Steven L. Eddins, "Digital Image Processing Using MATLAB", 2nd Edition, Pearson Education, 2010.*

MOOCs

1. *http://nptel.ac.in/courses/106105032/#*
2. *http://nptel.ac.in/courses/117105135/3*
3. *http://nptel.ac.in/courses/106105032/22*
4. *http://nptel.ac.in/courses/106105032/38*

18MCAE15 - ORGANIZATIONAL BEHAVIOR

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PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will achieve the following :

CO1 *: Given a case study, analyze the behavior of the individual.*

CO2 *: Given a case study, analyze the behavioral pattern of group interaction in organization*

CO3 *: Given a scenario in an organization assess the attitude and personality of the individuals in the organization.*

CO4 *: Given a business problem form groups and finds a solution to the problem.*

CO5 *: Given a problem in an organization, apply emotional intelligence and solve the problem.*

INTRODUCTION TO ORGANIZATIONAL BEHAVIOR

Concept- Nature- Characteristics- Conceptual Foundations and Importance- Models of Organizational Behavior- Management Challenge- A Paradigm Shift- Relationship with Other Fields- Organizational Behavior : Cognitive Framework- Behavioristic Framework and Social Cognitive Framework **(8)**

PERCEPTION AND ATTRIBUTION

Concept- Nature- Process- Importance. Management and Behavioural Applications of Perception. Attitude: Concept- Process and Importance- Attitude Measurement. Attitudes and Workforce Diversity. Personality: Concept- Nature- Types and Theories of Personality Shaping- Personality Attitude and Job Satisfaction.

Learning : Concept and Theories of Learning. **(10)**

MOTIVATION

Concepts and Their Application- Principles- Theories- Employee Recognition- Involvement- Motivating a Diverse Workforce. Leadership: Concept- Function- Style and Theories of Leadership-Trait- Behavioural and Situational Theories. Analysis of Interpersonal Relationship- Group Dynamics: Definition- Stages of Group Development- Group Cohesiveness- Formal and Informal Groups- Group Processes and Decision Making- Dysfunctional Groups. **(10)**

ORGANIZATIONAL POWER AND POLITICS

Concept- Sources of Power- Distinction Between Power- Authority and Influence- Approaches to Power- Political Implications of Power: Dysfunctional Uses of Power. Knowledge Management & Emotional Intelligence in Contemporary Business Organisation.

ORGANIZATIONAL CHANGE

Concept- Nature- Resistance to change- Managing resistance to change- Implementing Change- Kurt Lewin Theory of Change. **(8)**

CONFLICT

Concept- Sources- Types- Functionality and Dysfunctionality of Conflict- Classification of Conflict Intra- Individual- Interpersonal- Intergroup and Organizational- Resolution of Conflict- Meaning and Types of Grievance and Process of Grievance Handling. Stress: Understanding Stress and Its Consequences- Causes of Stress- Managing Stress. Organizational Culture: Concept- Characteristics- Elements of Culture- Implications of Organisation culture- Process of Organisational Culture. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Newstrom John W., "Organizational Behaviour: Human Behavour at Work", Tata Mc Graw Hill- 12th Edition, 2007.*
2. *Luthans Fred, "Organizational Behaviour", Tata McGraw Hill.*

3. *Mc Shane L. Steven, Glinow Mary Ann Von & Sharma Radha R., "Organizational Behaviour", Tata McGraw Hill- 3rd Edition, 2004.*
4. *Robbins Stephen P., "Organizational Behaviour", Pearson Education- 12th Edition, 2009.*
5. *Hersey Paul- Blanchard, Kenneth H and Johnson Dewey E., "Management of Organizational Behavior: Leading Human Resources",Pearson Education- 8th Edition.*
6. *Greenberg Jerald and Baron Robert A., "Behavior In Organisations: Understanding and Managing the Human Side of Work", Prentice Hall of India.*
7. *Davis, Keith, "Human Behaviour at Works", Tata Mc Graw Hill- New Delhi- 2012.*
8. *Pareek, Udai, "Behavioural Process in Organization", Oxford 4 IBH- New Delhi. 2000.*

MOOCs

1. *http://nptel.ac.in/courses/110105034/*
2. *http://nptel.ac.in/courses/110105033/*

18MCAE16 - PRINCIPLES OF MANAGEMENT

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Describe the principles of management.*

CO2 : *Prepare a decision tree for a given statement.*

CO3 : *Given a business plan, specify the management functions (planning- organizing- controlling and evaluating)*

CO4 : *Construct the organizational chart for given company.*

CO5 : *Prepare a flow chart of the selection process of a given company.*

MANAGEMENT

Concept- Nature- Importance- Management : Art and Science- Management as a Profession- Management Vs. Administration- Management Skills- Levels of Management- Characteristics of Quality Managers. Evolution of Management: Early contributions- Taylor and Scientific Management- Fayol's Administrative Management- Bureaucracy- Hawthorne Experiments and Human Relations- Social System Approach- Decision Theory Approach. Business Ethics and Social Responsibility: Concept- Shift to Ethics- Tools of Ethics. **(9)**

INTRODUCTION TO FUNCTIONS OF MANAGEMENT

Planning :Nature- Scope- Objectives and Significance of Planning- Types of Planning- Process of Planning-Barriers to Effective Planning- Planning Premises and Forecasting- Key to Planning- Decision Making. Organizing: Concept- Organisation Theories- Forms of Organisational Structure- Combining Jobs: Departmentation- Span of Control- Delegation of Authority- Authority & Responsibility- Organisational Design. **(11)**

STAFFING

Concept- System Approach- Manpower Planning- Job Design- Recruitment & Selection- Performance Appraisal Directing: Concept- Direction and Supervision Motivation: Concept- Motivation and Performance- Theories Of Motivation- Approaches for Improving Motivation- Pay and Job Performance- Quality of WorkLife- Morale Building. **(9)**

LEADERSHIP

The Core of Leadership: Influence- Functions of Leaders- Leadership Style- Leadership Development **(2)**

Communication : Communication Process- Importance of Communication- Communication Channels-Barriers to Communication. Controlling: Concept- Types of Control- Methods: Pre-control: Concurrent Control: Post-control- An Integrated Control System- The Quality Concept Factors affecting Quality- Developing a Quality Control System- Total Quality Control- Pre-control of Inputs- Concurrent Control of Operations. Post Control of Outputs. Change and Development: Model for Managing Change- Forces for Change- Need for Change- Alternative Change Techniques- New Trends in Organisational Change. **(7)**

Training and Development : Need for training- advantages of training programme- Types of training programmes- Training methods- Selection of a training method- Evaluation of training and development- Training practices in India. **(7)**

TOTAL : 45

REFERENCE BOOKS

1. *Robbins S.P., Coulter Mary & Niharika Vohra, "Management", 10th Edition, Pearson Education, 2010.*
2. *S.A. Sherlekar, "Ethics in Management", Himalayan Publishing Company. 2012*

3. *H. Koontz, "Essentials of Management : An International Leadership Perspective", McGraw Hill Publication, 2008.*
4. *L.M. Prasad, "Principles and Practices of Management" by Sultan Chand & Sons- 2012*

MOOCs

1. *http://nptel.ac.in/courses/110105081/*
2. *http://nptel.ac.in/courses/110105079/*
3. *http://nptel.ac.in/courses/110105079/4*
4. *http://nptel.ac.in/courses/122105021/*
5. *http://nptel.ac.in/courses/110105067/#*

18MCAE17 - PRINCIPLES OF ENVIRONMENTAL SCIENCE

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Predict the values of biodiversity for the sustainable development.*

CO2 : *Design the methods for the prevention of environmental pollution and solid waste management.*

CO3 : *Illustrate the use of alternate energy resources for growing energy needs.*

CO4 : *Classify the environmental segments, the causes for its deterioration, he measure taken for its prevention and the need for sustainable development.*

CO5 : *Identify the threats to environment, social issues related to it, the necessity for environmental legislation, sustainable development and the applications of bio technology and green chemistry for environmental protection.*

ENVIRONMENTAL CHEMISTRY

Chemistry and the Environment - Environmental segments - Composition and Characteristics of Atmosphere, Hydrosphere, Lithosphere, and Biosphere: Chemical species and particulates present in the environment - reactions occur in the atmosphere. Photochemical smog. Impact of man on the environment. Impact of Environment upon humans. **(9)**

ECOSYSTEMS AND BIODIVERSITY

Concepts of an ecosystem : types, structure and functions of the ecosystem. Food chains, food webs and ecological pyramids. Biodiversity: Definition - Genetic, species, ecosystem and landscape diversities - India as a mega diversity nation - Hot spots of biodiversity. Importance of biodiversity - loss of biodiversity - causes of reduction in biodiversity. Conservation of biodiversity - restoration of biodiversity. **(9)**

ENVIRONMENTAL POLLUTION

Sources, causes, effects and management of Air, Water, Soil, Marine, Noise and Radioactive pollution. Sources of Solid, Hazardous, Biomedical and Chemical wastes. Solid Waste Disposal and treatment **(9)**

ENERGY AND ENVIRONMENT

Energy resources - Growing energy needs - renewable and non-renewable energy sources - use of alternate energy sources - Solar, Wind, Tidal, Geothermal and OTEC - (Principles only) merits and limitations. **(3)**

SOCIAL ISSUES AND THE ENVIRONMENT

Sustainable development - Urban Population - problems related to energy - Water Conservation. Rainwater harvesting - Environment Ethics - Green house effect, Global warming, climate change, Nuclear hazards and accidents. Issues involved in enforcement of environment legislation - precautionary principle - polluter pays principle - the Beneficiary pays principle - role of an Individual in Environment protection - Environment (Protection) Act - Air (Prevention and Control of Pollution) Act. Water (Prevention andControl of Pollution) Act. Wildlife Protection Act and Forest (Conservation) Act. **(9)**

BIOTECHNOLOGY AND GREEN CHEMISTRY

Biotechnology and its applications in environmental protection - Bioinformatics - Bioremediation. Biological purification of contaminated air. Green chemistry for clean technology: Significance of green chemistry - Basic components of Green chemistry. Industrial applications of green chemistry. Green fuels - e-green Propellants and Biocatalysts. **(6)**

TOTAL : 45

REFERENCE BOOKS

1. *Dara, S.S. "A Text Book of Environmental Chemistry and Pollution Control", S. Chand and Company Ltd, 8th Revised Edition, 2008.*
2. *Kaushik, A. and Kaushik, C.P. "Environmental Science and Engineering", 2nd Edition, New Age International (P) Limited Publishers, 2006.*
3. *Dr. Raghavan Nambiar, K. "Text Book of Environmental Studies" Scitech Publications (India) Pvt. Ltd, Chennai, 2007.*
4. *Benny Joseph, "Environmental Studies" Tata McGraw Hill Publishing Company Ltd, 2008.*
5. *Surinder Deswal and Anupama Deswal, "A Basic course in Environmental Studies" Dhanpat Rai and Co. (P) Ltd, 2006.*

18MCAE18 - E-COMMERCE

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Specify Infrastructural requirements & Business models for an e-commerce start up. (From the prespective of Indian Businesses)*

CO2 : *Analyze different types of e marketing and e advertising stategies and e-payment alternatives commonly used in the industry and summarize the relative merits in Indian socio economic scenario.*

CO3 : *Discuss trends in CRM- SCM and Knowledge Management using web technologies and point out the suitable adaptations for a medium scale e-commerce firm in India.*

CO4 : *Appraise the impact of different types of mobile and wireless technologies on success of e-commerce in India.*

CO5 : *Understand ERP and EDI technologies can transform the Indian Business environment into paperless, cashless, easy-to-manage and regulated, with the use of cloud and open source technologies.*

INTRODUCTION

History - Early Business Information Interchange Efforts - Emergence of internet- WWW. E-Commerce - Advantages- Disadvantages - BAM Models - Transition to E-Commerce in India- E-Transmission Challenges- The Information Technology Act 2000 - Business Models - Enabling Technologies of WWW. Social Networks- Auctions- Portals: Social networks and online communities - Online auctions - E-commerce portals. **(7)**

ELECTRONIC MARKETING- SECURITY AND PAYMENT

Traditional Marketing - Web Presence Goal - Browsing Behavior Model - Online Marketing- E-Advertising- Trends- E-branding- Strategies. E- Security - Internet Security- E-business Risk Management Issues- Information Security Environment in India. E-Payment - Concerns in Internet Banking- Digital Payment Requirements- Token Based E-Payment Classification- E-Cash- Cheque Payment- Risk and E-Payment. **(8)**

CRM- SCM & SKM

E-CRM Solutions - Business Touch Points - Case Studies. Supply Chain - The new way- e-logistics- Fulfilling Customer's Needs- Smart Chains Smarter Gains. Real Time Benefits and Strategies - Advantages. Knowledge as Key Business Asset- Changes in - Global Business Economy- Technology. Knowledge - Definition- Management - Knowledge Management- Data Warehousing and Data Mining. Virtual value chain - 7 Dimensions - E-Commerce Strategy - planning E-Commerce Project. **(10)**

MOBILE COMMERCE AND TECHNOLOGIES

E-Business Portals. What? - Issues - Wireless- Cellular- Wireless Spectrum. - Success Stories. Technologies - mobile commerce- WAP Wireless Generations. Portals - Different Types- benefits- features. Requirements for Intell. **(10)**

ERP & EDI

Introduction -ERP and E2RP - Business Problems- New Paradigm- Drivers - Business processes and supporting processes. Architecture- Implementation- ERP Processes. ERP - Cloud and Open Sources.EDI - Concepts and Technology. **(10)**

TOTAL : 45

REFERENCE BOOKS

1. *P.T. Joseph S.J, "E-Commerce - An Indian Perspective", PHI Learning Private Limited, 4th Edition, 2012.*
2. *Kenneth C. Laudon, "E-Commerce : Business - Technology - Society", 4th Edition, Pearson.*

3. *Sandeep Desai, Abhishek Srivastava, "ERP to E2RP - A Case Study Approach", Eastern Economy Edition, PHI Learning Pvt. Ltd., 2013.*
4. *Kamalesh K. Bajaj, Debjani Nag, "E-Commerce - The Cutting Edge of Business", McGraw Hill Education (India) Private Limited, 2nd edition, 2005.*
5. *Ravi Kalakota- Marcia Robinson, "E - Business 2.0 - Roadmap for Success", Addison Wesley Professional, 2001.*

MOOCs

1. *http://nptel.ac.in/courses/106108103/pdf/PPTs/mod13.pdf*
2. *http://nptel.ac.in/courses/106108103/pdf/Lecture_Notes/LNm13.pdf*

18MCAE19 - DECISION MAKING

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to

CO1 : *Critically discuss different theories and theoretical perspectives in leadership - negotiation and decision making.*

CO2 : *Evaluate models to describe how leaders are perceived (leadership style)-analyse a leader's decision-making and role in negotiations.*

CO3 : *Analyse how decision-making and strategies in negotiations affect a leader's perception*

CO4 : *Use decision making tools to quantitatively analyse its impacts in a given situation.*

CO5 : *Apply programmed and non-programmed decisions to effectively manage uncertainty.*

INTRODUCTION TO DECISION MAKING

Basic concepts of decision making - The art of decision management- Fundamentals of Decision Making - The strategy pyramid - The DM portfolio- drivers of poor decision management- The ten cardinal decision issues and reviews- rationalistic versus evolutionary strategic decision making- Players in a decision- Representation of decision problem. **(9)**

STRATEGIC DECISION ANALYSIS

Introduction to strategic decision analysis - The decision analysis cycle- Sensitivity analysis- Expert and stakeholder opinions- Risk analysis- Public perception and risk communication- Deliberative democracy and public participation- Good heuristics for decision analysis- Negotiation and bargaining. **(9)**

RATIONAL DECISION MAKING

The Importance and Limitations of Rational Decision Making: Limited or "bounded" rationality. The Decision Process- Quantitative and qualitative factors- marginal analysis- cost effective analysis. **(9)**

DECISION ANALYSIS & UNCERTAINITY

Modelling Uncertainity- utility model- risk attitude- Subjective Expected Utility (SEU) modelling- Decision Tress and Influence diagrams. Programmed and Non-Programmed Decisions- the Uncertainty Problem: deal with unknowns. The Madness and wisdom of crowds. **(9)**

INFORMATION AND COMMUNICATION

Negotiation-Information to support decisions-Framing and Communicating Decisions. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *French- Simon. Maule- John. & Papamichail- Nadia, "Decision Behaviour- Analysis and Support", New Delhi: Cambridge University Press-2010.*
2. *James M. Kouzes, Barry Z.Posner, John Wiley & Sons "The Leadership challenge, How to make Extraordinary things happen in organizations", 2016.*
3. *J.Edward Russo and Paul J.H. Shoemaker "Winning decisions : getting it right the first time", 1st edition, 2002 special markets, currency books.*

MOOCs

1. *nptel.ac.in/courses/106101061/21*
2. *https://www.youtube.com/watch?v=o6rcKNRe3Ho*

18MCAE20- ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Highlight the characteristics of a successful entrepreneur*

CO2 *: Understand the role of entrepreneurship in the economic development of a country*

CO3 *: Formulate the business plans for an efficient and successful business*

CO4 *: Justify the need for developing rural entrepreneurship and agri-preneurship in India*

CO5 *: State the economic factors influencing the emergence and development of entrepreneurship in a country*

ENTERPRENEURSIP

Entrepreneur - Types of Entrepreneurs - Difference between Entrepreneur and Intrapreneur - Entrepreneurship in Economic Growth- Factors Affecting Entrepreneurial Growth. **(9)**

MOTIVATION

Major Motives Influencing an Entrepreneur - Achievement Motivation Training- Self Rating - Business Games- Thematic Apperception Test - Stress Management - Entrepreneurship Development Programs - Need - Objectives. Rural entrepreneurship and agri-preneurship development **(9)**

BUSINESS

Small Enterprises - Definition- Classification - Characteristics- Ownership Structures - Project Formulation - Steps involved in setting up a Business - identifying- selecting a Good Business opportunity- Market Survey and Research- Techno Economic Feasibility Assessment - Preparation of Preliminary Project Reports - Project Appraisal - Sources of Information - Classification of Needs and Agencies. **(9)**

FINANCING AND ACCOUNTING

Need - Sources of Finance- Term Loans- Capital Structure- Financial Institution- Management of working Capital- Costing- Break Even Analysis- Taxation - Income Tax- Excise Duty - Sales Tax. **(9)**

SUPPORT TO ENTREPRENEURS

Sickness in small business - Concept- Magnitude- Causes and Consequences- Corrective Measures - Business Incubators - Government Policy for Small Scale Enterprises - Growth Strategies in small industry - Expansion- Diversification- Joint Venture- Merger and Sub Contracting. **(9)**

TOTAL: 45

REFERENCE BOOKS

1. *Khanka. S.S., "Entrepreneurial Development" S.Chand& Co. Ltd., Ram Nagar, New Delhi, 2013.*
2. *Donald F Kuratko, "Entrepreneurship Theory Process and Practice", Cengage Learning, 9th Edition, 2014.*
3. *Hisrich R D, Peters M P, "Entrepreneurship", Tata McGraw-Hill, 8th Edition, 2013.*
4. *Poornima M Charantimath "Entrepreneurship Development And Small Business Enterprise", Pearson Publication, Paper Back, 2006.*

MOOCs

1. *http://www.sanfoundry.com/best-reference-books-entrepreneurial-development/*
2. *http://www.tandfonline.com/toc/TEPN20/curre*

18MCAE21 - E-PORTFOLIO MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Understand market efficiency and Investment Process.*

CO2 : *Manage investment portfolios and optimally diversify portfolios.*

CO3 : *Access quantitative and qualitative skills necessary for the construction- revision and Security evaluation of financial portfolios.*

CO4 : *Apply forecasting process and construct the portfolio.*

CO5 : *Evaluate investment strategies and predict the market position.*

INTRODUCTION

Introduction to Portfolio Management; Systematic Portfolio management-Investment managers - Force of Change - Theory and Application - Database - Tools of Analysis - Objectives- Market efficiency- Dimension of Risks and returns- Asset allocation- Asset classes and investing. **(9)**

PORTFOLIO CONSTRUCTION AND ANALYSIS

Introduction - Portfolio Construction Process- Markowitz model - Concepts of efficiency - Security and Portfolio Return- Risk return and weighting changes - Short selling - Required Model Inputs Capital Market Theory and Applied Portfolio Analysis - CAPM Assumptions and Implications- The Security Market Line/Capital Asset Pricing Model-The Single-Index Model- Fundamental Attributes. **(9)**

SECURITY VALUATION AND RISK ANALYSIS

Bond Valuation and Risk Analysis - Valuation Theory - Duration- Convexity- Reinvestment Rate Risk- Risk Premium- Fundamental Sources of Risk- Applying Valuation Model Methods- Stock Valuation Models- Stock Value and Differing Model Inputs- Growth Stocks and the Two-Stage Growth Model- The Market Line Technique- Extra market Factor-Three Stage DDM Application **(9)**

ASSET CLASS MANAGEMENT

Disciplined Stock Selection- Active-Passive Strategies- A Stock Selection Strategy- Designing the Investment Process- Measuring Predictive Ability- Composite Forecasting- Generating Return Forecasts- Generating a Return Distribution- Adjusting for Predictive Capability - Transaction Costs - Applied Composite Forecasting - Portfolio Construction - Portfolio Optimization - Managing the Process over Time - Performance of Strategy over Time - Long/Short Strategies - Return Patterns - Long/Short Risk. **(9)**

PORTFOLIO PERFORMANCE ANALYSIS

Evaluating Portfolio Performance- Evaluating Investment Strategies - Mutual Fund Objectives - Calculating Fund Returns - Risk Adjusted Performance- Components of Investment Performance - Stock Selection - Market Timing- Return Attribution - Long-Term Goals: Strategic Asset Allocation - Appraising Asset-Mix Changes - Evaluating Asset-Class Managers - Multifactor Adjustment - Information Ratio - Aggregating Return Components. **(9)**

TOTAL: 45

REFERENCE BOOKS

1. *James L. Farrell, Jr. and Walter J. Reinhart, "Portfolio Management Theory and Application", McGraw Hill, 2nd edition.*
2. *Schultz Collins Lawson, "Portfolio Management: Theory & Practice", Schultz Collins Lawson Chambers, Inc. Investment Counsel, 2008.*
3. *Prasanna Chandra, "Investment Analysis and Portfolio Management", Tata McGraw Hill Education, 2008.*

MOOCs

1. *http://nptel.ac.in/courses/110105035/*
2. *http://nptel.ac.in/courses/110105036/*

18MCAE22 - FINANCIAL TECHNIQUES AND ANALYSIS

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Understand some financial aspects of a business firm.*

CO2 : *Devise a method for organized collection of data according to logical and consistent accounting procedures.*

CO3 : *Interpret the balancing figures for knowing the assets position and reveal the activities of cash inflow and outflow.*

CO4 : *Review the operational performance and draw conclusions.*

CO5 : *Knowledge on improvement of a business entity using trend analysis.*

INTRODUCTION

Definition-meaning of terms-Liquidity- Solvency- Profitability- Efficiency- financial statements-Income statement- Balance Sheet-statement of earnings-Statement of changes in financial position- Cash flow statement-Fund flow statement. **(9)**

FINANCIAL ANALYSIS

External analysis- Internal Analysis- Short term Analysis- Horizontal Analysis- Vertical Analysis- Comparative Financial Statements and Common size statement: Income statement-Cash flow Statement and Balance sheet- Statement of Changes in Working Capital-Risk Analysis. **(9)**

RATIO ANALYSIS

Relationship- Items and group of items-Representation of ratios-Classification of ratios-Functional classification-liquidity ratio-Solvency ratio-Profitability ratios-Turnover ratios-Balance sheet ratio-Leverage ratio. **(9)**

TREND ANALYSIS

Revenue and Cost analysis-revenue- Cost- Trend line- Realizing spike- Sharp decline- Inaccuracy. Investment Analysis- Historical trend line- Cause-and-effect relationship-Predicting the future - Detect signs of change in market- Revenue Patterns and expense report. **(9)**

CAPITAL BUDGETING

Capital Expenditure- Methods of evaluation of invest proposal- Accounting rate of return-Average Accounting Return-Payback Period- Net present Value-Profitability Index- IRR- Modified IRR- Real options evaluation. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *K.R.Subramanyam and John J Wild, "Financial Statement Analysis", McGraw-Hill Education, 10th edition, 2014.*
2. *William J. Carney, "Corporate Finance Principles and Practice", Foundation Press, 2014.*
3. *Erich A. Helfert, "Techniques of Financial analysis; A Practical guide to measuring business performance", McGraw Hill, 9th edition, 1996.*

MOOCs

1. *http://nptel.ac.in/courses/110107081/15*
2. *http://nptel.ac.in/courses/105103023/39*

18MCAE23 - MACHINE LEARNING

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Recognize fundamental issues and challenges of machine learning : data, model selection, model complexity, supervised and unsupervised learning.*

CO2 *: Understand and apply Decision trees and Artificial Neural Networks.*

CO3 *: Distinguish the strength and weakness of Bayesian learning.*

CO4 *: Analyze and apply Instance based learning, Genetic algorithms and rule based learning.*

CO5 *: Assess capability of Reinforcement learning and study its application.*

INTRODUCTION

Designing a Learning System - Perspectives and Issues in Machine Learning

CONCEPT LEARNIG AND GENERAL TO SPECIFIC ORDERING - Concept Learning Task- Concept Learning as Search- Find-S- Version Space- Inductive bias. **(5)**

DECISION TREE LEARNING : Decision tree representation, Decision tree Learning Algorithm- Hypothesis Basis- Inductive bias-Issues in Decision Tree learning. **(5)**

ARTIFICIAL NEURAL NETWORKS : Introduction- Neural Network Representations- Perceptrons - Multilayer Networks Back Propagation Algorithm- Remarks on the Back propagation Algorithm- Face Recognition Example- Advanced Topics in Artificial Neural Networks.

EVALUATING HYPOTHESIS : Motivation, Estimating Hypothesis Accuracy, Basis of Sampling Theory, A General Approach for Deriving Confidence Intervals- Difference in Error of Two Hypothesis- Comparing Learing Algorithms **(8)**

BAYESIAN LEARNING : Bayes Theorem - Bayes theorem and Concept Learning- Maximum Likelihood and Least Square Error Hypothesis- Maximum Likelihood Hypothesis for Predicting Probabilities- Minimum Description Length Principle- Bayes Optimal Classifier- Gibs Algorithm- Naive Bayes Classifier-Bayesin Belief Networks- The EM Algorithm. **(7)**

INSTANCE BASED LEARNING : k-Nearest Neighbour Learning, Locally weighted Regression- Radial Basis Functions- Case based Reasoning.

GENETIC ALGORITHMS : Motivation, Genetic Algorithms- Examples- Hypothesis Space Search- Genetic Programming- Models of Evolution and Learning - Parallelizing Genetic Algorithms. **(10)**

LEARNING SET OF RULES : Sequential Covering Algorithms- Learning First Order Rules- Learning Sets of First order Rules FOIL- Induction as Inverted Deduction- Inverting Resolution.

REINFORCEMENT LEARNING : The learning task - Non deterministic Rewards and Actions - Temporal Difference Learning- Generalizing from Examples- Relationship to Dynamic Programming. **(10)**

TOTAL: 45

REFERENCE BOOKS

1. *Tom M Mitchell, "Machine Learning", McGraw Hill, 1st Edition, 2003.*
2. *Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 2nd Edition, 2010.*

3. *Stephan Marsland, "Machine Learning - An Algorithmic Perspective", Chapman and Hall, 1st Edition, 2009.*
4. *Nils Nilsson, "Introduction to Machine Learning", MIT Press, 1997.*
5. *Jude Shavil, Thomas G Dietterich, "Readings in Machine Learning", Morgan Kaufmann Publishers, 1990.*

MOOCs

1. *http://nptel.ac.in/courses/106105152/*
2. *https://onlinecourses.nptel.ac.in/noc17_cs26/preview*

18MCAE24 - DATA ANALYTICS

L	T	P	C
3	0	0	3

PRE-REQUISITES
18MCA42

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Outline the definitions, concepts and enabling technologies of data analytics.*

CO2 *: Analyze different statistical analysis techniques to be applied on different types of datasets.*

CO3 *: Develop regression models using R for a given dataset.*

CO4 *: Apply text analysis methods to analyze unstructured data.*

CO5 *: Create solutions for real world business problems and effectively present results using data visualization techniques.*

INTRODUCTION

Introduction to Big Data Analytics : Big Data Overview - State of the Practice in Analytics - Key Role for the New Big Data Ecosystem- Examples of Big Data Analytics. Data Analytics Lifecycle: Overview - Discovery - Data Preparation - Model Planning - Model Building - Communicate Results - Operationalize - Case Study. **(10)**

BASIC DATA ANALYTIC METHOD USING R

Introduction to R - Exploratory Data Analysis - Statistical Methodsfor Evaluation. **(8)**

REGRESSION AND TIME SERIES ANALYSIS

Linear Regression - Logistic Regression- Time Series Analysis : Box-Jenkins Methodology-ARIMA Model: Autocorrelation Model-Auto Regressive Models-Moving Average Model-ARMA and ARIMA Models. **(9)**

TEXT ANALYSIS

Text Analysis Steps with Example- Collecting- Representing Text - Term Frequency -Categorizing Documents by Topics - Determining Sentiments. **(10)**

DATA ANALYTICS PROJECT

Communicating and Operationalizing and Analytics Project - Creating the Final Deliverables - Data Visualization. **(8)**

TOTAL : 45

REFERENCE BOOKS

1. *EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley, 2015.*
2. *Thomas A. Runkler, "Data Analytics - Models and Algorithms for Intelligent Data Analysis", Springer, 2012.*

MOOCs

1. *https://www.mooc-list.com/course/regression-modeling-practice-coursera*
2. *https://cran.r-project.org/doc/contrib/usingR.pdf*
3. *https://www.mooc-list.com/course/hands-text-mining-and-analytics-coursera*

18MCAE25 - NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

PRE-REQUISITES
18MCA33

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Understand core algorithms and data structures used in NLP.*

CO2 : *Utilize corpora and annotations added to them.*

CO3 : *Build statistical NLP components- such as n-gram language models- text classifiers and part-of-speech taggers- that learn from such corpora.*

CO4 : *Evaluate the merits of different machine learning methods for given NLP tasks.*

CO5 : *Appreciate the relationship between linguistic representations and computational applications.*

INTRODUCTION

Human Languages - Models - Ambiguity - Processing paradigms; Phases in Natural Language Processing - Applications. Text Representation in Computers - Encoding Schemes - Linguistics Resources. Introduction to Corpus - Elements in Balanced Corpus - TreeBank - PropBank - WordNet - VerbNet. Resource Management with XML- Management of Linguistic data with the help of GATE- NLTK. **(6)**

WORD LEVEL ANALYSIS

Regular Expressions and Automata - Morphology and Finite State Transducer - Probabilistic Models of Pronunciation and Spelling - N-grams - HMMs and Speech Recognition. **(9)**

SYNTACTIC ANALYSIS

Word Classes and Part-of-Speech Tagging- Context-Free Grammars - Parsing with Context-Free Grammars - Features and Unification - Lexicalized and Probabilistic Parsing - Language and Complexity. **(11)**

SEMANTIC ANALYSIS AND DISCOURSE PROCESSING

Representing Meaning - Semantic Analysis - Lexical Semantics - Word Sense Disambiguation and Information Retrieval. **(10)**

APPLICATIONS

Text Summarization - Text Classification - Question Answering - Sentiment Analysis and Opinion Mining. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Jurafsky D. and J. H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing: Computational Linguistics and Speech Recognition", 2nd Edition, Upper Saddle River NJ: Prentice-Hall, 2008.*
2. *Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.*
3. *Jurafsky and Martin, "Speech and Language Processing", Prentice Hall, 1st Edition (January 26- 2000), SBN: 0130950696*
4. *James Allen, "Natural Language Understanding", 2nd Edition, Benjamin/Cummings Publishing Company, 1995.*

MOOCs

1. *https://www.youtube.com/playlist?list=PL6397E4B26D00A269*
2. *https://www.youtube.com/watch?v=aeOLjFe256E*
3. *https://www.youtube.com/watch?v=FLZvOKSCkxY*

18MCAE26 - SOCIAL NETWORK ANALYSIS

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Understand concept of semantic web and related applications.*

CO2 : *Represent knowledge using ontology.*

CO3 : *Evaluate importance of human behaviour in social web and related communities.*

CO4 : *Understand importance of trust and privacy in social networks.*

CO5 : *Apply techniques for visualization of social networks.*

INTRODUCTION

Introduction to Semantic Web : Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and Measures in Network Analysis - Electronic Sources for Network analysis: Electronic Discussion Networks- Blogs and Online Communities - Web-based networks - Applications of Social Network Analysis. **(9)**

MODELLING- AGGREGATING AND KNOWLEDGE REPRESENTATION

Ontology and their role in the Semantic Web: Ontology-based Knowledge Representation - Ontology Languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and Aggregating Social Network Data: State-of the-art in Network Data Representation - Ontological Representation of Social Individuals - Ontological Representation of Social Relationships - Aggregating and Reasoning with Social Network Data - Advanced Representations. **(10)**

EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL

Extracting Evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Definition of Community - Evaluating Communities - Methods for Community Detection and Mining - Applications of Community Mining Algorithms - Tools for Detecting Communities Social Network Infrastructures and Communities - Decentralized Online Social Networks - Multi- Relational Characterization of Dynamic Social Network Communities. **(9)**

PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES

Understanding and Predicting Human Behaviour for Social Communities - User Data Management - Inference and Distribution - Enabling New Human Experiences - Reality Mining - Context - Awareness - Privacy in Online Social Networks - Trust in Online Environment - Trust Models based on Subjective Logic - Trust Network Analysis - Trust Transitivity Analysis - Combining Trust and Reputation - Trust Derivation based on Trust Comparisons - Attack Spectrum and Counter. **(9)**

VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

Graph Theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing Online Social Networks- Visualizing Social networks with Matrix-based Representations - Matrix and Node-Link Diagrams - Hybrid Representations - Applications - Cover Networks - Community Welfare - Collaboration Networks - Co-Citation Networks. **(8)**

TOTAL : 45

REFERENCE BOOKS

1. *Peter Mika, "Social Networks and the Semantic Web", 1st Edition, Springer 2007.*
2. *Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.*
3. *Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking - Techniques and Applications", 1st Edition, Springer 2011.*

4. *Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.*
5. *Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access:Techniques for Improved user Modelling", IGI Global Snippet, 2009.*
6. *John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.*

MOOC

1. https://www.youtube.com/watch?v=n3ziCzUGu2M

18MCAE27 - INTELLIGENT INFORMATION RETRIEVAL

L	T	P	C
3	0	0	3

PRE-REQUISITES
18MCA15, 18MCA31

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Understand algorithms and techniques for information retrieval.*

CO2 : *Design a search engine or any text retrieval system.*

CO3 : *Apply data mining techniques and quantitative evaluation methods for IR systems.*

CO4 : *Develop applications with retrieval capabilities.*

CO5 : *Combine aspects of information visualization and mining for information retrieval and web information retrieval.*

BASICS OF INFORMATION RETRIEVAL

Boolean Retrieval - The Term Vocabulary and Posting Lists - Scoring- Term Weighting and the Vector Space Model - Computing Scores in a Complete Search System - Evaluation in Information Retrieval. **(11)**

IR MODELS

XML Retrieval - Probabilistic Information Retrieval : Review - Ranking Principle - Binary Independence Model - Language Models for Information Retrieval : Language Models - Query Likelihood Model. **(10)**

TEXT CLASSIFICATION AND SVM MODEL

Text Classification and Naïve Bayes : Text Classification Problem - Naïve Bayes Text Classification - Bernoulli Model - Properties of Naïve Bayes - Feature Selection. Support Vector Machines and Machine Learning on Documents : SVM Models - Machine Learning Methods. **(9)**

CLUSTERING AND MATRIX DECOMPOSITIONS

Flat Clustering : Problem Statement - K-means - Hierarchical Clustering: Agglomerative Clustering - Centroid Clustering- Divisive Clustering - Matrix Decompositions and Latent Semantic Indexing. **(9)**

WEB SEARCH AND IR

Web Search Basics - Web Crawling and Indexes : Overview - Crawling - Link Analysis : Pagerank. **(6)**

TOTAL : 45

REFERENCE BOOKS

1. *Christopher Manning, Prabhakar Raghavan and Hinrich Schutze, "Introduction to Information Retrieval", Cambridge University Press, 2012.*
2. *Ricardo Baeza-Yates, Berthier Ribeiro-Neto, Modern Information Retrieval: The concepts and Technology behind Search (ACM Press Books), Second Edition, 2011.*
3. *D.A. Grossman, O. Frieder, Information Retrieval: Algorithms and Heuristics, Springer, 2004.*
4. *Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, Addison Wesley, First Edition, 2009.*
5. *Mark Levene, An Introduction to Search Engines and Web Navigation, Wiley, Second Edition, 2010.*

MOOCs

1. *https://www.youtube.com/watch?v=5L1qemKyUKA (18-1 onwards)*

18MCAE28 - BIG DATA TECHNOLOGIES

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Build single and multi-node Hadoop clusters on Linux or Windows platform*

CO2 : *Use Hadoop file system commands to load and execute programs on it.*

CO3 : *Write map-reduce programs for data intensive applications and execute them on the Hadoop platform.*

CO4 : *Use NoSQL databases like MongoDB in data processing applications.*

CO5 : *Choose appropriate big data technologies to analyse big data for a given analytic requirement.*

FUNDAMENTALS OF BIG DATA

Classification of Digital Data- Characteristics of Data-Evolution of Big Data-Definition-Challenges-Traditional Business Intelligence Versus Big Data. **(6)**

BIG DATA ANALYTICS

Introductionto Big Data Analytics-Classification of Analytics-Challenges of Big Data-Terminologies used in Big Data Environments-Big Data technologies: NoSQL and Hadoop. **(6)**

HADOOP

Data Storage and Analysis-Comparison with Other Systems-A Brief History of Hadoop-Apache Hadoop and the Hadoop Ecosystem-Setting up a Hadoop Cluster. **(8)**

HADOOP DISTRIBUTED FILE SYSTEM

Design of HDFS -HDFS Concepts: Blocks-Name Nodes and Data Nodes-HDFS Federation-HDFS High-Availability-The Command-Line Interface-Basic File System Operations-Hadoop File Systems-The Java Interface-Reading Data From a Hadoop URL-Reading Data Using the File System API- Writing Data-Directories-Querying the File System-Deleting Data. **(9)**

MAP REDUCE

A Weather Dataset- Data Format- Analyzing the Data with Hadoop -Map and Reduce- Java Map Reduce-Scaling Out-Data Flow-Combiner Functions-Running a Distributed Map Reduce Job-Map Reduce Program Examples. **(9)**

NOSQL AND MONGODB

Introduction to NoSQL-Types of NoSQL Databases-Advantages and Use-SQL versus NoSQL.

Introduction to MongoDB-Data Types-MongoDB Query Language. **(7)**

TOTAL : 45

REFERENCE BOOKS

1. *Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", 1st Edition, Wiley, 2016.*
2. *Tom White, "Hadoop: The Definitive Guide, O'Reilly Media", 3rd Edition, Yahoo Press, 2012.*
3. *Chuck Lam, "Hadoop in Action", Manning Publications, 2011.*
4. *Srinath Perera,Thilina Gunarathne, "Hadoop Map Reduce Cookbook", Packt Publishing Limited, 2013.*

MOOCs

1. *https://www.mooc-list.com/course/hadoop-platform-and-application-framework-coursera*
2. *https://www.mooc-list.com/course/introduction-big-data-coursera*
3. *https://www.mooc-list.com/course/big-data-analysis-hive-spark-sql-dataframes-and-graphframes-coursera*

18MCAE29 - AD HOC NETWORKS

L	T	P	C
3	0	0	3

PRE-REQUISITES
18MCA32

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Describe unique issues in ad-hoc networks and MAC protocols and their classifications.*

CO2 : *Discuss challenges in designing routing and transport protocols for ad-hoc networks.*

CO3 : *Demonstrate familiarity with common wireless sensor node architecture and the organization of MAC protocols developed for WSN.*

CO4 : *Demonstrate knowledge of routing in WSN and to analyze and classify wireless mesh networks.*

CO5 : *Develop simple routing solutions for ad-hoc- WSN and mesh networks.*

AD-HOC MAC

Introduction - Issues in Ad-hoc Wireless Networks. MAC Protocols - Issues- Classifications of MAC protocols- Multi channel MAC & Power Control MAC Protocol. **(9)**

AD-HOC NETWORK ROUTING & TCP

Issues - Classifications of routing protocols-Hierarchical and Power aware. Multicast routing - Classifications: Tree based- Mesh based. Ad-hoc Transport Layer Issues. TCP over Ad-Hoc- Feedback based- TCP with explicit link- TCO-Bus- Ad-Hoc TCP- and Split TCP. **(9)**

WSN - MAC

Introduction - Sensor Network Architecture- Data dissemination- Gathering. MAC Protocols - Self -organizing- Hybrid TDMA/ FDMA and CSMA based MAC **(9)**

WSN ROUTING- LOCALIZATION & QOS

Issues in WSN routing - OLSR- AODV- Localization - Indoor and Sensor network Localization. QoS in WSN **(9)**

MESH NETWORKS

Necessity for Mesh Networks - MAC enhancements - IEEE 802.11s Architecture - Opportunistic routing - Self configuration and Auto configuration - Capacity Models - Fairness- Heterogeneous Mesh Network -Vehicular Mesh Networks. **(9)**

Total : 45

REFERENCE BOOKS

1. *C. Siva Ram Murthy and B.S. Manoj, "Ad Hoc Wireless Networks : Architectures and Protocols", Pearson Education, 2004.*
2. *Feng Zhao and Leonidas Guibas, "Wireless Sensor Networks", Morgan Kaufman Publishers, 2004.*
3. *C.K.Toh, "Ad Hoc Mobile Wireless Networks : Protocols and Systems", 2nd Edition, Pearson Education, 2002.*
4. *Thomas Knag and Sebastin Buettrich, "Wireless Mesh Networking", O'Reilly Publishers, 2007.*
5. *Charles E.Perkins, "Ad Hoc Networking", Addison Wesley, 2000.*

MOOCs

1. *http://nptel.ac.in/courses/106105160/*

18MCAE30 - INTERNETWORKING PROTOCOLS AND MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
18MCA32

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Illustrate the working principles of link layer and network layer protocols used for data communication in the Internet.*

CO2 *: Determine the suitability of User Datagram Protocol for the given application in terms of reliability and performance.*

CO3 *: Understand and experiment the working of Transmission Control Protocol for the given application based on its requirements.*

CO4 *: Analyze the requirements for monitoring and controlling a network using Simple Network Management Protocol and the Management Information Base.*

CO5 *: Develop TCP and UDP based socket programs for the given client server communication scenario*

LAYER I & II PROTOCOLS

Introduction to TCP/IP Reference model - Link layer - Internet Protocol - Address Resolution Protocol- Internet Control Message Protocol- IP Routing - Dynamic Routing Protocols. **(9)**

UDP AND APPLICATIONS

User Datagram Protocol - Broadcasting and Multicasting - Internet Group Management Protocol - Trivial File Transfer Protocol - Bootstrap Protocol **(9)**

TRANSMISSION CONTROL PROTOCOL

Connection Establishment and Termination - TCP Interactive Data Flow - TCP Bulk Data Flow - TCP Timeout and Retransmission - TCP Timers **(9)**

NETWORK MANAGEMENT

Introduction - Network Monitoring - Network Control. SNMPv1: Concepts - Management information Standard MIBs - Simple Network Management Protocol **(9)**

SOCKET PROGRAMMING

Introduction to Sockets - Socket Addresses - Elementary Socket System Calls-Client Server Communication using Sockets: Connection Oriented Protocol- Connection less Protocol - Advanced Socket System Calls - Socket Options **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Kevin R. Fall, W. Richard Stevens, "TCP/IP Illustrated, Volume 1:The Protocols", Pearson Education Asia, 2nd Edition, 2012.*
2. *William Stallings, "SNMP, SNMPv2, SNMPv3 and RMON 1 and 2", Pearson Education Asia, 3rd Edition, 2013.*
3. *W. Richard Stevens, "UNIX Network Programming", Prentice Hall India, 2nd Edition, 2009.*
4. *Behrouz A. Forouzan, "TCP/IP Protocol Suite", Tata McGraw-Hill Publishing Company Limited, New Delhi, 4th Edition, 2010.*
5. *Donahoo M., Calvert K., "TCP/IP Sockets in C, Practical Guide for Programmers", Morgan Kauffman Publishers, 2001.*

MOOCs

1. *http://nptel.ac.in/courses/106105081/31*
2. *nptel.ac.in/courses/106105081/37*
3. *nptel.ac.in/courses/106105081/21*

18MCAE31 - MOBILE COMPUTING

L	T	P	C
3	0	0	3

PRE-REQUISITES
18MCA32

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Describe wireless and mobile computing systems and analyze the architecture- functions and emerging techniques in GSM*

CO2 : *Understand the issues and techniques used in the design of MAC for Wireless communication.*

CO3 : *Explain the structure and components for Mobile IP and mobility management*

CO4 : *Describe the types and functionalities of transport and application layer services for wireless communication*

CO5 : *Develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.*

Introduction to Mobile Computing

Introduction to MC- novel applications- limitations- Architecture. GSM : Mobile services- System architecture- Radio interface- Protocols- Localization and calling- Handover- Security- New data services. **(8)**

Medium Access Control

Motivation for a specialized MAC (Hidden and exposed terminals- Near and far terminals)- SDMA- FDMA- TDMA- CDMA. **(8)**

Mobile Network Layer

Mobile IP - Goals- Assumptions- Entities and terminology - IP packet delivery - Agent advertisement and discovery - Registration - Tunneling and encapsulation - Optimizations - Dynamic Host Configuration Protocol (DHCP). **(9)**

Mobile Transport Layer

Traditional TCP- Indirect TCP- Snooping TCP- Mobile TCP- Fast retransmit/fast recovery- Transmission /time-out freezing- Selective retransmission- Transaction oriented TCP. **(10)**

Mobile Application Layer

Wireless Application Protocol - Introduction - Protocol architecture - WDP - WTLS - WTP - WSP - WML - WML Script - WAE - WTA. **(10)**

TOTAL : 45

REFERENCE BOOKS

1. *Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition, 2004.*
2. *Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002.*
3. *William Stallings, "Wireless Communications and Networks", Prentice Hall of India, Pearson Education, 2nd Edition, 2004.*
4. *Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd., New Delhi, 2012.*

MOOCs

1. *https://onlinecourses.nptel.ac.in/noc16_cs13*

18FY22F - BASIC FRENCH

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Understand basics of the Language*

CO2 *: Write simple narration and description and speak to communicate ideas.*

CO3 *: Demonstrate confidence in Social Interactions.*

INTRODUCTION **(2)**

UNITÉ-1 : Faire connaissance - inviter et répondre à une invitation - décrire les personnes- articles définis et indéfinis - genre etnombre des noms et des adjectifs- interrogation et négation - conjugaison du présent. Paris monuments et lieux publics - la vie de quatre parisiens de professions différentes. **(11)**

UNITÉ-2 : Exprimer l' ordre et l'obligation demander et commander - evaluer et apprécier- féliciter et remercier - articles partitifs -adjectifs démonstratifs et possessifs prépositions et adverbes de quantité et de l'imperatif verbes pronominaux - une région deFrance la Bourgogne - vie quotidienne à la compagne. **(11)**

UNITÉ-3 : Raconter et rapporter - donner son avis - se plaindre et réprimander - expliquer et justifier - pronoms compléments - futur proche - passé composé et imparfait. Plusieurs régions de France - différents univers sociaux. **(11)**

UNITÉ-4 : Demander l'autorisation - interdire - formuler des projects - discuter et débattre. Pronoms < en > et < y > - pronoms relatifs et superlatifs - conjugaison du futur - présent continu et passé récent.La vie administrative et régionale - problems economiques et écologiques - traditions et modernité. **(10)**

TOTAL : 45

REFERENCE BOOKS

1. *Le Nouveau Sans Frontières, Philippe Dominique, Jacky Girardet, Michèle Verdelhan.*
2. *Dondo Modern French Course, Mathurin Dondo*
3. *Modern French Grammar, Margaret Lang and Isabelle Perez.*

18FY22G - BASIC GERMAN

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Understand fundamental concepts of the Language*

CO2 *: Write simple narration and description and speak to communicate ideas.*

CO3 *: Demonstrate confidence in Social Interactions.*

DEUTSCH-EIN GRUNDKURS GERMAN-A BASIC COURSE

1. EINFÜHRUNG

BegrÜßung - Name - Vorname - Familienname - Anrede

2. THEMA

Hallo! Wiegeht's? Begegnungen

Guten Tag, ich suche…, Im Supermarkt

Arbeit und Freizeit Familie and Haushalt

3. GRAMMATIK

Position des Verbs : Aussage, W- Frage und Ja/ Nein - Frage; Artikel die der das.

W- Frage; Konjugation in Pr sens;

Nominativ : bestimmter, unbestimmter and negative Artikel Akkusativ : Akkusativ-Erg nzung

Artikel als Pronomen

Dative - Erg nzung :Personalpronomen und Ortsangaben; Imperativ

Modalverben; Ortsangaben; Richtungsangaben;

Zeitangaben; Ordinalzahlen

Possessiv- Artikel; trennbare und nicht trennbareVerben; Wechselprapositionen

Unterricht 50 + Teste 10 = 60 Stunden

Lehrbuch

REFERENCE BOOKS

1. Studio d A1: Kurs - und Übungsbuch (Deutsch alsFremdsprache) CornelsenVerlag.
2. Tangarmaktuell1 :Kursbuch + Arbeitsbuch (Deutsch alsFremdsprache)
   Max HueberVerlag

18MCAEL01 - MOBILE APPLICATION DEVELOPMENT LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

18MCA22

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Use the components of Android development environment for mobile application development*

CO2 *: Design GUI forms using layouts,views, event handling, notifications and content providers in Android studio.*

CO3 *: Implement database applications using SQLite and perform CRUD operations*

CO4 *: Develop mobile applications that make use of camera and media player in Android.*

CO5 *: Use location based services, network services and graphics to develop innovative mobile apps.*

CONCEPTS TO BE COVERED

1. Android Development Environment
   - Download and Install SDK and ADT
   - Working of Eclipse and Android Emulator
2. Generic UI development
   - Views and View groups
   - Event Handling and Listeners
   - Layouts and spinner
3. Storing and Retrieving Data
   - Android storing and retrieving data using SQL file
   - Working with content provider
4. Notification and Alarms
   - Action Bars-Menus-Dialogs
   - Notifications and Toast
5. Camera and Media player
   - Camera Application
   - Media player and media recorder
6. Location Based Services
   - Finding locations and Tracking Movement
   - Map based activity and Proximity alerts
7. Communication via Network and Web
   - SMS and MMS
   - Bluetooth and WI-FI
8. Graphics and Animation
   - Different shapes of different colours
   - Moving from one direction to another
   - Tweened animation

MOOCs

1. *http://barbra-coco.dyndns.org/student/learning_android_studio.pdf*
2. *https://www.edx.org/course/android-app-development-beginners-galileox-caad002x*
3. *https://www.coursera.org/learn/java-for-android*

18MCAEL02 - GRAPHICS AND MULTIMEDIA LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Design graphical primitives using algorithms*

CO2 *: Develop 2D Transformations.*

CO3 *: Design interactive graphics applications.*

CO4 *: Design objects and layers for scene in animation.*

CO5 *: Develop animated application software.*

CONCEPTS TO BE COVERED

COMPUTER GRAPHICS

1. Primitive Algorithms
   Line - Bresenham- DDA- Midpoint. Circle - Midpoint- Trigonometric Ellipse - Midpoint- Trigonometric
2. Polygon- Polygon Filling.
3. Transformations - 2D Translations- Scaling- Rotation

MULTIMEDIA AND ANIMATIONS

1. Flash Programming (OR) Maya
2. Creating Layers- Symbol objects- effects for objects
3. Creating scene by combining objects and layers
4. Creating Animations using various technologies
5. Creating Interactive Animation.
6. Adding audio to animations.
7. Creating small animation projects.

MOOCs

1. http://www.nptelvideos.in/2012/11/computer-graphics.html
2. http://nptel.ac.in/courses/106106090/

18MCAEL03 - INTERNET OF THINGS LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Choose the required sensor and perform calibration, for a given requirement.*

CO2 *: Devise interface circuit for connecting a chosen sensor to Galileo board.*

CO3 *: Develop software for Galileo board to interact with the sensor to meet requirements.*

CO4 *: Develop software to interact(send/receive data) with Web/Application server located in the Internet.*

CO5 *: Use data analytics tool to analyze the data collected and present the report to the end user.*

Concepts to be covered

1. Programs for exploring the features of Contiki such as protothreds- timers- networking primitives by using Cooja simulator.
2. Developing applications using Galileo board- exploiting all features of the board.
3. Application on wireless sensor networks
4. NesC Programming language
5. WSNs Projects of the SENSES Lab
6. A simple application blink

MOOCs

1. *http://nptel.ac.in/courses/108102042/26*
2. *https://www.class-central.com/course/nptel-introduction-to-internet-of-things-10093*
3. *http://nptel.ac.in/course.php*

18MCAEL04 - NATURAL LANGUAGE PROCESSING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to :

CO1 *: Apply basic algorithms in the area of Natural Language Processing.*

CO2 *: Perform morphological analysis on text.*

CO3 *: Apply techniques for syntactic analysis.*

CO4 *: Use algorithms at semantics level and resources of natural language data-corpora.*

CO5 *: Apply techniques for information extraction.*

CONCEPTS / TO BE COVERED

Topics will include (but are not restricted to) machine translation, sequence tagging, constituent and dependency parsing, information extraction, semantics.

1. Language Models
2. Machine Translation
3. Morphological and Syntactical analysis
4. Text Classification
5. Sequence Tagging
6. Constituency Parsing
7. Dependency Parsing
8. Information Extraction
9. Machine Comprehension

Structured Prediction, a branch of Machine Learning relevant to NLP can be included if students have studied Machine Learning as a course.

MOOCs

1. https://www.youtube.com/watch?v=j6BsoiKDat0&list=PLDB034BC533455720

18MCAEL05 - SOCIAL NETWORK ANALYSIS LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Input data, represent social networks as a graph and apply visualization techniques.*

CO2 *: Visualize network datasets.*

CO3 *: Perform different network measurements.*

CO4 *: Build and implement social network designs.*

CO5 *: Apply social network theory to social network datasets.*

CONCEPTS TO BE COVERED

1. Data Management
2. Network Visualization
3. Cohesion, centralization and core-periphery
4. Node-level measurements
5. Statistical measurements, multivariate
6. Creating sub-groups
7. Ego-networks
8. Personal networks
9. Triad analysis, roles and equivalence
10. Testing hypotheses

MOOCs

1. https://www.youtube.com/watch?v=j6BsoiKDat0&list=PLDB034BC533455720

18MCAEL06 - VIRTUALIZATION AND CLOUD COMPUTING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES
18MCA26, 18MCA37

ASSESSMENT : PRACTICAL

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 *: Demonstrate knowledge on creating, managing, and migrating virtual machines using a virtualization tool.*

CO2 *: Develop an application, deploy it in virtual machine, and access the application from local/remote host.*

CO3 *: Develop an application, launch it on a public PaaS cloud, and access it with proper authentication mechanisms.*

CO4 *: Create and manage virtual machine instances using a public IaaS cloud.*

CO5 *: Apply knowledge in using cloud storage for storing the data in a secure manner.*

CONCEPTS TO BE COVERED

1. Virtualization Software Installation
2. Creating single/multiple virtual machines
3. Communication between host machine and virtual machine
4. Communication between two virtual machines on the same host / different hosts
5. Virtual machine migration
6. Deploying and accessing simple applications in a virtual machine

Google App Engine

7. Develop an application, launch it on Google App Engine, and access it with proper authentication mechanisms

Amazon Web Services

8. Create and manage Amazon EC2 instances
9. Run web applications on EC2 instances and access them from remote clients
10. Create and manage Amazon S3 instances
11. Upload files to S3 after applying proper security mechanisms to ensure data confidentiality and integrity

MOOCs

1. *http://nptel.ac.in/courses/106106129/28*
2. *http://nptel.ac.in/courses/106105167/*
3. *https://www.edx.org/course/cloud-computing-security-usmx-university-maryland-university-cc617x*

18MCAOE01 - ACCOUNTING AND FINANCIAL MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Prepare books of accounts and verify correctness using trial balance- for any business organization.*

CO2 : *Prepare statements of financial accounting to ascertain the profit-forany trading or manufacturing organization*

CO3 : *Perform cost estimation and determine the optimum units of products for a firm using Cost Sheet- CVP analysis and Marginal Costing Techniques*

CO4 : *Prepare financial statements using ratio analysis- budgeting- working capital management- capital budgeting and budgetary control techniques and present facts to assist in strategic decision making- given a set of investment options for a business*

CO5 : *Develop software solutions to automate a given accounting- costing or financial process- using MS-Excel*

FINANCIAL ACCOUNTING

Introduction : Accounting Concepts- Principles and Conventions - Basic Accounting Procedures - Journal and Ledger- Trial Balance. **(12)**

FINAL ACCOUNTS

Manufacturing and Trading Account- Profit and Loss Account- Balance Sheet. Final accounts with adjustments - Working with excel worksheets for automating Final Accounts. **(8)**

COST ACCOUNTING

Methods and Techniques of Cost Accounting - Classification of Cost - Material Cost- Labour Cost-Overheads- Fixed and Variable Costs- Cost-Volume-Profit Analysis - Marginal Costing and Decision Making **(9)**

FINANCIAL MANAGEMENT

Objectives and Scope of Financial Management - Analysis and Interpretation of Financial Management -Ratio Analysis - financial system - capital investment decision through Pay-back Period Method- Average Rate of Return - Internal Rate of Return - Cost of capital - Discounted cash flow analysis. **(8)**

BUDGETING AND BUDGETARY CONTROL

T types of budgets - Preparation of various functional budgets - preparation of cash budgets - flexible budgets - advantages of budgeting and budgetary control **(8)**

TOTAL : 45

REFERENCE BOOKS

1. *Grewal T S, "Double entry book keeping, Finanacial Accounting", Sultan Chand & Sons, 2012.*
2. *Sharad K. Maheswari, Maheswari S.N., "Principles of Management Accounting Vol. I & II", SultanChand & Sons, 2007.*
3. *Vinayakam N, Mani P.L., Nagarajan K.L., "Principles of Accountancy", S.Chand & Co., Ltd., 2008.*
4. *Sashi K. Gupta & Sharma R.K., "Management Accounting", Kalyani Publishers, 2011.*

18MCAOE02 - BASICS OF JAVA PROGRAMMING

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Express knowledge on the basic features of Java Language like identifiers, keywords, operators, control structures and classes.*

CO2 : *Apply object oriented concepts using language feature like classes, inheritance, packages, exception handling.*

CO3 : *Create application program interfaces and implement them as required.*

CO4 : *Create applications with efficient GUI programming and Event Handling.*

CO5 : *Develop applications supported with back end programming in support with conventional databases.*

INTRODUCTION AND JAVA ENVIRONMENT

How Computer Architecture Affects a Language ? - Why Java ? - Features of Java Language- JVM -The heart of Java - Java's Magic Bytecode. Installing Java- Java Program Development - Java Source File Structure -Compilation- Executions. Variables- Keywords- Constants- Comments - Primitive Datatypes- Operators- Assignments **(6)**

OBJECT ORIENTED PROGRAMMING

Class Fundamentals - Object & Object reference - Object Life time & Garbage Collection- Creating and Operating Objects - Constructors and initialization- Access Control- Modifiers- Design of Accessors and Mutator Methods - methods. Argument Passing Mechanism- Method Overloading- Recursion- Dealing with Static Members- Finalize() Method- Native Method. Use of "this" reference- Use of Modifiers with Classes & Methods- Cloning Objects. **(6)**

EXTENDING CLASSES AND INHERITANCE

Use and Benefits of Inheritance in OOP- Types of Inheritance in Java- Inheriting Data members and Methods - Role of Constructors in inheritance - Overriding Super Class Methods -Use of "super" keyword- Polymorphism in inheritance - Type Compatibility and Conversion- Inner Class & Anonymous Classes -Abstract Class & Interfaces- Implementing interfaces-Initializing & Accessing Array- Multi -Dimensional Array- Operation on String- Mutable & Immutable String. **(10)**

PACKAGES AND EXCEPTION HANDLING

Organizing Classes and Interfaces in Packages- Package as Access Protection- Defining Package- CLASSPATH Setting for Packages - Making JAR Files for Library Packages Import and Static Import Naming Convention For Packages. Exceptions Hierarchy -Types of Exception -Control Flow In Exceptions- Use of try- catch- finally- throw- throws in Exception Handling -In-built and User Defined Exceptions- Checked and Un-Checked Exceptions. **(6)**

INPUT/OUTPUT STREAMS

Input/Output Operation in Java(java.io Package)- Streams and the new I/O Capabilities- Understanding Streams- The Classes for Input and Output- The Standard Streams- File I/O Basics- Reading and Writing to Files- Buffer and Buffer Management- Read/Write Operations with File Channel- Serializing Objects **(8)**

GUI AND BACKEND INTERFACE

Designing Graphical User Interfaces in Java - Components and Containers- Basics of Components- Using Containers- Layout Managers- Adding a Menu to Window and Extending GUI Features Using Swing Components. Event-Driven Programming in Java- Event- Handling Process- Event-Handling Mechanism- Event Listeners. Database Programming using JDBC - Introduction to JDBC- JDBC Drivers & Architecture- Connecting to conventional Databases **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Herbert Schildt, "Java The Complete Reference", Tata MCGraw Hill Publishing Company Limited, 9th Edition, 2014.*
2. *E. Balagurusamy, "Programming with Java:A Primer", Tata MCGrawHill Publishing Company Limited, 5th Edition, 2015.*
3. *Cay S. Horstmann, Gray Cornell, "Core Java Volume I, Fundamentals", Pearson Education, 9th Edition, 2013.*
4. *Herbert Schildt, "Java: A Beginners Guide", Tata MCGraw Hill Publishing Company Limited, 6th Edition, 2014*

MOOCs

1. *https://www.javaworld.com/article/2076075/learn-java/core-java-learn-java-from-the-ground-up.html*
2. *https://docs.oracle.com/javase/tutorial/java/index.html*

18MCAOE03 - C# AND DOT NET PROGRAMMING

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Develop simple .NET applications.*

CO2 : *Analyze the basic concepts of objected oriented aspects of C#.*

CO3 : *Create windows applications and controls.*

CO4 : *Illustrate different web based applications in .NET.*

CO5 : *Analyze performance of CLR and .NET Framework.*

INTRODUCTION

Introducing C# - Understanding .NET, overview of C# - Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and Explicit casting, Constant, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing. **(9)**

OBJECT ORIENTED ASPECTS OF C#

Class, Objects, Constructors and its types, inheritance, properties, indexers, Index overloading, Polymorphism, Sealed class and methods, interface, Abstract class - Abstract and Interface, Operator overloading, Delegates, events, errors and exceptions, threading. **(10)**

APPLICATION DEVELOPMENT ON .NET

Building windows application - Creating window forms with events and controls, Menu creation, Inheriting window forms- SDI and MDI application- Dialog Box(Modal and Modeless), Accessing data with ADO.NET- Dataset- typed dataset- data Adapter- updating database using stored procedures, SQL Server with ADO.NET- handling exceptions, validating controls, windows application configuration. **(8)**

WEB BASED APPLICATION DEVELOPMENT ON .NET

Programming web application with web forms- ASP.NET introduction, Working with XML and .NET, Creating Virtual Directory and Web Application, Session management techniques- web.config- web services- Passing datasets- Returning datasets from web services- Handling transaction- Handling exceptions-Returning exceptions from SQL Server. **(10)**

CLR AND .NET FRAMEWORK

Assemblies, Versioning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET. **(8)**

TOTAL : 45

REFERENCE BOOKS

1. *Efraim Herbert Schildt, "The Complete Reference: C# 4.0", Tata Mc Graw Hill.*
2. *Larissa Christian Nagel et al, "Professional C# 2012 with .NET 4.5", Wiley India, 2012.*
3. *Carlo Andrew Troelsen, "Pro C# 2010 and the .NET 4 Platform", Fifth edition, 2010.*

MOOCs

1. *https://www.youtube.com/watch?v=OBsGRqXzOhk*
2. *http://nptel.ac.in/courses/106104074/2*

18MCAOE04 - PYTHON PROGRAMMING

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Develop algorithmic solutions for the simple computational problems.*

CO2 : *Explain the core programming basics in terms of variables- operators and expressions.*

CO3 : *Analyze the suitable program construct for given software requirement to represent its solution.*

CO4 : *Illustrate concise and efficient python programs using function and demonstrate the use of exceptions- modules and packages in handling files.*

CO5 : *Use data structures and appropriate algorithm construct for python programs to solve the specified requirements.*

ALGORITHMIC PROBLEM SOLVING

Algorithms- Building blocks of algorithms (statements, state, control flow, functions) - Notation (pseudo code - Flow chart (programming language) - Algorithmic problem solving- Simple strategies for developing algorithms (Iteration- Recursion). Illustrative problems: Find minimum in a list- Insert a card in a list of sorted cards- Guess an integer number in a range- Towers of Hanoi. **(9)**

DATA - EXPRESSIONS - STATEMENTS

Python interpreter and interactive mode; Values and types: Int- Float- Boolean- String and List; Variables- Expressions- Statements- Tuple assignment- Precedence of operators- Comments; Modules and functions- Function definition and use- Flow of execution- Parameters and arguments; Illustrative programs: Exchange the values of two variables- Circulate the values of n variables- Distance between two points. **(9)**

CONTROL FLOW- FUNCTIONS

Conditionals: Boolean values and operators- Conditional (if)- Alternative (if-else)- Chained conditional (if-elif-else); Iteration: state- While- For- Break- Continue- Pass; Fruitful functions: Return values- Parameters- Local and global scope- Function composition- Recursion; Strings: String slices-Immutability- String functions and methods- String module; Lists as arrays. Illustrative programs: Square root- Gcd- Exponentiation- Sum an array of numbers- Linear search- Binary search. **(9)**

LISTS- TUPLES- DICTIONARIES

Lists: List operations- List slices- List methods- List loop- Mutability- Aliasing- Cloning lists- List parameters; Tuples: Tuple assignment- Tuple as return value; Dictionaries: Operations and methods; Advanced list processing - List comprehension; Illustrative programs: Selection sort- Insertion sort- Mergesort- Histogram. **(9)**

FILES- MODULES- PACKAGES

Files and exception : Text files- Reading and writing files- Format operator; Command line arguments- Errors and exceptions- Handling exceptions- Modules- Packages; Illustrative programs: Word count- Copy file. **(9)**

Total : 45

REFERENCE BOOKS

1. *Charles Dierbach, "Introduction to Computer Science using Python : A Computational Problem-Solving Focus", Wiley India, 2013.*
2. *Kenneth A. Lambert, "The Fundamentals of Python: First Programs", Cengage Learning, 2011.*

3. *David Beazley, Brian K. Jones, "Python Cookbook", O'Reilly Media, 3rd Edition, 2013.*
4. *Zed Shaw, "Learn Python The Hard Way", Addison Wesley, 3rd Edition, 2014.*

MOOCs

1. http://nptel.ac.in/courses/117106113/34

18MCAOE05 - DATA MINING AND WAREHOUSING

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Identify the need for data mining in organizations and design data mining solutions wherever necessary*

CO2 : *Apply various data pre-processing methods on a given data based on the analysis requirement.*

CO3 : *Analyze and implement data mining algorithms like association rule mining- classification and clustering on data to derive meaningful insights from data.*

CO4 : *Construct a legitimate mining solution with the help of design technique guidelines and validate the suitability of the techniques applied.*

CO5 : *Understand big data concepts and real-time applications of data mining in various domains.*

INTRODUCTION

Definition- Need for Data Mining- Kinds of Data and Patterns- Technologies -Applications and Issues.

Types of Data : Data Objects and Attribute Types- Basic Statistical Descriptions of Data. Data Preprocessing: Overview- Data Cleaning: Missing Values-Noisy Data-Data Integration: Entity Identification Problem- Redundancy and Correlation Analysis- Data Reduction: Principal Component Analysis **(12)**

DATA WAREHOUSE AND OLAP TECHNOLOGY

Data Warehouse-Basic Concepts- Data Warehouse Modeling: Data Cube- Schemas **(7)**

DATA MINING TECHNIQUES

Mining Frequent Patterns and Associations: Basic Concepts-Frequent Itemset Mining Methods: Apriori Algorithm. Classification: Basic Concepts-Decision Tree Induction-Naïve Bayesian Classification. Cluster Analysis: Cluster Analysis- k-Means and k-Medoids Algorithm. Outlier Detection: Outliers and Outlier Analysis. **(14)**

BIG DATA

Definition of Big Data - Need - Introduction to Big Data Analytics **(6)**

CASE STUDY

Data Mining Applications **(6)**

TOTAL: 45

REFERENCE BOOKS

1. *Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining - Concepts and Techniques", 3rd Edition, Elsevier Publications,2012.*
2. *Paul C. Zikopoulos, Chris Eaton, Dirk de Roos, George Lapis, "Understanding Big Data", Mc-Graw Hill, 2012.*
3. *Arun K. Pujari, "Data Mining Techniques", Universities Press, 2009.*

MOOCs

1. *https://www.coursera.org/specializations/data-mining*
2. *https://www.mooc-list.com/course/data-mining-weka-waikato*

18MCAOE06 - NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

PRE-REQUISITES
18MCA33

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Understand core algorithms and data structures used in NLP*

CO2 : *Utilize corpora and annotations added to them*

CO3 : *Build statistical NLP components such as n-gram language models, text classifiers and Parts-of-speech taggers, that learns from such corpora*

CO4 : *Evaluate the merits of different machine learning methods for given NLP tasks*

CO5 : *Appreciate the relationship between linguistic representations and computational applications*

INTRODUCTION

Human languages- Models- Ambiguity- Processing paradigms; Phases in Natural Language Processing- Applications. Text Representation in Computers- Encoding Schemes- Linguistics Resources. **(8)**

Introduction to Corpus - Elements in Balanced Corpus- TreeBank- PropBank- WordNet- VerbNet. Resource Management with XML- Management of Linguistic Data with the help of GATE- NLTK. **(7)**

WORD LEVEL ANALYSIS

Regular Expressions and Automata- Morphology and Finite State Transducer- Probabilistic Models of Pronunciation and Spelling- N-grams- HMMs and Speech Recognition. **(9)**

SYNTACTIC ANALYSIS

Word classes and Part-of-Speech Tagging- Context-Free Grammars- Parsing with Context-Free Grammars- Features and Unification- Lexicalized and Probabilistic Parsing- Language and Complexity. **(11)**

SEMANTIC ANALYSIS AND DISCOURSE PROCESSING

Representing Meaning- Semantic Analysis- Lexical Semantics- Word Sense Disambiguation and Information Retrieval. Simple Applications in NLP. **(10)**

TOTAL : 45

REFERENCE BOOKS

1. *Jurafsky D. and J. H. Martin, "Speech and language processing: An Introduction to Natural Language Processing: Computational Linguistics and Speech Recognition", 2nd Edition, Upper Saddle River NJ: Prentice-Hall, 2008.*
2. *Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press- 2008.*
3. *Jurafsky and Martin, "Speech and Language Processing", Prentice Hall, 1st Edition (January 26- 2000)- SBN: 0130950696*
4. *James Allen, "Natural Language Understanding", 2nd Edition, Benjamin/Cummings Publishing Company, 1995.*

MOOCs

1. *https://www.youtube.com/playlist?list=PL6397E4B26D00A269*
2. *https://www.youtube.com/watch?v=aeOLjFe256E*
3. *https://www.youtube.com/watch?v=FLZvOKSCkxY*

18MCAOE07 - SOCIAL NETWORK ANALYSIS

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of the course, students will be able to:

CO1 : *Understand concept of semantic web and related applications.*

CO2 : *Represent knowledge using ontology.*

CO3 : *Model social network data.*

CO4 : *Understand importance of communities in social network.*

CO5 : *Apply techniques for visualization of social networks.*

INTRODUCTION

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key Concepts and Measures in Network Analysis - Electronic Sources for Network Analysis: Electronic Discussion Networks- Blogs and Online communities - Web-based Networks - Applications of Social Network Analysis **(9)**

MODELLING- AGGREGATING AND KNOWLEDGE REPRESENTATION

Ontology and their role in the Semantic Web : Ontology-based Knowledge Representation - Ontology Languages for the Semantic Web: Resource Description Framework - Web Ontology Language. **(7)**

Modelling and aggregating social network data : State-of the-art in network data representation - Ontological representation of Social Individuals - Ontological Representation of Social Relationships - Aggregating and Reasoning with Social Network Data - Advanced Representations. **(9)**

EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL

Extracting Evolution of Web Community from a Series of Web Archive - Detecting communities in Social Networks - Definition of community - Evaluating Communities - Methods for Community Detection and Mining - Applications of Community Mining Algorithms - Tools for Detecting Communities Social Network Infrastructures and Communities - Decentralized Online Social Networks - Multi- Relational Characterization of Dynamic Social Network Communities. **(10)**

VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix Representation - Visualizing Online Social Networks- Visualizing Social Networks with Matrix-based Representations - Matrix and Node-Link Diagrams - Hybrid Representations - Applications - Cover Networks - Community Welfare - Collaboration Networks - Co-Citation Networks. **(10)**

TOTAL : 45

REFERENCE BOOKS

1. *Peter Mika, "Social Networks and the Semantic Web", 1st Edition, Springer 2007.*
2. *BorkoFurht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.*
3. *Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking - Techniques and Applications", 1st Edition, Springer, 2011.*
4. *Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.*

5. *Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access:Techniques for Improved User Modelling", IGI Global Snippet, 2009.*
6. *John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.*

MOOCs

1. https://www.youtube.com/watch?v=n3ziCzUGu2M