COIMBATORE INSTITUTE OF TECHNOLOGY

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

COIMBATORE - 641 014, TAMILNADU, INDIA

DIAMOND JUBILEE
(1956 - 2016)

Department of Civil Engineering

B.E. CIVIL ENGINEERING

Curriculum and Syllabi

Under Choice Based Credit System

(For the students admitted during 2015 - 2016 and onwards)

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COIMBATORE INSTITUTE OF TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

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 Coimbatore Institute of Technology 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

DEPARTMENT OF CIVIL ENGINEERING

VISION AND MISSION OF THE DEPARTMENT

Vision

To provide quality education in Civil Engineering and to become a state-of-the-art source of world-class Civil Engineers and Researchers.

Mission

To impart quality education with necessary skills to meet the requirements of the industry and to perform with professional ethics and an attitude for innovation in Civil Engineering through state-of-the-art technology

COIMBATORE INSTITUTE OF TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The B.E. Degree Programme in Civil Engineering is offered in the department with the following Educational Objectives

PEO1 To equip the graduates with sufficient knowledge and capabilities to become leaders in industry and academia.

PEO2 To imbibe an attitude in the graduates for research and development and with an aptitude for lifelong learning.

PEO3 To inculcate professional ethics with a commitment to the society and environment.

COIMBATORE INSTITUTE OF TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

PROGRAMME OUTCOMES (POs)

On Completion of the B. E. Programme in Civil Engineering, Graduates will be able to demonstrate an ability to

1. Apply mathematical, scientific and technical knowledge to solve problems in Civil Engineering

2. Explain complex Civil Engineering problems, formulate methodology and provide solutions

3. Solve well-defined and open-ended problems

4. Solve complex problems experimentally and analytically

5. Adopt emerging technologies, modern tools and techniques

6. Contribute to the improvement of the society through appropriate technology

7. Protect the environment with sustainable technologies

8. Practice in their profession with ethics

9. Excel as an individual and member of a multi-disciplinary team

10. Exhibit communication skills through oral, written, graphical and multimedia tools

11. Employ technical, managerial and financial skills in managing Projects

12. Continue life-long learning through membership in professional societies

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DEPARTMENT OF CIVIL ENGINEERING
B.E. CIVIL ENGINEERING - FULL TIME
(III TO VIII SEMESTER)

III SEMESTER

Course Code	Course Name	L	T	P	C	Category
	THEORY					
15CEM31	Complex Variables Fourier Transforms and Partial Differential Equations	2	2	0	3	BS
15CE31	Mechanics of Solids	2	2	0	3	ES
15CE32	Mechanics of Fluids	2	2	0	3	ES
15CE33	Surveying	3	0	0	3	PC
15CE34	Construction Technology	3	0	0	3	PC
15CE35	Engineering Geology	3	0	0	3	ES
15HSS01	Science of Creativity and Professional Ethics	1	0	0	1	HS
	PRACTICAL					
15CE36	Survey Practical	0	0	4	2	PC
15CE37	Computer Aided Building Drawing	0	0	4	2	PC
	TOTAL CREDITS				**23**	

IV SEMESTER

Course Code	Course Name	L	T	P	C	Category
	THEORY					
15CE41	Numerical Methods	2	2	0	3	BS
15CE42	Strength of Materials	2	2	0	3	PC
15CE43	Applied Hydraulics & Hydraulic Machinery	2	2	0	3	PC
15CE44	Water Supply Engineering	3	0	0	3	PC
15CE45	Concrete Technology	3	0	0	3	PC
15CE46	Highway Engineering	3	0	0	3	PC
	PRACTICAL					
15CE47	Hydraulic Engineering Laboratory	0	0	4	2	PC
15CE48	Strength of Materials Laboratory	0	0	4	2	PC
15CE49	Survey Camp (During Vacation - 2 weeks)#				2	EEC
	TOTAL CREDITS				**24**	

 # Survey Camp will be conducted during the WINTER VACATION after III Semester Examinations and the Evaluation will be done in the beginning of IV Semester. Grades and Credits Earned will appear in the IV Semester Mark sheet

V SEMESTER

Course Code	Course Name	L	T	P	C	Category
	THEORY					
15CE51	Structural Analysis - I	2	2	0	3	PC
15CE52	Design of Reinforced Concrete Structural Elements	2	2	0	3	PC
15CE53	Mechanics of Soils	3	0	0	3	PC
15CE54	Waste Water Engineering	3	0	0	3	PC
15CE55	Irrigation Engineering	3	0	0	3	PC
	Professional Elective I	3	0	0	3	PE
	PRACTICAL					
15CE56	Highway Engineering Laboratory	0	0	4	2	PC
15CE57	Environmental Engineering Laboratory	0	0	4	2	PC
	TOTAL CREDITS				**22**	

VI SEMESTER

Course Code	Course Name	L	T	P	C	Category
	THEORY					
15CE61	Structural Analysis - II	2	2	0	3	PC
15CE62	Design of Steel Structures	2	2	0	3	PC
15CE63	Foundation Engineering	3	0	0	3	PC
15CE64	Design of Reinforced Concrete Structures	2	2	0	3	PC
	Professional Elective II	3	0	0	3	PE
	Professional / Open Elective III	3	0	0	3	PE / OE
	PRACTICAL					
15CE65	Quantity Surveying and Project Planning Laboratory	0	0	4	2	PC
15CE66	Soil Mechanics Laboratory	0	0	4	2	PC
15CE67	Mini Project	0	0	4	2	EEC
	TOTAL CREDITS				**24**	

VII SEMESTER

Course Code	Course Name	L	T	P	C	Category
	THEORY					
15CE71	Construction Management	3	0	0	3	PC
15CE72	Engineering Economics	3	0	0	3	PC
15CE73	Earthquake Resistant Design of Structures	3	0	0	3	PC
15CE74	Prestressed Concrete Structures	3	0	0	3	PC
	Professional/Open Elective IV	3	0	0	3	PE / OE
	PRACTICAL					
15CE75	Computer Applications Laboratory	0	0	4	2	EEC
15CE76	Concrete Laboratory	0	0	4	2	EEC
	TOTAL CREDITS				**19**	

VIII SEMESTER

Course Code	Course Name	L	T	P	C	Category
	THEORY					
	Professional Elective V	3	0	0	3	PE
	Professional Elective VI	3	0	0	3	PE
	Professional Elective VII	3	0	0	3	PE
	Professional Elective VIII	3	0	0	3	PE
	Professional/Open Elective IX	3	0	0	3	PE / OE
	PRACTICAL					
15CE81	Project Work & Viva Voce	-	-	10	5	EEC
	TOTAL CREDITS				**20**	

TOTAL CREDITS : 184

Note : Project work will be carried out during VII and VIII semesters. Grades and Credits earned will appear in the VIII Semester Grade sheet.

* HS - Humanities and Social Sciences

BS   - Basic Sciences

ES   - Engineering Sciences

PC   - Professional Core

PE   - Professional Elective

OE   - Open Elective

EEC - Employability Enhancement Courses

PROFESSIONAL ELECTIVES (PE)

Course Code	Course Name	L	T	P	C
15CEE01	Advanced Surveying	3	0	0	3
15CEE02	Advanced Concrete Structures	3	0	0	3
15CEE03	Advanced Steel Structures	3	0	0	3
15CEE04	Structural Design and Drawing	2	2	0	3
15CEE05	Health Monitoring of Structures	3	0	0	3
15CEE06	Earthquake Resistant Design of Timber and Masonry Structures	3	0	0	3
15CEE07	Prefabricated Structures	3	0	0	3
15CEE08	Design of Bridges	3	0	0	3
15CEE09	Theory of Plates	3	0	0	3
15CEE10	Finite Element Method	3	0	0	3
15CEE11	Experimental Stress Analysis	3	0	0	3
15CEE12	Optimization in Civil Engineering	3	0	0	3
15CEE13	Smart Materials and Structures	3	0	0	3
15CEE14	Advanced Construction Technology	3	0	0	3
15CEE15	Town Planning and Architecture	3	0	0	3
15CEE16	Construction Equipments and Techniques	3	0	0	3
15CEE17	Valuation of Immovable Properties	3	0	0	3
15CEE18	Professional Practice in Civil Engineering	3	0	0	3
15CEE19	Infrastructure Planning and Management	3	0	0	3
15CEE20	Advanced Foundation Engineering	3	0	0	3
15CEE21	Soil Structure Interaction	3	0	0	3
15CEE22	Remote Sensing and GIS	3	0	0	3
15CEE23	Railway Engineering	3	0	0	3
15CEE24	Tunnel Engineering	3	0	0	3
15CEE25	Airport and Harbour Engineering	3	0	0	3
15CEE26	Pavement Design	3	0	0	3
15CEE27	Hydraulic Structures	3	0	0	3
15CEE28	Engineering Hydrology	3	0	0	3
15CEE29	Water Power Engineering	3	0	0	3
15CEE30	Industrial Wastewater Treatment	3	0	0	3
15CEE31	Air Pollution and Control	3	0	0	3
15CEE32	Theory of Architecture	3	0	0	3
15CEE33	Building Services and Systems Engineering	3	0	0	3
15CEE34	Engineering Risk and Benefit Analysis	3	0	0	3
15CEE35	Disaster Management	3	0	0	3
15CEE36	Renewable Energy Resources	3	0	0	3

Course Code	Course Name	L	T	P	C
15CEE37	Construction Project Management	3	0	0	3
15CEE38	Environmental Impact Assessment	3	0	0	3
15CEE39	Solid and Hazardous Waste Management	3	0	0	3
15CEE40	Principles of Sustainable Development	3	0	0	3
15CEE41	Safety Engineering in Buildings	3	0	0	3
15CEE42	Probability and Statistics	3	0	0	3
15CEE43	Entrepreneurship in Civil Engineering	3	0	0	3

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LIST OF OPEN ELECTIVES

DEPARTMENT OF CIVIL ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
15CEE35	Disaster Management	3	0	0	3	All Branches
15CEE36	Renewable Energy Resources	3	0	0	3	All Branches
15CEE38	Environmental Impact Assessment	3	0	0	3	All Branches
15CEE39	Solid and Hazardous Waste Management	3	0	0	3	All Branches
15CEE40	Principles of Sustainable Development	3	0	0	3	All Branches
15CEE41	Safety Engineering in Buildings	3	0	0	3	All Branches

DEPARTMENT OF MECHANICAL ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
15MEOE01	Robotics	3	0	0	3	All Branches
15MEOE02	Low Cost Automation	3	0	0	3	All Branches
15MEOE03	Adaptive Control and Process Dynamics	3	0	0	3	All Branches
15MEOE04	Project Planning and Management	3	0	0	3	All Branches
15MEOE05	Supply Chain Management	3	0	0	3	All Branches
15MEOE06	Resource Management Techniques	2	2	0	3	All Branches
15MEOE07	Sustainable Development	3	0	0	3	All Branches
15MEOE08	Processing and Applications of Biomaterials	3	0	0	3	All except CSE & IT
15MEOE09	Numerical Simulation of Fluid Flow	3	0	0	3	All Circuit Branches
15MEOE10	Solar Energy Utilisation	3	0	0	3	Civil & Chemical

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
15EEOE01	Energy Auditing	3	0	0	3	ECE, Mech, Chemical & Civil
15EEOE02	Solar and Wind Energy Systems	3	0	0	3	ECE, Mech & Chemical
15EEOE03	Hybrid Smart Vehicles	3	0	0	3	All Branches except Civil & Chemical
15EEE07	Electrical Safety	3	0	0	3	All Branches
15EEE14	Energy Efficient Lighting System	3	0	0	3	All Branches

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
15ECOE01	Consumer Electronics	3	0	0	3	Civil & Mech
15ECOE02	ARM System Architecture	3	0	0	3	CSE & IT
15ECOE03	Broadband Communication	3	0	0	3	Mech, EEE, CSE & IT
15ECOE04	Robotics for Industrial Applications	3	0	0	3	Mech, CSE & IT
15ECOE05	Signal Processing and its Applications	3	0	0	3	Chemical, Mech & CSE

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
15CSOE01	Fundamentals of Software Engineering	3	0	0	3	EEE, ECE, Mech, Chemical & Civil
15CSOE02	Introduction to Data Warehousing and Data Mining	3	0	0	3	EEE, ECE, Mech, Chemical & Civil
15CSOE03	Introduction to Embedded Systems	3	0	0	3	Mech, Chemical & Civil
15CSOE04	Internet Programming	3	0	0	3	EEE, ECE, Mech, Chemical & Civil
15CSOE05	Customer Relationship Management Essentials	3	0	0	3	IT, EEE, ECE, Mech, Chemical & Civil
15CSOE06	E-commerce	3	0	0	3	IT, EEE, ECE, Mech, Chemical & Civil

DEPARTMENT OF INFORMATION TECHNOLOGY

Course Code	Course Name	L	T	P	C	Eligible Branches
15ITOE01	Digital Computer Basics	3	0	0	3	Mech, Civil & Chem
15ITOE02	Programming in Java	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
15ITOE03	Fundamentals of Database Systems	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
15ITOE04	Cloud Computing Fundamentals	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
15ITOE05	Information Security Fundamentals	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
15ITOE06	Introduction to Human Computer Interaction	3	0	0	3	CSE, EEE, ECE, Mech, Civil & Chemical
15ITOE07	Enterprise Resource Planning Concepts	3	0	0	3	CSE, EEE, ECE, Mech, Civil & Chemical

DEPARTMENT OF CHEMICAL ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
15CHOE01	Industrial Safety Engineering	3	0	0	3	All Branches
15CHOE02	Risk Analysis and Hazop	3	0	0	3	All Branches
15CHOE03	Green Technology	3	0	0	3	All Branches
15CHOE04	Corrosion Science and Engineering	3	0	0	3	All Branches
15CHOE05	Introduction to Chemical Engineering	3	0	0	3	All Branches

DEPARTMENT OF MATHEMATICS

Course Code	Course Name	L	T	P	C	Eligible Branches
15MOE01	Graph Theory and Its Applications	3	0	0	3	All Branches
15MOE02	Methods of Applied Mathematics	3	0	0	3	All Branches
15MOE03	Linear and Non-Linear Programming	3	0	0	3	All Branches
15MOE04	Probability and Random Processes	3	0	0	3	All Branches

DEPARTMENT OF PHYSICS

Course Code	Course Name	L	T	P	C	Eligible Branches
15POE01	Introduction to Nanoscience and Nanotechnology	3	0	0	3	Civil, Mech, EEE, ECE, CSE & Chemical
15POE02	Physics and Technology of Thin Films	3	0	0	3	Mech, EEE, ECE & Chemical
15POE03	Solar Cell Fundamentals and Materials	3	0	0	3	EEE, ECE & Chemical
15POE04	Advanced Material Processing Technologies	3	0	0	3	Mech & Chemical

DEPARTMENT OF CHEMISTRY

Course Code	Course Name	L	T	P	C	Eligible Branches
15COE01	Medical Nano Technology	3	0	0	3	Chemical
15COE02	Advanced Drug Delivery System	3	0	0	3	Chemical
15COE03	Biosensors	3	0	0	3	Chemical, ECE & EEE
15COE04	Nanocomposites	3	0	0	3	Mech, Chemical & Civil
15COE05	Biorefinery	3	0	0	3	Mech & Chemical

DEPARTMENT OF HUMANITIES

Course Code	Course Name	L	T	P	C	Eligible Branches
15HOE01	Principles of Management	3	0	0	3	All Branches
15HOE02	Current Trends in Indian Economy	3	0	0	3	All Branches
15HOE03	Monetary Economics	3	0	0	3	All Branches
15HOE04	Accounting for Managerial Decisions	3	0	0	3	All Branches
15HOE05	Entrepreneurship Development	3	0	0	3	All Branches
15HOE06	Employability Skills	3	0	0	3	All Branches
15HOE07	English for Academic Purposes	3	0	0	3	All Branches
15HOE08	English for Competitive Exams	3	0	0	3	All Branches
15HOE09	Life and Literature	3	0	0	3	All Branches

15CEM31 - COMPLEX VARIABLES FOURIER TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
2	2	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : *Apply complex variables ideas to solve engineering problems, partial differential equation ideas in modelling.*

CO2 : *Solve engineering problems and Fourier transform ideas to analyze and solve communication oriented problems.*

CO3 : *Solve problems related with the above mentioned areas and can identify the areas in their discipline where in these ideas could be directly applied.*

COMPLEX DIFFERENTIATION

Analytic functions-Definitions and properties-Cauchy Riemann equations in Cartesian and polar co-ordinates-construction of analytic functions-Conformal mappings-Bilinear transformation-the mappings of the form $w = z+a$, az, $1/z$, z^2, e^z, $\sin z$, $\cos z$ - Simple problems **(6)**

COMPLEX INTEGRATION

Cauchy's integral theorem-Integral formula-Taylor's and Laurent's series (without proof)-Types of singularities, Poles and residues-Cauchy's residue theorem-Applications-contour integration using circular and semicircular contours. **(6)**

PARTIAL DIFFERENTIAL EQUATIONS

Formation by elimination of arbitrary constants and functions-solution by direct method-solution of first order nonlinear PDE-standard types- Lagrange's linear equation-Linear higher order homogeneous PDE with constant co-efficients. **(6)**

FOURIER TRANSFORMS

Fourier integral theorem (without proof)-infinite Fourier transform-Infinite Fourier sine and cosine transforms,properties and problems-Convolution theorem-Parseval's identity-Finite Fourier sine and cosine transforms, properties and problems. **(6)**

BOUNDARY VALUE PROBLEMS

Vibration of strings- One dimensional wave equations, one dimensional heat flow-Unsteady state and steady state-Two dimensional heat flow steady state in Cartesian coordinates-Separation of variables-Fourier series solutions. **(6)**

TOTAL : 30 + 30 = 60

TEXT BOOKS

1. *Srimanta Pal and Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press India, 1st Edition, 2015.*

2. *E.Rukmagadachari, "Engineering Mathematics Vol II& Vol III",Pearson Education, 1st Edition.*

3. *Veerajan.T, "Engineering Mathematics", For Semester I & II, Third Edition, Tata Mc Graw Hill Publishing Company Ltd., 2012.*

4. *Veerajan.T, "Engineering Mathematics", (For Semester III), 3rd Edition, 4th Reprint, Tata Mc Graw Hill Publishing Company Ltd., 2008.*

REFERENCE BOOKS

1. *Erwin Kreyszig, "Advanced Engineering Mathematics",8th Edition, John Wiley & Sons (Asia) Private Limited., 2008.*

2. *Grewal, B.S., "Higher Engineering Mathematics", 40th Edition, Khanna Publishers, 2007.*

3. *Free E-book: Erwin Kreyszig"Advanced Engineering Mathematics", 8th Edition, John Wiley & Sons (Asia) Private Limited., 2008 - http://www-elec.inaoep.mx/~jmram/kreyzig-ECS-DIF1.pdf.*

4. *http://nptel.ac.in/courses/111105035/.*

15CE31 - MECHANICS OF SOLIDS

L	T	P	C
2	2	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Compute simple stress and strain, thermal stresses*

CO2 : *Compute principal stresses and strain for two dimensional stress system, strain energy due to suddenly applied load and impact load*

CO3 : *Practice shear force and bending moment computations and construct shear force and bending moment diagrams for determinate beams*

CO4 : *Compute stresses related to bending, shear and torsion*

CO5 : *Compute stresses in thin and thick cylinders*

CONCEPT OF STRESS AND STRAIN

Simple stresses and strains at a point -Normal and shear Stresses - Hooke's Law - Young's modulus - Bars subjected to axial Forces - simple problems - Thermal stresses - Simple statically Indeterminate problems like compound bars. Changes in dimensions and volume - Poisson's ratio - Modulus of Rigidity - Surface and volume strains - Bulk modulus - Relation between Elastic constants - Simple Tension Test on a Mild Steel rod - Stress-strain diagram - Concept of Factor of Safety and permissible stresses. **(6)**

STRAIN ENERGY PRINCIPLES AND COMPLEX STRESSES

Strain energy -Resilience - Stresses due to suddenly applied loads and impact loads.

Complex stresses - Components of stress on inclined planes - Expression for stressed element subjected to two normal stresses with shear - Principal stresses and Principal planes - Mohr's circle of stress. **(6)**

BENDING OF BEAMS

Types of Beams - Types of loads and loading diagrams - Shear force and Bending Moment -Relationship between loading intensity, shear force and bending moment - Shear force and bending moment diagrams for statically determinate beams. Theory of simple bending -Stress distribution due to shear force and bending moment - Design of beams - Beams of uniform strength - Flitched beams - Beams of Two materials - Leaf springs. **(6)**

TORSION AND SPRINGS

Torsion of solid and hollow circular shafts - Power transmitted through shafts - Strain energy due to torsion - Combined bending and torsion -Close coiled helical springs. **(6)**

THIN AND THICK CYLINDER

Stresses in thin walled Cylindrical and spherical shells - Wire wound cylindrical Vessels - Thick cylinder - Lame's equations - Compound cylinders - Shrink fit. **(6)**

TOTAL : 30 + 30 = 60

TEXT BOOKS

1. *Rajput, R.K., "Essentials of Strength of Materials", S.Chand & Company Ltd., New Delhi, 2015.*
2. *Bansal R.K., "Strength of Materials", Laxmi Publications, New Delhi, 2010.*

REFERENCE BOOKS

1. Sadhu Singh, "Strength of Materials", Khanna Publishers, New Delhi, 2012.

2. Prakash Rao D.S., "Strength of Materials" Volume I, Universities Press (India) Limited, Hyderabad, 2002.

3. Lehri, R.S.,Lehri., AS., "Strength of Materials", S K Kotaria & Press, New Delhi, 2009.

4. Timonshenko, S.P, Gere, J.M., "Mechanics of Materials", CBS Publishers, New Delhi, 2002.

5. Egor P.Popov, "Introduction to Mechanics of Solids", Prentice Hall of India, New Delhi, 2003.

6. Punmia B.C, Ashok Jain and Arun Jain, "Mechanics of Materials", Laxmi Publications, New Delhi, 2000.

7. Beer F.P, Johnston E. R., DeWolf J. T. and Mazurek D., "Mechanics of Materials", McGraw-Hill Higher Education, 6th edition, 2011.

15CE32 - MECHANICS OF FLUIDS

L	T	P	C
2	2	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : Outline the basic properties of fluids in rest and motion

CO2 : Determine the pressure at a point in a fluid at rest or in motion using manometers or mechanical gauges

CO3 : Examine the effect of fluid pressure at rest or in motion on submerged and floating bodies and in containers

CO4 : Computing the flow parameters in fluid flow using Continuity and Bernoulli's equation

CO5 : Applying the concept of dimensional analysis to solve the fluid problems through model studies

CO6 : Computing the flow parameters in pipes for laminar and turbulent flow

PROPERTIES OF FLUIDS & FLUID PRESSURE

Introduction of basic properties - Viscosity - compressibility - surface tension - real and ideal fluids - Concept of Fluid pressure - Pressure head - Significance of pressure in fluid statics and dynamics - Various methods of pressure measurements. **(6)**

HYDROSTATICS

Total pressure and centre of pressure on plane submerged surfaces - simple problems - Buoyancy - Centre of buoyancy - Metacentre and metacentric height - conditions of equilibrium of floating and submerged bodies - Fluid mass subjected to uniform linear acceleration - fluid containers subjected to constant rotation. **(6)**

CONCEPTS OF FLUID FLOW

Classification of fluid flow - velocity and acceleration - velocity potential and stream function- continuity equation - Euler's equation of motion - Bernoulli's equation - applications - venturimeter, orifice meter, pitot tube - simple problems - Velocity and discharge through orifices and mouthpieces. **(6)**

DIMENSIONAL ANALYSIS AND MODEL STUDIES

Fundamental dimensions - dimensional homogeneity - Dimensional analysis by Rayleigh's method and Buckingham Pi-Theorem - Dimensionless parameters - Similitude and model studies - Distorted Models. **(6)**

FLOW THROUGH PIPES

Laminar flow in circular pipes - Hagen - Poisueills's equation - Turbulent flow - Darcy-Weisbach equation - major and minor losses - transmission of power through pipes - parallel, series pipes - flow through long pipes - flow between reservoirs - flow through siphon pipes - water hammer **(6)**

TOTAL : 30 + 30 = 60

TEXT BOOKS

1. Bansal R.K., "TextBook of Fluid Mechanics and Hydraulic Machines", M/s.Lakshmi Publications (P) Ltd, New Delhi, 2010.

2. Modi P.N, & Seth S.M., "Hydraulics, Fluid Mechanics & Hydraulic Machinery", Standard Book house, New Delhi, 2015.

REFERENCE BOOKS

1.	Kumar K.L, "Engineering Fluid Mechanics", M/s.S.Chand Co., Madras, 2003.

2.	Ramamrutham S, & R. Narayan "Hydraulics, Fluid Mechanics And Fluid Machines", Dhanpat Rai Publishing Company (P) Limited, New Delhi,2006

3.	Arora K.R., "Fluid Mechanics, Hydraulics and Hydraulic Machines", Standard Publishers Distributors, 2013.

4.	Victor L. Streeter, "Fluid Mechanics", McGraw Hill Book Company, 1962.

5.	Merle Potter, David C. Wiggert, "Fluid Mechanics", Schaum's Outline Series, McGraw-Hill Publications, New Delhi, 2008.

6.	Natarajan, "Principles of Fluid Mechanics", Oxford and IBH Publishing Company (P) Ltd., New Delhi, 2008.

15CE33 - SURVEYING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Assess the field measurements by chain, compass and theodolites, Electronic theodolite, Electronic total station, EDM, GPS*

CO2 : *Calculate elevations and contour of fields using dumpy and auto levels and distance with tachometer*

CO3 : *Determine latitudes and departures through traversing by theodolites and determine area by triangulation*

CO4 : *Calculate the elements of setting out of curves for roads and railways*

CO5 : *Ascertain the area by simpson's rule and trapezoidal rule and volume by prismoidal and trapezoidal rule*

LINEAR AND ANGULAR MEASUREMENTS

Importance of surveying to engineers, plane and geodetic surveying, principles of surveying, classification of surveys, Accuracy and Errors, Linear Measurements, obstruction and hypotenuse, EDM

Measurement of directions: Reference meridians, bearing and azimuths, Compass, Vernier theodolite, Measurements of horizontal and vertical angles, application of Electronic Theodolites and Total Station, GPS coordinates measurements   **(9)**

LEVELLING AND CONTOURING

Methods of determining elevations, dumpy and auto level, Direct levelling- basic terms and definitions, principle, booking and reduction of field notes, curvature and refraction correction, temporary adjustments. Contouring: methods and uses.   **(9)**

THEODOLITE TRAVERSING AND TRIANGULATION

Principles of traversing by theodolite, computations of traverse coordinates

Principle and Classification of triangulation system, Selection of base line and stations- Orders of triangulation - Triangulation figures- Station marks and signals - marking signals- Extension of base, Reduction of Centre, Selection and marking of stations.

(9)

CURVES

Elements of simple circular curves, theory and methods of setting out simple circular curves, transition curves, compound curve and reverse curve, Introduction to vertical curves   **(9)**

COMPUTATION OF AREA AND VOLUME

Computation of Areas: Methods to compute area of traverse- Determining areas from Plans, Trapezoidal rule- Simpson's rule - Computation of Volumes- Volume from cross sections, Trapezoidal and Prismoidal formulae, Determination of capacity of reservoir   **(9)**

TOTAL : 45

TEXT BOOKS

1. *Kanetkar, T.P., and Kulkarni, S.V., "Surveying and Levelling" Volume I and II, Pune Vidthyarth Griha Prakashan, Pune 2011.*

2. *B.C. Punmia, "Surveying", Volume I, Laxmi Publications, New Delhi, Sixteenth edition,2016.*

REFERENCES

1. *R. Subramanian, "Surveying and Levelling", Oxford University Press, Third edition 2010.*

2. *C. Venkataramiah, "Text Book of Surveying", Universities Press, Second edition 2011.*

3. *T.P. Kanetkar and S.V. Kulkarni, "Surveying and Levelling", Part- I, Vidyarthi Ghrih Prakashan Pune, Twenty fourth edition 2010.*

4. *Milton. O. Schimidt, "Fundamentals of Surveying", CL - Engineering, ISBN 13: 9780534041618 2008.*

5. *S.K. Roy, "Fundamentals of Surveying", PHI Learning Pvt. Ltd., ISBN 8120341988, 9788120341982, 2014.*

6. *S.K. Duggal, "Surveying", Vol. I, Tata McGraw Hill - Publishing Co. Ltd., New Delhi, ISBN 0070534705, 9780070534704, 2016.*

15CE34 - CONSTRUCTION TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Define the specifications for the materials to be used for construction for the given design drawings of a building.*

CO2 : *Formulate the methods of construction of foundation and super structure for a building following the design drawing.*

CO3 : *Formulate the methodology for construction of staircase in a building given the geometrical and structural design.*

CO4 : *Develop a procedure for the fabrication and erection of the selected type of doors and windows.*

CO5 : *Develop the procedure for the erection of formworks and scaffolding for construction using materials like steel and timber.*

CO6 : *Describe the requirements for fire safety, thermal and sound insulation in a building.*

FOUNDATIONS

Introduction - Building components - Site selection - Functions of foundation -Requirements of good foundation - Types of foundations- Selection, Description and Construction of Spread footing - Combined footing - Strap footing - Raft foundation - Grillage foundation - Types of piles - Pile driving - Under reamed pile foundation for black cotton soils. Setting out foundation - Excavation of foundation trenches -Timbering of trenches - Excavation in ground with sub-soil Water - Anti-termite treatment - Pre-construction & post Construction treatment. **(9)**

MASONRY

Types of bonds in brickwork - Construction methods in brickwork- 1½, 1, ½ thick brick walls-Estimation of brickwork materials, brick, sand and cement for $1m^3$ - Classification of stone masonry - Joints in stone masonry -Concrete block walls - Types of concrete blocks. **(9)**

ROOFS AND FLOORS

Types of roofs - Flat, slope and curved - Types of roof truss - Wooden and Steel-Erection Methods- Purlins - Types of roof coverings- aluminium, steel sheets, corrugated iron and tiles -Market sizes. Drainage in roofs- slope and diameter - Flooring - Ground level flooring in poor Soils and Normal Soils. Floor-Different types of flooring materials- advantages and disadvantages - Construction methods of different types of floors. Causes and effect of dampness - Methods of damp proofing - Materials used for damp proofing course. **(9)**

STAIRS, DOORS, WINDOWS AND FORM WORK

Staircase -Terminology and Specification- classification of staircase and its details -Construction details - Geometric design of Staircase, Ramps, Elevators and Escalators. Types of doors and windows and ventilators - drawings - Materials for Doors and Windows - Standard sizes of Doors and Windows - Door and Window Fixtures-. Formwork - Requirements - shuttering for columns - Shuttering for beam and slab floor - Formwork for Stairs & Walls. Shoring - Underpinning - various types of Scaffolding. **(9)**

PLASTERING, PAINTING AND INSULATION

Plastering and pointing - Methods of plastering - Types of plastering- External wall cladding-Defects in Plastering - Treatment and repair techniques for defects in plastering - Material requirement for $100m^2$ of plastering. Different types of pointing. Paints - Types of paints - Paintings of Interior & Exterior walls, wooden and steel members- Requirement for 100 m^2 of painting. Fire protection - Fire resisting properties of common building materials - Fire safety equipments for buildings - Thermal Insulation and sound insulations. **(9)**

TOTAL : 45

TEXT BOOK

1. Punmia. B.C., Ashok.K.Jain & Arun.K.Jain, "Building Construction", Laxmi Publications (P) Ltd, New Delhi, 2016.

REFERENCE BOOKS

1. Sharma S.K. and Kaul B.K., "Building Construction", S.Chand & Company Ltd., New Delhi, 1987.
2. Sushil Kumar., "Building Construction", Standard Publishers distributors, New Delhi, 2016.

15CE35 - ENGINEERING GEOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : Describe about weathering, type of soils, geological work of various agents, ground water, earthquake, interior and age of earth.

CO2 : Explain about geological subsurface features and elements of crystallography.

CO3 : Identify minerals based on their physical properties.

CO4 : Identify rocks based on mineralogy, texture, structure and mode of occurrence

CO5 : Employ the geological knowledge for various projects like dams & reservoirs, tunnels, coastal protection, landslide mitigation

CO6 : Interpret Subsurface geological features and properties of rocks using fundamental principles of geophysical methods

GENERAL GEOLOGY

The need for imparting geological training to the engineers. Weathering, soils, Geological work of wind, Rivers, Glacier, ground water - Earthquake, Interior of the earth, Age of the earth. **(9)**

STRUCTURAL GEOLOGY & CRYSTALLOGRAPHY

Contours, Dip, Apparent Dip, True Dip, strike, thickness of strata, folds, faults, joints, unconformities, outlier, Inlier's, overlap, offlap. Outline of elementary crystallography - symmetry elements, goniometer, miller's indices, study of the axial relation and symmetry elements of the normal class of the cubic, tetragonal, Hexagonal, orthorhombic, monoclinic and triclinic systems. **(9)**

MINERALOGY

Physical properties of minerals - characteristic features of the following rock forming minerals and miscellaneous minerals. Quartz group - Rock crystal, Chalcedony, Agate, Flint, Jasper, opal Felspar group - Orthoclase, Microcline, Plagioclase Felspars. Pyroxene group - Hypersthene, Augite.Amphibole group - Hornblende only.Mica group - Muscovite, Biotite, Phlogopite and Lapidolite. olivine, garnet, Beryl, Kyanite, Serpentine, Asbestos, Talc, clayminerals, Bauxite, Apatite,Corundum, Hematite, Magnetite, chromite, Calcite, Magnesite, Barite, Gypsum, Galena,Pyrite, Fluorite and Graphite - Identification of minerals and its uses. **(9)**

PETROLOGY & STRATIGRAPHY

Elementary classification, textures and structures of the three groups of rocks - forms and mode of occurrence of igneous rocks, Detailed description, distribution and economic uses of the following rock types: Igneous Rocks - Granite, Syenite,Diorite, Gabbro, Pyroxenite, Dolerite, Rhyolite, Trachyte, Andesite, Basalt. Sedimentary Rocks - Conglomerate, Breccia, Sandstone, shale, limestone, laterite. Metamorphic Rocks - Slate, Phyllite, Schist, Gneiss, Quartzite, Marble, Granulite & Charnockite. Outline of stratigraphy of India with particular reference to the following: Dharwars (Archaeans), Cuddapahs, Vindhyans, Gondwanas, Trichy Cretaceous, Deccan Traps, Tertiary with special emphasis on formation containing Lignite/petroleum. Identification of rocks, description, distribution and uses. **(9)**

APPLIED GEOLOGY

Landslide and related phenomenon, Geology of Reservoir and dam sites, Geology of Tunneling, Geology of Building stones, Building sites and Road metals, Geology of coastal protection, Fundamental principles of Geophysical methods-Engineering properties of Rocks. **(9)**

TOTAL : 45

TEXT BOOK

1. Parbinsingh., "A Text book of Engineering and General Geology", Kataria & Sons, Publishing House, Delhi, 2012.

REFERENCE BOOKS

1. Chenna Kesavulu N., "Textbook of Engineering Geology", Laxmi Publications, New Delhi, Second edition, 2016.

2. Krynine and Judd, "Principles of Engineering Geology and Geotechnics", Tata McGraw Hill, New Delhi, 1998.

3. Tyrrell, "Principles of Petrology", B.I .Publications, Bombay, 1998.

4. Billings, "Structural Geology", Asia Publishing House, New Delhi, 1989.

5. Sathya Narayanaswamy. B.S., Engineering Geology Laboratory Manual, LCSE - New Delhi.

6. Gurappa. K. M., Structural Geology Maps and Problems.

7. Gohale. N. E., Manual of Geological Map, CBS Publishers, New Delhi, 1987.

15HSS01 - SCIENCE OF CREATIVITY AND PROFESSIONAL ETHICS

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : *Describe the principles of karma yoga and functioning of mind and consciousness.*

CO2 : *Hypothesize the evolution of Universe and living beings in a global and societal context*

CO3 : *Infer the principles of Yoga to practice it and know the value of health.*

CO4 : *Interpret the philosophy of introspection procedures for better living*

CO5 : *Assess, take personal responsibility and follow professional ethics for sustained growth in career and life.*

LIFE FORCE, MIND AND CONSCIOUSNESS

Science of Creativity and Personality Development - Objectives - Principles of Karma Yoga - Duty Consciousness - Communism and Capitalism - Law of Nature - Life Force - Origin - Potentiality of the Life Force - Premordial State - Wave Theory - Consciousness - Pancha Thanmatras - Secret of Revelations - Mind - Biomagnetism - Physical Transformation of Biomagnetism.

(7)

EVOLUTION OF THE UNIVERSE AND LIVING BEINGS

Evolution of the Universe: Creation Theory - Evolution Theory - Theory of Permanence - Theory of Mithya - Evolution of Living Beings: Absolute Space and Force - Plants Experience Pain - Two Eyes and Two Ears - Seven Constituent Layers in the Body.

(5)

YOGA AND ITS BENEFITS

Simple and Safe Yoga - Upa Yoga Practices: Yoga for Peace - Yoga for Health - Yoga for Joy - Yoga for Love - Yoga for Well-being - Yoga for Success. Physical Exercise - Meditation - Seven Centers of Meditation - Benefits - Effect of Good Vibrations - Cause and Effect System -Food and Health. (6)

INTROSPECTION

Attachment, Detachment and Moderation in Enjoyment - Imaginary Expectations - Harmony in Life: Self, Family, Society and Nature - Introspection: Analysis of Thought, Moralization of Desire, Neutralization of Anger, Eradication of Worries and Self Realization. (6)

HUMAN VALUES

Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Virtues - Respect for Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - Commitment - Empathy - Self Confidence - Challenges in Work Place - Impact of cyberspace on individuals. (6)

THEORY : 15

PRACTICE : 15

TOTAL : 30

TEXT BOOKS

1. *Yogiraj Vethathri Maharishi, "Karma Yoga - The Holistic Unity", Vethathri Publications, IV Edition, 2009. (Chapters 1-7, 10-12)*

2. *R.S.Naagarazan, "A Textbook on Professional Ethics and Human Values", New Age International Publishers, New Delhi, 2011.*

REFERENCE BOOKS

1. *Sadhguru, "Body the Greatest Gadget and Mind is your Business", Diamond Pocket Books Pvt. Ltd, Isha Foundations, 2013.*

2. *Swami Vivekananda and Swami Nikhilananda, "Karma Yoga and Bhakti Yoga", II Edition, Ramakrishna Vivekananda Publications, 2008.*

3. *Henry Dreyfuss, "The Measure of Man and Woman: Human Factors in Design", John Wiley and Sons Publications, 2012.*

4. *Mike W. Martin and Roland Schinzinger,"Ethics in Engineering", IV Edition, McGraw Hill, NewYork, 2005.*

5. *M. Govindarajan, S. Natarajan, V.S. Senthilkumar, "Engineering Ethics", I Edition, Prentice Hall of India, 2009.*

15CE36 - SURVEY PRACTICAL

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : *Prepare area map by measuring field using chain, compass, electronic total station and determine the distance between inaccessible points*

CO2 : *Assess longitudinal and cross sections, contours and to determine the elevations of given points using dumpy, auto level and electronic total station*

CO3 : *Find horizontal and vertical angles and determine height of given objects using transit and electronic theodolite, Tacheometer and electronic total station*

CO4 : *Practice setting out of simple curve and buildings using chain, tape, theodolite and electronic total station*

CO5 : *Determine accurate distance and co-ordinates using Electronic distance meter and global positioning system*

LIST OF EXPERIMENTS

1. Survey of an area by Chain Survey (Closed Traverse) &Plotting-Identification of missing boundary marks

2. Determination of two inaccessible points with Compass

3. Survey of a given area by Prismatic Compass (Closed Traverse) and plotting after adjustment

4. Fly Leveling (Differential leveling)

5. An exercise of L.S. and C. S. and Plotting

6. Horizontal angles by Electronic Theodolite

7. Horizontal distance by stadia tacheometry and Heights and distances by tangential tacheometry (Electronic Theodolite)

8. Setting out simple curve by linear methods and setting out of buildings

9. Horizontal and vertical distance using Total Station and area calculation using Total Station, Contouring, L.S. and C.S

10. EDM, GPS demonstration

REFERENCES

1. *James M. Anderson and Edward M. Mikhail, "Surveying, Theory and Practice", 7th Edition, McGraw Hill, 2001.*

2. *Bannister and S. Raymond, "Surveying", 7th Edition, Longman 2004.*

3. *Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2004.*

4. *Arora K.R., "Surveying Vol I & II", Standard Book house, 10th Edition 2008.*

5. *Laboratory Manual, "Surveying-I", Department of Civil Engineering, G.H. Raisoni College of Engineering Hingna Road, Digdoh Hills, Nagpur - 16.*

6. *Laboratory Manual, "Surveying - II", Department of Civil Engineering, Aurora's Technological & Research Institute Parvathapur, Uppal, Hyderabad-98*

15CE37 - COMPUTER AIDED BUILDING DRAWING

L	T	P	C
0	0	4	2

ASSESSMENT: PRACTICAL

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : *Prepare the site plan, landscape design and arrange the components of building to satisfy the functional and orientation aspect*

CO2 : *Sketch the detailed drawings of plan, elevation and section by manual and computer aided drawing and list the schedule of joineries*

CO3 : *Prepare working drawing for the execution of civil engineering work.*

CO4 : *Prepare the plumbing and electrical layout of a building*

DRAFTING TECHNIQUES

Architectural lines and pencils used - Architect's scales, templates, flexible rules, overlays, under lays - Architectural lettering - Layout of Architectural Drawing for presentation and submission.

BASIC HOUSE DESIGN

Concept of one, one and half and two storey - Split level design. Study of Function, location, shape and size and planning of the following building areas.

- Living areas - living rooms, dining room entry way, foyer, patios and porches.
- Sleeping areas - bedrooms with and without attached toilets.
- Service areas - Kitchen, cabinets, Toilets, washing places, garages.
- Fixing the size of doors, windows and sunshades.

PREPARATION OF DRAWINGS

Detailed drawings of floor plans, elevations and sections to show various features in a building.

Preparation of plot plans with a study of property lines - location of building on the site - Landscape plot plans

PREPARATION OF WORKING DRAWINGS

Detailed drawings of different types of doors, windows with specifications.

Detailed layout design and drawing of different types of staircases.

Detailed planning and drawing of electrification and Plumbing layout in buildings.

Preparation and submission of building drawing using AutoCAD.

TEXT BOOK

1. *Shah. M.G, Kale. C.M and Patki. S.Y, "Building Drawing", Tata McGraw Hill Book Co., 2004*

REFERENCES BOOKS

1. *Clois E.Kicklighter., "Architecture, Residential Drawing and Design", The Good Heart - Willcox Company Inc., 2000.*
2. *Donald E. Hepler and Paul I. Wallach., "Architecture, Drafting and Design", Tata McGraw Hill Book Co., New Delhi, 1998.*

15CE41 - NUMERICAL METHODS

L	T	P	C
2	2	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : *Solve linear simultaneous equations by direct and iterative methods.*

CO2 : *Apply finite difference methods to solve a civil engineering problem which includes analysing the structures for shear force and bending moment, finding the deflection and vibration in beams and finding bending of laterally loaded thin plates.*

CO3 : *Apply numerical integration techniques to find the deflection of non prismatic beams.*

CO4 : *Apply eigen values and eigen vectors to find the principal planes, principal axes, principal stresses and principal moment of inertia.*

CO5 : *Solve ordinary and partial differential equations to apply in fluid flow problems.*

LINEAR SIMULTANEOUS ALGEBRAIC EQUATION

Direct methods: Gauss-elimination, Gauss-Jordan, Triangulation and Partition methods. Iterative methods: Jacobi and Gauss-Seidel methods. **(6)**

FINITE DIFFERENCE METHODS

Applications: Shear force, Bending moment and Deflection variation in statically determinate beams - Deflection in Statically indeterminate beams - Vibration of beams - Bending of laterally loaded thin plates. **(6)**

NUMERICAL INTEGRATION

Trapezoidal Rule, Simpson's one third Rule - Gaussian quadrature formula - Application of quadrature rule to deflection of non - prismatic simple beams **(6)**

EIGEN VALUES AND EIGEN VECTORS

Iterative method (Power method) - Jacobi method - Applications: Principal stresses and Principal planes - Principal moment of inertia and principal axes - Application of finite difference in eigen value problems to buckling of columns **(6)**

ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Ordinary Differential Equations: Taylor series method - modified Euler's method - Runge-kutta method of fourth order - Milne's predictor - corrector method.

Partial Differential Equations: Finite difference approximation - solution of partial differential equations - Laplace equation - Liebmann's iteration process- Poisson's equation - parabolic equation - Bender-schmidt and Crank-Nicholson scheme- Hyperbolic equation. **(6)**

TOTAL : 30 + 30 = 60

TEXT BOOKS

1. *Krishna Raju, N. and Muthu K.U., "Numerical Methods for Engineering Problems", Macmillan India Limited, 2011.*

2. *Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Numerical Methods", S. Chand &Company Limited, 2005.*

REFERENCE BOOKS

1. *Jain.M.K, Iyengar.S.R.K, and Jain.R., "Numerical Methods for Scientific and Engineering Computation", New Age International (P) Ltd, Publishers, 2004.*

2. *Scarborough.J.B, "Numerical Mathematical Analysis", Oxford and IBH Publishing Company, 1992.*

3. *Rajasekaran.S., "Numerical Methods in Science and Engineering (A Practical approach)", A.H. Wheeler & Co.1987.*

15CE42 - STRENGTH OF MATERIALS

L	T	P	C
2	2	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : Determine slope and deflection of statically determinate beams

CO2 : Draw Shear force and bending moment diagram for statically indeterminate beams and analysis of cables

CO3 : Compute the stresses due to combined bending and axial load for short column and critical load calculation in long columns

CO4 : Demonstrate various theories of failures for design

CO5 : Calculate stresses due to unsymmetrical bending

CO6 : Derive the shear centre for thin walled open sections

DEFLECTION OF DETERMINATE BEAMS

Governing differential equation - slope and deflection of beams - Double Integration method - Macaulay's method - Moment area method - Conjugate beam method. Deflection due to shear. **(6)**

STATICALLY INDETERMINATE BEAMS

Analysis of propped cantilevers and fixed beams - Continuous beams - Theorem of Three moments. Reactions, Shear Force, Bending Moment and fixed end moments due to concentrated loads, uniformly distributed loads and uniformly varying loads and settlement of supports.

Cables : Components and their functions, reactions - tension and length of suspension cables - effect of temperature.Stiffening girders - three hinged and two hinged. **(6)**

THEORY OF COLUMNS

Short columns -Stresses due to combined bending and axial Force - core of section - unsymmetrical sections - Elastic buckling of long columns - Euler's theory for long Columns - Critical loads with different end conditions - limitations of Euler's theory - Rankine's formula. **(6)**

THEORIES OF FAILURE

Maximum principal stress theory, maximum shear stress theory, strain energy theory, shear strain energy theory & maximum principal strain theory- Strain rosettes - Theories of failure and their Importance in design. **(6)**

UNSYMMETRICAL BENDING AND SHEAR CENTRE

Significance of shear centre - Location of shear centre for Thin walled open sections with one axis of symmetry. Analysis of stresses and deflections due to unsymmetrical Bending. **(6)**

TOTAL : 30 + 30 = 60

TEXT BOOKS

1. *Rajput, R.K., "Strength of Materials", S.Chand & Company Ltd., New Delhi, 2007.*
2. *Bansal R.K., "Strength of Materials", Laxmi Publications, New Delhi, 2010.*

REFERENCE BOOKS

1. Sadhu Singh, "Strength of Materials", Khanna Publishers, New Delhi, 2012.

2. Prakash Rao D.S., "Strength of Materials" Volume I, Universities Press (India) Limited, Hyderabad, 2002.

3. Lehri R.S., Lehri A.S., "Strength of Materials", S K Kotaria & Press, New Delhi, 2009.

4. Timoshenko, S.P, Gere, J.M., "Mechanics of Materials", CBS Publishers, New Delhi, 2002.

5. Egor P. Popov,"Introduction to Mechanics of Solids", Prentice Hall of India, New Delhi, 2003.

6. Punmia B.C., Ashok Jain and Arun Jain, "Strength of Materials and Theory of Structures", Vol.1, Laxmi Publications, New Delhi, 2000.

7. Beer F.P., Johnston E.R., DeWolf J.T. and Mazurek D., "Mechanics of Materials", McGraw-Hill Higher Education, 6th edition, 2011

15CE43 - APPLIED HYDRAULICS AND HYDRAULIC MACHINERY

L	T	P	C
2	2	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : *Illustrate to find the hydraulically best section for open channel uniform flow and find the flow parameters*

CO2 : *Describe the rate of flow of water in an open channel through notches, weirs and flumes*

CO3 : *Compute the flow characteristics of non-uniform flow in open channels based on geometrical and flow parameters*

CO4 : *Find relative and absolute velocity on flat and curved vanes in rest and motion*

CO5 : *Demonstrate the Pelton, Francis and Kaplan turbines and their suitability based on its performance*

CO6 : *Illustrate the Centrifugal and Reciprocating pumps and their performance based on speed and head*

UNIFORM FLOW IN OPEN CHANNELS

Uniform flow - Chezy's equation - Manning's equation - hydraulically best section for rectangular, trapezoidal and circular channels - circular sections running partially full - Flow over notches and weirs - flumes **(6)**

NON-UNIFORM FLOW IN OPEN CHANNELS

Non-uniform flow - critical depth - specific energy - flow characteristics - hydraulic jump - backwater curves - surges in channels. **(6)**

IMPACT OF JETS

Impulse momentum principle - its applications on impact of liquid jets on plates and vanes at rest and in motion - moment of momentum equation - its applications on plates and vanes mounted on wheels - jet propulsion. **(6)**

TURBINES

Classifications - Applications of Impact of Jets on Vanes to Turbines - velocity triangles - work done and efficiencies - Study of Pelton wheel, Francis turbine and Kaplan turbine - characteristics curves - performance of turbines - specific speed - unit quantities - model testing of turbines - selection of turbines **(6)**

PUMPS

Classification - Centrifugal pumps - work done - minimum starting speed - NPSH - characteristic curves - multistage pumps - specific speed - model testing

Reciprocating pump - work done - effect of acceleration and friction on pressure head - maximum speed of the pump - air-vessels - work saved against friction **(6)**

TOTAL : 30 + 30 = 60

TEXT BOOKS

1. *Bansal.R.K., "Text Book of Fluid Mechanics and Hydraulic Machines", M/s.Lakshmi Publications, Madras, 2005.*

2. *Modi.P.N, & Seth.S.M., " Hydraulics, Fluid Mechanics & Hydraulic Machinery", Metropolitan Book Company, New Delhi, 2013.*

REFERENCE BOOKS

1. *Kumar.K.L, "Engineering Fluid Mechanics", M/s.S.Chand Co., Madras.2003.*

2. *Ramamrutham.S, "Fluid Mechanics, Hydraulics & Fluid Machinery", M/s.DhanpatRai & Sons, New Delhi, 1998.*

3. *Arora K.R., "Fluid Mechanics, Hydraulics and Hydraulic Machines", Standard Publishers & Distributors, 1998.*

15CE44 - WATER SUPPLY ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : *Outline the importance of various essential demands in public water supply schemes.*

CO2 : *Summarize the implications of essential primary water quality parameters and also discuss the long-term surveillance of prevailing sources of water.*

CO3 : *Demonstrate the necessity and economic feasibility in transport of potable water.*

CO4 : *Employ the design guidelines in conventional treatment of water.*

CO5 : *Interpret and comprehend the adoption of both auxiliary treatments and economic distribution of water.*

QUANTITY OF WATER

Objectives of public water supply scheme - Components of water supply project - Design period - Population forecast methods -Water demands and variation in demand pattern- Estimating the quantity of water.   **(9)**

SOURCES AND QUALITY OF WATER

Surface and ground water sources - Factors to be considered - Assessment of capacity of impounding reservoirs: Mass in-flow curve and analytical methods - Intake structures and their selection- Infiltration galleries - Water quality parameters: physical, chemical, and biological - Water analysis and drinking water standards of India- impurities of water - waterborne diseases - water bacteria - Determination of bacterial numbers.   **(9)**

TRANSMISSION OF WATER

Different categories of pipes used in transmission - Analysis and design of pressure pipes - Application of nomograms in the design - Pipe materials and their selection - Laying, jointing and testing of pipes - Pumping of water and selection of pumps - pumping station and its requirement - Various valves used in transmission - corrosion control in pipelines.   **(9)**

TREATMENT OF WATER

Treatment units - Objectives, principles and design of flash mixer, flocculator, sedimentation tank and clariflocculator - filtration - rapid sand filtration units and pressure filters.   **(9)**

MISCELLANEOUS TREATMENT AND DISTRIBUTION OF WATER

Disinfection - Chlorination and its methods - aeration, water softening, iron and manganese removal and fluoride removal - Distribution system and its Requirements - Distribution network layouts - Analysis by Hardy Cross method and Equivalent Pipe method- Distribution reservoirs- leakage detection and prevention.   **(9)**

TOTAL : 45

TEXT BOOKS

1. Garg S.K. "Environmental Engineering (Vol. I) Water Supply Engineering", Khanna Publishers, New Delhi, 2010.

2. Birdie G.S, "Water Supply and Sanitary Engineering", DhanapatRai Publications, New Delhi, 2000.

REFERENCE BOOKS

1. Raju,B.S.N , "Water Supply and Waste Water Engineering", Tata McGraw - Hill Co, New Delhi, 1995.

2. Duggal,K.N., "Elements of Environmental Engineering", S. Chand & Co, New Delhi, 2002.

3. Punmia B.C, Ashok Jain and Arun Jain, "Water Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2004.

4. Manual on Water supply and Treatment, CPHEEO, Government of India, New Delhi, 1999.

15CE45 - CONCRETE TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : State the different types of materials, all properties and tests as per codes specifications for the primary ingredients used in manufacture of concrete.

CO2 : Illustrate the different method of designing concrete mixes for the different types of primary ingredients and admixtures as per IS code and ACI specifications. Show the improvement of concrete properties by varying the quantities of primary ingredients.

CO3 : Explain and discuss the different methods of manufacturing concrete. Describe the different equipment used for the same

CO4 : Discuss the properties of fresh and hardened concrete as per code requirements

CO5 : Identify the types of concretes used for special requirements.

CEMENT AND AGGREGATES

Types of cement - properties and specific uses of various cements - Tests of cement - Fineness - Setting time - Consistency- Soundness - compressive strength.

Properties of aggregates - shape, texture, bond, strength, soundness and thermal properties - grading - bulking of sand - Tests on aggregates - Flakiness index - Elongation index - Crushing value - Impact value- Abrasion value. **(9)**

WATER, ADMIXTURES AND CONCRETE MIX DESIGN

Quality of water for mixing and curing - use of Sea water for mixing concrete.

Air-entraining agents - Accelerators - Retarders - Pozzolona - Water proofing agents - workability agents - plasticizers - super plasticizers

Factors affecting mix proportion - Water cement ratio - Aggregate cement ratio - Mix design by I.S.method and ACI method
(9)

MANUFACTURE OF CONCRETE

Measurement of materials - Volume batching and weigh batching - mixing of concrete - Types of mixers-Transporting of concrete-placing of concrete - compaction of concrete - Methods of compacting concrete- Tamping - Vibration - Vibroprocessing - Jolting - Rolling - Centrifugation -Curing of concrete - Different methods of curing. **(9)**

PROPERTIES AND TESTS ON FRESH AND HARDENED CONCRETE
FRESH CONCRETE

Workability - Workability Tests - Slump Test - Compacting factor Test - Flow test - Kelly Ball test - Vee Bee consistometer test - segregation and Bleeding.

HARDENED CONCRETE

Compressive Strength of concrete - Modulus of Rupture -Tensile Strength - Modulus of elasticity - Bond stress - Shrinkage of concrete - Factors affecting shrinkage of concrete - creep - Factors influencing creep - Factors affecting permeability - Thermal properties **(9)**

QUALITY CONTROL AND SPECIAL CONCRETES

Sampling - Frequency of sampling - Standard deviation - acceptance criteria as per IS 456 - 2000.

Light weight concrete - Fibre Reinforced Concrete - High density Concrete - Polymer Concrete - Ferrocement- Shotcreting - Hot weather concreting - Cold weather concreting - high strength concrete - High performance concrete - Self compacting concrete - Ready mixed Concrete. **(9)**

TOTAL : 45

TEXT BOOK

1. Shetty M.S., "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2005.

REFERENCE BOOKS

1. Neville.A.M., "Properties of Concrete", ELBS, 2011.
2. Santhakumar A.R., "Concrete Technology" Oxford University Press, New Delhi, 2012
3. Krishnasamy K.T., "Concrete Technology", Dhanpat Rai, New Delhi, 2012.
4. Gambhir M.L., "Concrete Technology", Tata McGraw Hill Publishing Company Limited, New Delhi, 2009.
5. IS 456- 2000 : Indian Standard Code of Practice for Plain and Reinforced Concrete, BIS, New Delhi.
6. IS 10262-2009 : Guidelines for Concrete Mix Design proportioning.

15CE46 - HIGHWAY ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1   :   *Explain the types of Indian roads, organizations and pavements*

CO2   :   *Design the components of horizontal and vertical alignments in Highway Engineering*

CO3   :   *Outline the types of road construction materials and construction procedures*

CO4   :   *Describe the traffic engineering studies and operations*

HIGHWAY PLANNING

IRC, CRRI and NHAI-Classification of roads-Road patterns-Planning Surveys-Master Plan and Phasing of master plan- Highway alignment -Factors -Engineering surveys-Drawings and reports -Highway project-New and re alignment project. Maximum dimension of road vehicles and loaded weight-Passenger Car Units- Pavements - flexible - rigid - comparison - soil subgrade, sub base and base course, wearing course and their evaluation - Highway drainage - significance - requirements   **(9)**

HIGHWAY GEOMETRIC DESIGN

Cross section elements - Friction, roughness, light reflecting characteristics-camber - Width of carriage way, medians-Kerbs-Road margins-Cross section of roads in embankment and cutting -Width of formation. IRC standards-Right of way-Recommended road width for different classes of roads-Sight distance-Design of Horizontal Alignments-Design Speed-Radius of Horizontal Curves-Super elevation- Widening of pavement on horizontal curves-Transition curves-Types- Length-Examples. Design of vertical alignment-Gradient-Types-Gradient for different terrains-Vertical curves -Summit curves, Valley curves- Examples.**(9)**

HIGHWAY CONSTRUCTION AND MAINTENANCE

Materials - Properties of road aggregates and tests - Bituminous materials - Types- Requirements - Tests- Bituminous mixes-Highway construction - Earthwork and preparation of subgrade- Construction procedure for Bituminous Pavements - types - Cement concrete pavements - types Pavement failures -Flexible and rigid-Types-Causes-Maintenance- Pavement evaluation - Design concepts.   **(9)**

TRAFFIC ENGINEERING

Scope- Characteristics- Road user-Vehicle-Traffic studies - Volume, Speed, Origin and Destination, Capacity, Parking and Accidents.   **(9)**

TRAFFIC OPERATIONS

Traffic regulations- Traffic control devices - Traffic signs - Traffic signals - Road markings - Traffic islands - Control of access on highways - Intersections at grade - Grade separated intersections.   **(9)**

TOTAL : 45

TEXT BOOK

1.   *Khanna.S.K and Justo.C.E.G., "Highway Engineering", Khanna Publishers, Roorkee, 2001.*

REFERENCE BOOKS

1.   *Sharma S.K., "Principles, Practice and Design of Highway Engineering", S.Chand&co., New Delhi, 2012.*

2.   *Kadayali., "Principles, Practice and Highway Engineering", Khanna Publishers, New Delhi, 2007.*

3.   *Smith T.N and Hurd E.W., "Traffic Engineering", McGraw Hill, New Delhi, 2003.*

4.   *IRC Codes 15-2002, 37-2001, 38-1988, 52-1988, 62-1976, 66-1976, 73-1980, 58-2002 & IRC SP 23-1993.*

15CE47 - HYDRAULIC ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : Examine the flow meters through Venturimeter and Orificemeter

CO2 : Calculate the major and minor losses of flow of water through pipes

CO3 : Compute the rate of flow of water from a tank and in an open channel

CO4 : Examine the Bernoulli's Theorem for varying cross section of pipe flow

CO5 : Determine the metacentric height of the model of the ship in hydrostatic condition

CO6 : Find the performance of centrifugal, reciprocating pumps, Pelton and Francis turbines through characteristic curves

LIST OF EXPERIMENTS

1. Calibration of flow meters
2. Flow through pipes - Major & Minor losses
3. Flow through Orifices & Mouthpieces
4. Flow over Notches
5. Verification of Bernoulli's Theorem
6. Metacentric Height
7. Impact of Jets
8. Performance of Pumps
9. Performance of Turbines

REFERENCE BOOKS

1. "Hydraulic Engineering Laboratory Instruction Manual", Published by the Department of Civil Engineering, CIT, Coimbatore, 2015.
2. Bansal R.K., "Text Book of Fluid Mechanics and Hydraulic Machines", M/s.Lakshmi Publications, Madras, 2005.
3. Kumar K.L, "Engineering Fluid Mechanics", M/s.S.Chand Co., Madras, 2003.

15CE48 - STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOME

At the end of this course, the student will be able to

CO1   :   Assess the strength properties of mild steel rod and brick

CO2   :   Assess the hardness number of various metals

CO3   :   Assess the impact load on given metal.

CO4   :   Calculate the deflection of wood and springs.

CO5   :   Assess the flexural strength in beams

LIST OF EXPERIMENTS

1.   Tension test on mild steel rod
2.   Shear test on mild steel rod
3.   Tests on brick
4.   Hardness test - Brinell hardness number
5.   Hardness test - Rockwell hardness number
6.   Impact flexure test on metals
7.   Test on wood
8.   Test on helical spring
9.   Deflection test of wooden beams
10.   Flexure test on cantilever and fixed beams
11.   Torsion test

REFERENCE BOOKS

1.   *Rajput R.K, "Strength of Materials", S.K. Kataria and Sons, New Delhi, 2007.*
2.   *IS: 3495 Part I to IV - 1976, "Methods of Test for Burnt Clay Building Bricks", Bureau of Indian Standards, New Delhi.*

15CE49 - SURVEY CAMP

ASSESSMENT : PRACTICAL

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Practice in measurement of areas using chain, cross staff, tape, electronic theodolite, electromagnetic distance meter and electronic total station*

CO2 : *Practice measurement of levels and contour for quantity calculations using dumpy and auto level, electronic total station*

CO3 : *Practice measurement of angles, distances and height of given objects using transit and electronic theodolite, electronic total station*

CO4 : *Practice in the civil engineering field for setting out of buildings and curves using tape, electronic theodolite and electronic total station*

LIST OF EXPERIMENTS

1. Survey of a given area by offset method using Chain and tape
2. Survey of a given area using Prismatic Compass and plotting after adjustment
3. Finding the reduced levels of given points by differential levelling using dumpy level
4. Calculate the volume by assessing L.S. and C. S. of given field and Plotting
5. Measurement of Horizontal distance by stadia tacheometry and Heights and distances by tangential tacheometry
6. Measurement of Horizontal and vertical angles, Setting out of building by Electronic Theodolite
7. Setting out of building plans using tape
8. Measurement of area and Contour, L.S. and C.S, Setting out of building plans using Electronic Total Station
9. Measurement of distance and Area using EDM
10. Determination of global positioning of objects using GPS

15CE51 - STRUCTURAL ANALYSIS I

L	T	P	C
2	2	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to:

CO1 : *Compute static and Kinematic indeterminacy of structures.*

CO2 : *Calculate the forces of pin jointed structures by Method of tension coefficient.*

CO3 : *Apply energy concepts and theorems to find the deflection of statically determination structures.*

CO4 : *Construct ILD for moving loads and analyze determinate and indeterminate beams.*

CO5 : *Analyze two hinged and three hinged parabolic and circular arches to determine bending moment, axial thrust and radial shear force.*

CO6 : *Analyze statically indeterminate beams and trusses by consistent deformation method.*

FUNDAMENTALS OF STRUCTURAL ANALYSIS AND ANALYSIS OF PIN JOINTED SPACE TRUSSES

Determination of static indeterminacy and kinematic indeterminacy- Principle of superposition- Analysis of Pin jointed plane and space trusses by Method of Tension coefficient. **(6)**

ENERGY CONCEPTS

Strain energy and Complementary energy - Deflection by strain energy method for statically determinate beams.

Virtual work- principle of virtual work for deformable bodies- unit load method - Deflection of determinate beams and plane trusses.

Castigliano's theorems - deflection calculation for simple determinate beams - Maxwell's reciprocal theorem for deflection. **(6)**

ANALYSIS OF STATICALLY INDETERMINATE BEAMS AND PLANE TRUSSES

Analysis of statically indeterminate beams - Consistent deformation method - Theorem of least work (beams upto 2 degrees only).

Analysis of statically indeterminate plane trusses by Consistent deformation method - Lack of fit - settlement and temperature effects. **(6)**

ANALYSIS OF ARCHES

Analysis of three hinged arches of parabolic and circular profiles - Analysis of two hinged symmetric parabolic and circular arches. Settlement and temperature effects. **(6)**

MOVING LOADS AND INFLUENCE LINES

Influence lines for shear force, bending moment and reactions in statically determinate beams - Calculation of shear force and bending moment due to concentrated and distributed moving loads - Influence lines for forces in members of statically determinate plane trusses .

Influence lines for reactions, shear force and bending moment in statically indeterminate beams by Muller-Breslau's principle - Application of Muller Breslau principle to beams with degree of static indeterminacy not exceeding one. **(6)**

TOTAL : 30 + 30 = 60

TEXT BOOKS

1. Gupta S.P and Pandit G.S, "Theory of Structures, Vol. I & II", Tata McGraw Hill, New Delhi, 2012.

2. Bhavikatti S.S, "Structural Analysis" Vol. I & II, Vikas Publishing House (P) Ltd., New Delhi, 2011.

3. Vaidyanathan. R, and Perumal. P. "Structural Analysis", Vol. I & II, Laxmi Publications (P) Ltd., New Delhi, 2008.

REFERENCE BOOKS

1. *Rajasekaran S. and Sankarasubramanian G., "Computational Structural Mechanics" Prentice Hall of India, New Delhi, 2012.*

2. *Prakash Rao D.S., "Structural Analysis", Universities Press, Hyderabad, 2001.*

3. *Armenakas A.E., "Classical Structural Analysis", Mc-Graw Hill Book Co., NewYork, 1995.*

4. *Reddy C.S, "Basic Structural Analysis", Tata Mc-Graw Hill, New Delhi, 2012.*

5. *Junnarkar and Shah., "Mechanics of Structures" Vol.II, Charotar Publishing House, Anand, 2012.*

6. *Punmia B.C and A.K.Jain, "Strength of Materials and Theory of Structures", Vol.II, Laxmi Publications, New Delhi, 2005.*

7. *Wang C.K, "Intermediate Structural Analysis", Tata Mc-Graw Hill, New Delhi, 2010.*

8. *Ramamrutham. S. and Narayan R., "Theory of Structures" Dhanpatrai Publishing Company (P) Ltd., New Delhi, 2016.*

15CE52 - DESIGN OF REINFORCED CONCRETE STRUCTURAL ELEMENTS

L	T	P	C
2	2	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : Explain the concepts of Working Stress and Limit State Method of Design

CO2 : Design and detailing of beams for combined bending, shear and torsion

CO3 : Design and detailing of one way, two way and staircase slab

CO4 : Design and detailing of short and long columns

CO5 : Design and detailing of isolated and combined footings for columns and wall footing

MATERIALS FOR CONCRETE AND CONCEPT OF LIMIT STATE DESIGN

IS code regulations - Materials for concrete - Stress - Strain curve for concrete in compression - Concrete mix proportioning - Types of reinforcement - Plain and deformed bars - Stress - strain curve for reinforcing steel. Concept of WSD (No problems) and LSD - Difference between WSD and LSD - Characteristic loads and strengths - partial safety factor. **(4)**

LIMIT STATE DESIGN OF BEAMS

Design of singly and doubly reinforced rectangular and flanged beams. Design of beams for combined bending moment, transverse shear and torsion. Design of continuous beams using B.M. and S.F. coefficients as per IS code - Design of lintels-detailing. **(8)**

LIMIT STATE DESIGN OF SLABS

Types of slabs - Design of one-way simply supported and continuous slab using BM and SF co-efficient as per IS code - design of two way, simply supported and continuous slab as per IS code - Detailing. Design of staircase slab - Design of waist slab for dog-legged stair- Detailing. **(6)**

LIMIT STATE DESIGN OF COLUMNS

Design of short rectangular and circular columns subjected to axial compressive load - Design of short columns subjected to combined axial compressive load, uni-axial and biaxial bending moments using Design Aids - Design of long columns - Detailing. **(6)**

DESIGN OF FOOTINGS

Design of wall footings - Design of isolated, square and rectangular footings - Combined rectangular and trapezoidal footings - Detailing. **(6)**

TOTAL : 30 + 30 = 60

TEXT BOOKS

1. Unnikrishna Pillai and Devados Menon, "Reinforced Concrete Design", Tata Mc Graw Hill Publishing Co, New Delhi, 2011.

2. Varghese P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India Pvt. Ltd., 2004.

REFERENCE BOOKS

1. Subramanian N., "Design of Reinforced Concrete Structures", Oxford University Press, 2008.

2. Sinha N.C., and Roy S.K., "Fundamentals of Reinforced Concrete", S.Chand and Company, New Delhi, 2013.

3. Sinha S.N., "Reinforced Concrete Design", Tata Mc Graw - Hill Publishing Co, Ltd., New Delhi, 2012.

4. MacGregor J.G., "Reinforced Concrete Mechanics and Design", Prentice Hall, New Jersey, 2011.

5. Mallick S.K., and Gupta, A.P., "Reinforced Concrete", Oxford & IBH Publishing Co., New Delhi, 2012.

6. Ashok K Jain, "Reinforced Concrete Limit State Design". New Chand Bros, Roorkee, 2012.

7. Krishna Raju N. and Pranesh R.N., "Reinforced Concrete Design-IS:456 - 2000, Principles and Practice" New Age International Publishers, New Delhi, 2003.

8. Syal I.C., and Goel A.K.,"Reinforced Concrete Structure", A.H .Wheeler & Co, 2004.

9. IS: 456 - 2000, Indian Standard Code of Practice for Reinforced Concrete, Bureau of Indian Standards, New Delhi.

10. SP- 16 - 1980, Design Aids for reinforced Concrete, Bureau of Indian Standards, New Delhi.

11. SP - 34 - 1987, Hand Book on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi.

15CE53 - MECHANICS OF SOILS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : Explain basic properties of soil and classify according to IS classification system.

CO2 : Determine the permeability of soils by understanding and applying Darcy's law.

CO3 : Compute stresses and stress increments within soil and stress due to external loads.

CO4 : Compute settlement by understanding theory of consolidation.

CO5 : Compute shear strength of soils based on shear parameters obtained from shear tests.

CO6 : Check stability of slopes incorporating relevant soil parameters

BASIC SOIL PROPERTIES

Soil formation and soil types - Civil engineering problems related to soils - Nature of soil - Simple definitions - Phase relationships - Classification - IS Classification system. Compaction - Factors affecting compaction - Laboratory and field compaction methods.

(9)

SOIL WATER

Principles of water flow - Darcy's law - Permeability - Laboratory Methods - Field measurement of permeability - Effective stress concept - Dry and saturated soils. **(9)**

STRESS DISTRIBUTION AND CONSOLIDATION

Stress distribution in soil media - Boussinesq's Analysis - Westergaard's Analysis - Intensity of vertical stress using influence charts. Consolidation - measurement of compressibility - e-log P curves - Terzaghi's one dimensional consolidation theory - Determination of coefficient of consolidation. **(9)**

SHEAR STRENGTH

Shear at a point - Mechanism of shear resistance - Mohr- Coulomb failure criterion - measurement of shear strength - Direct shear test - Triaxial shear test - Unconfined compression strength test - Vane shear test - Shear strength of clay soil - Shear strength of sand. **(9)**

STABILITY OF SLOPES

Types of slopes - Stability of infinite slope - Stability of Finite slope - Total stress Analysis - Swedish circle method - Use of Taylor's stability number - Slope failure mechanism - Effect of Tension cracks. **(9)**

TOTAL : 45

TEXT BOOKS

1. *GopalRanjan and Rao, ASR, "Basic and Applied Soil Mechanics", New Age International (P) Limited Publication, New Delhi, Second Edition, 2010.*

2. *Venkataramaiah, "Geotechnical Engineering", New Age International Ltd., New Delhi Third Edition, 2012.*

3. *Punmia, B.C, "Soil Mechanics and Foundation Engineering", Laxmi Publications, New Delhi, Sixteenth Edition, 2005.*

REFERENCE BOOKS

1. *Alam Singh, "Modern Geotechnical Engineering", IBS Publications, New Delhi, 2010.*

2. *Muni Budhu, "Soil Mechanics and Foundation Engineering", Wiley India Publication, New Delhi, Second Edition, 2010.*

3. *Braja M. Dass and KhaledSobhan," Principles of Geotechnical Engineering," Cengage learning, 2013.*

15CE54 - WASTE WATER ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : *Recognize the origin and importance of effective conveyance of domestic sewage.*

CO2 : *Summarize the perspectives of various house drainage systems.*

CO3 : *Demonstrate not only the physico-chemical and bio-chemical characteristics of domestic sewage; but also deploy the appropriate conventional treatment schemes.*

CO4 : *Illustrate the employability of appropriate biological treatment schemes.*

CO5 : *Recognize the current need for membrane technologies in achieving the recycling of treated effluents*

QUANTITY AND CONVEYANCE

Necessity and objectives of sanitary engineering projects - Definitions - systems of sewerage - quantity of sewage -components and design period of sewerage projects- Fluctuations in flow pattern - Estimation of storm runoff -design discharge for separate sewer and combined sewer-Hydraulics of sewers - Self cleansing velocity, non scouring velocity- design of sewer for full flow/ half flow conditions, use of nomograms for design - sewer and drain section, materials for sewer. **(9)**

SEWER APPURTENANCES AND HOUSE DRAINAGE SYSTEMS

Sewer appurtenances - sewer joints - sewer excavation, laying and testing of sewers - sewer cleaning and maintenance - necessity of sewage pumping, pumping station -design of pumps and pumping station. House drainage - Sanitary fixtures / fittings - systems of plumbing - General layout of house drainage - street connections. Septic tanks and effluent disposal system - dispersion trench, soak pit and anaerobic up flow filter. **(9)**

QUALITY OF SEWAGE AND PRIMARY TREATMENT

Characteristics and composition of sewage - physical and chemical analysis - DO, BOD,COD and their significance - cycles of decomposition - Objectives and basic principles of sewage treatment - primary treatment - screens - Grit chamber - principles of sedimentations- sedimentation tank types-surface overflow rate, detention time and Design of primary settling tanks. **(9)**

BIOLOGICAL TREATMENT OF SEWAGE

Microbiology of wastewater treatment - bacterial growth curve, optimal microbiological growth phase for wastewater treatment - Basic principles of biological treatment -types - suspended and attached growth process - trickling filters- types, comparison and construction, recirculation. Recirculation ratio, operational problems, design of high rate and standard rate filters. - activated sludge process (ASP) -flow diagram- process modification of ASP -aeration - diffuser, mechanical aeration -design of ASP and oxidation ditches - process description of Sequential batch reactor (SBR), Upflow anaerobic sludge blanket reactor (UASB), fluidized bed reactor (FBR), packed bed reactor(PBR) and extended bed reactor (EBR). **(9)**

SLUDGE DISPOSAL

Membrane filtration- process, classification, characteristics, configuration, operation, fouling and control -types of membrane technologies and their application in wastewater treatment - comparison- electrodialysis- sludge - types and characteristics-sludge thickening - application and types-stabilization, types - anaerobic digestion process, types - design of anaerobic digesters. sludge drying, methods - sludge drying bed - sludge disposal -zones of pollution in lakes - Eutrophication - recycle & reuse of wastewater -disposal of sewage by dilution and land disposal - self purification of streams - oxygen sag curve. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Garg S. K., "Environmental Engineering", Vol. I & Vol. II, Khanna Publishers, New Delhi, 1994.*

2. *Metcalf and Eddy, "Wastewater Engineering Treatment, Disposal and Reuse", McGraw-Hill Publishing Co, Indian Edition, New Delhi, 2005.*

3. Mark J. Hammer, "Water and Waste Water Technology", Prentice hall of India 2008.
4. Hussain S. K., "Text Book of Water Supply and Sanitary Engineering", Oxford and IBH, 1976.
5. Duggal K.N., "Elements of public Health Engineering", S.Chand and Company Ltd, New Delhi, 1998.

REFERENCE BOOKS

1. Manual on wastewater and treatment CPHEEC, Ministry of Urban Affairs and Employment, Govt. of India, New Delhi, 1990.
2. Shah C. S., "Water supply and Sanitation", Galgotia publishing company, New Delhi, 1994.

15CE55 - IRRIGATION ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : *Compute the demand and the available quantity of water required for irrigating a given crop area*

CO2 : *Determine the yield of a well*

CO3 : *Produce hydraulic and geometrical design of storage and distribution systems to supply water for a given area*

CO4 : *Demonstrate suitable techniques for the construction and maintenance of a reservoir and a canal network*

CO5 : *Design, operate and maintain a canal*

CO6 : *Plan and develop a procedure to implement an irrigation project given an agricultural command area*

WATER AND IRRIGATION

Irrigation - Necessity - Advantages - ill-effects - Types - Methods - Quality of water - Standards - Crops - Seasons - Definitions related to agriculture and irrigation - Rotation of crops - Crop water requirements - Base period - Duty - Delta - Consumptive use - Irrigation Efficiencies - Assessment of irrigation water - Water logging - Causes and effects - Remedies - Drainage - Necessity - Advantages - Types.   **(9)**

HYDROLOGY

Surface hydrology - Precipitation - Types, forms, Measurement - Evaporation - measurement - Infiltration - measurement - Transpiration - Run-off - Hydrograph - Unit Hydrograph for single peaked storm - S-curve technique - Flood Estimation.   **(9)**

GROUND WATER

Occurrence of ground water - aquifer - aquiclude - confined, unconfined and perched aquifer - Ground water yield - specific capacity of a well - measurement of yield of an open well by pumping test and recuperation test - Typical cross sections of types of open and tube wells - Elementary design of open and tube wells using direct discharge equation (without derivation of formula).   **(9)**

CANAL ENGINEERING

Canals - Classification - Distribution network - Cross sectional details - Sedimentation in canals - Silt theories - Design of canals based on silt theories and use of charts - Balancing depth of cutting - Design procedure for fixing longitudinal section - Canal losses - Canal maintenance - Canal lining - types - Design of lined canals.   **(9)**

RESERVOIR PLANNING

Dams - Brief idea about types of dam(detailed study not required) - Reservoir - Types, Investigations for reservoir planning - Selection of site for reservoir - Zones of storage - Capacity - Yield - Mass curve analysis - Capacity for specific demand and yield for given capacity - Fixing reservoir capacity - Economic height of a dam - Reservoir sedimentation and control.   **(9)**

TOTAL : 45

TEXT BOOKS

1. *Garg S.K, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi, 2009.*
2. *Punmia B. C. and Pande B. B. Lal, "Irrigation and Water Power Engineering", Laxmi Publications, New Delhi, 2009.*

REFERENCE BOOKS

1. *Micheal A.M., "Irrigation - Theory & Practice", Vikas publishing house, New Delhi, 2006.*
2. *Sharma R.K., "Irrigation Engineering & Hydraulic Structures", Oxford and IBH Publishing Company, New Delhi, 2007.*

15CE56 - HIGHWAY ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Determine the properties of Coarse aggregate related to highway requirements for laying pavement*

CO2 : *Evaluate the properties of Bitumen related to flexible pavement*

LIST OF EXPERIMENTS
TESTS ON COARSE AGGREGATE

1) Los Angeles Abrasion Test
2) Impact Test
3) Shape Test
4) Water Absorption and Specific Gravity Test.
5) Sieve Analysis Test
6) Bulk Density Test

TESTS ON BITUMEN

1) Ductility Test
2) Viscosity Test
3) Softening Point Test
4) Penetration Test

REFERENCE BOOKS

1. *S.K.Khanna & C.E.G. Justo, "Highway Material Testing", Nem Chand & Bros, Roorkee, 2007.*
2. *Bureau of Indian Standard Code of Practice for*
   • *Particle Size and Shape IS 2386 - Part I*
   • *Specific gravity, Density, Voids, Absorption and Bulking IS 2386 - Part III*
   • *Mechanical Properties IS 2386 - 1963 - Part IV*
   • *Soundness IS 2386 -1963 - Part V*

15CE57 - ENVIRONMENTAL ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : *Ascertain the suitability of water samples for drinking and construction purpose.*

CO2 : *Ascertain the suitability of wastewater samples as per effluent standards.*

CO3 : *Select the degree of treatment based on the results of water samples.*

CO4 : *Select the degree of treatment based on the results of the wastewater samples.*

LIST OF EXPERIMENTS

1. Determination of Acidity of the given Water/Wastewater Sample.

2. Determination of Alkalinity of the given Water/Wastewater Sample.

3. Determination of Hardness of the given Water/Wastewater Sample.

4. Estimation of Chlorides in the given Water/Wastewater Sample.

5. Determination of pH, turbidity and specific conductivity of the given Water/Wastewater Sample.

6. Determination of Dissolved Oxygen Content in the given Water/ Wastewater Sample.

7. Assessment of Settleable, Total, Volatile, Fixed, Dissolved and Suspended Solids in Water/Wastewater Sample.

8. Turbidimetric-based Estimation of Sulphates in the given Water/Wastewater Sample.

9. Assessment of Optimum Coagulant Dose (OCD) to treat the given turbid water.

10. Assessment of Available Chlorine in the given Bleaching powder sample and Estimation of Residual Chlorine of the given Polluted Water/Wastewater Sample.

11. Assessment of Biochemical Oxygen Demand (BOD) of the given Water/Wastewater Sample.

12. Assessment of Chemical Oxygen Demand (COD) of the given Water/Wastewater Sample.

REFERENCE BOOK

1. *"Environmental Engineering Laboratory manual", Department of Civil Engineering, Coimbatore Institute of Technology.*

15CE61 - STRUCTURAL ANALYSIS II

L	T	P	C
2	2	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : *Analyze statically indeterminate structures by slope deflection method.*

CO2 : *Analyze continuous beams and plane frames using moment distribution method.*

CO3 : *Formulate flexibility matrix and apply to analyse determinate and indeterminate structures.*

CO4 : *Formulate stiffness matrix and apply to analyse determinate and indeterminate structures.*

CO5 : *Outline the basic concepts, applications and limitations of FEM.*

SLOPE DEFLECTION METHOD

Application of slope deflection method to the analysis of statically indeterminate beams and rigid jointed plane frames - Effects of settlement of supports for beams only (Examples on structures having Kinematic indeterminacy not exceeding three). **(6)**

MOMENT DISTRIBUTION METHOD

Stiffness and carry over factors - Application of the method to the analysis of continuous beams and rigid jointed plane frames - effects of settlement of supports - Symmetric and skew symmetric loadings. **(6)**

MATRIX FLEXIBILITY METHOD

Element flexibility - Structure flexibility - Formulation of Structure flexibility matrix - Determination of forces - Application to simple indeterminate beams, frames and trusses. **(6)**

MATRIX STIFFNESS METHOD

Element stiffness - Structure stiffness - Formulation of Structure stiffness matrix - Application to simple indeterminate beams, frames and trusses. **(6)**

INTRODUCTION TO FINITE ELEMENT METHOD

Basic steps - Concept of an element - Various element shapes - Application of FEM - Limitations - Element stiffness matrix for one dimensional members - Procedure of assembly and solving equations (No problems). **(6)**

TOTAL : 30 + 30 = 60

TEXT BOOKS

1. *Gupta S.P and Pandit G.S, "Theory of Structures, Vol. I & II", Tata McGraw Hill, New Delhi, 2012.*

2. *Bhavikatti S.S, "Structural Analysis" Vol. I & II, Vikas Publishing House (P) Ltd., New Delhi, 2011.*

3. *Vaidyanathan R. and Perumal P., "Structural Analysis", Vol. I & II, Laxmi Publications (P) Ltd., New Delhi, 2008.*

REFERENCE BOOKS

2. *Rajasekaran S. and Sankarasubramanian G., "Computational Structural Mechanics," Prentice Hall of India, New Delhi, 2012.*

2. *Prakash Rao D.S., "Structural Analysis", Universities Press, Hyderabad, 2001.*

3. *Armenakas A.E., "Classical Structural Analysis" Mc-Graw Hill Book Co., New York, 1995.*

4. *Reddy C.S, "Basic Structural Analysis", Tata Mc-Graw Hill, New Delhi, 2012.*

5. *Junnarkar and Shah., "Mechanics of Structures" Vol.II, Charotar Publishing House, Anand, 2012.*

6. *Punmia B.C and A.K.Jain "Strength of Materials and Theory of Structures", Vol.II, Laxmi Publications, New Delhi, 2005.*

7. *Wang C.K, "Intermediate Structural Analysis", Tata Mc-Graw Hill, New Delhi, 2010.*

8. *Krishnamoorthy C.S., "Finite Element Analysis, Theory and Programming," Tata McGraw Hill Company, 2000.*

9. *Reddy J.N., "An Introduction to the Finite Element Method", Tata McGraw Hill Company, NewDelhi, 2005.*

15CE62 - DESIGN OF STEEL STRUCTURES

L	T	P	C
2	2	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : Describe the Working Stress Method and Limit State Method design concepts

CO2 : Design the bolted and welded connections

CO3 : Design the tension members as per IS code and concepts of shear lag

CO4 : Design the compression members as per IS code

CO5 : Design the laterally supported and unsupported beams as per IS code

CO6 : Analyze statically indeterminate beams and portal frames using plastic theory

CONCEPTS OF STRUCTURAL STEEL DESIGN

Working Stress Design - Limit State Design - Stress-strain relation of Mild steel - Modified stress-strain diagram - Assumptions in Plastic theory - Collapse load - load factor - plastic bending - Plastic hinge - Plastic moment of resistance - Plastic modulus - Shape factor - Plastic Analysis - Kinematic theorem, Static theorem and Uniqueness theorem - Propped cantilevers - Fixed beams and Continuous beams - Portal Frames. **(6)**

CONNECTIONS

Bolted and welded connections for axial forces- eccentric connections with bolt and weld. Beam to beam connection - framed connection. Beam to column connection - Unstiffened seat connection - stiffened seat connection - single and double stiffener angle. **(6)**

TENSION MEMBERS

Design of tension members subjected to axial tension- tension member subjected to bending - lug angles. Design of Tension Splice - Concept of Shear leg **(6)**

COMPRESSION MEMBERS

Design of compression members with single rolled steel sections - Angle struts. Design of built-up compression members - Design of lacings and battens - Eccentrically loaded column -column splices - column bases for axial and eccentric loads. **(6)**

BEAMS

Design of laterally supported beam for flexure, shear, web crippling and buckling and deflection. Built-up Beams - cross sections - beams with restrained and unrestrained compression flange. **(6)**

TOTAL : 30 + 30 = 60

TEXT BOOKS

1. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.

2. Duggal.S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publication, 2011.

3. Jayagopal.L.S & Tensing.D, "Design of Steel Structures", Vikas Publication House Ltd, Noida.

4. Gambir M.L., "Fundamentals of Structural Steel Design", Tata McGraw Hill Publication, New Delhi, 2013.

REFERENCE BOOKS

1. Bhavikatti.S.S, "Design of Steel Structures by Limit State Design", I.K International Pvt. Ltd., New Delhi 2011.

2. Ramachandra, Virendra Gehlot, "Limit State Design of Steel Structures", Scientific Publishers, Jodhpur, 2010.

3. Shiyekar.M.R. "Limit State Design in Structural Steel", PHI learning Pvt. Ltd., Delhi, 2013.

4. IS 800 - 2007, "Code of Practice for use of Structural Steel in General Building Construction," Bureau of Indian Standards, New Delhi.

5. SP6 ISI Hand Book for "Structural Engineers and Application of Plastic Theory in Design of Steel Strictures", 1972.

15CE63 - FOUNDATION ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : Understand types of foundation and collect required data for selection of foundation through suitable soil investigations

CO2 : Compute Bearing Capacity of soils and settlements of foundations.

CO3 : Plan suitable methods to reduce settlements and increase Bearing Capacity.

CO4 : Compute load carrying capacity and settlement of pile and pile groups.

CO5 : Check the stability of retaining walls by understanding theories of earth pressure

CO6 : Assess weak ground characteristics and suggest different ground improvement alternatives.

SOIL INVESTIGATION AND CHOICE OF FOUNDATION

Methods of Soil Exploration - Boring - Sampling - Disturbed and undisturbed Sampling - Sampling techniques - Bore log and soil investigation report - Function and requirements of good foundation -Choice of foundation based on soil conditions.   **(9)**

BEARING CAPACITY AND SHALLOW FOUNDATIONS

Location and depth of foundations- Bearing capacity of shallow foundations on homogeneous deposit - Terzaghi's Theory - IS Code method - Field tests - Factors influencing Bearing Capacity - Settlement of foundations - Components of settlement - Allowable and maximum differential settlement - Proportioning of footing (No structural design) - Methods of improving bearing capacity - Methods of minimizing settlements.   **(9)**

PILE FOUNDATIONS

Need for deep foundations -Types of piles - classification of piles - Load carrying capacity of piles in granular and cohesive soils -Static and Dynamic formulae - Pile carrying capacity by field tests - Pile load test - Group Capacity - Settlement of Pile groups - Negative skin friction.   **(9)**

EARTH PRESSURE ON RETAINING WALLS

Earth pressure theory - Plastic equilibrium in soils - active and passive state - Rankine's theory - Coulomb's wedge theory - Earth pressure on retaining walls of simple configurations - Stability of retaining wall -Culmann's graphical method for determining earth pressure.   **(9)**

GROUND IMPROVEMENT METHODS

Problematic soils - Measurement of swell and swell pressure - Ground improvement methods -Preloading - Soil replacement - Densification - Stabilization - Soil reinforcement - Geotextiles - Geosynthetics.   **(9)**

TOTAL : 45

TEXT BOOKS

1. *Varghese P.C., "Foundation Engineering", Prentice Hall of India, 2005.*

2. *Gopal Ranjan and Rao A.S.R., "Basic and Applied Soil Mechanics", New age International (P) Ltd Publications, New Delhi, Second Edition, 2010.*

REFERENCE BOOKS

1. *Venkataramaiah C, "Geotechnical Engineering", New Age International Ltd., New Delhi,2008.*

2. *Alam Singh., "Modern Geotechnical Engineering", IBS Publications, New Delhi, 2012.*

3. *Punmia B.C., "Soil Mechanics and Foundation Engineering", Laxmi Publications, New Delhi, Sixteenth Edition, 2005.*

4. *Braja M. Dass, "Principles of Foundation Engineering", Thomson Brooks Gole, Singapore, 2005.*

15CE64 - DESIGN OF REINFORCED CONCRETE STRUCTURES

L	T	P	C
2	2	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : *Understand the concepts of yield line theory.*

CO2 : *Design retaining walls*

CO3 : *Analyse Building frames for gravity and wind loads*

CO4 : *Design water tanks using working stress method*

YIELD LINE THEORY

Introduction to yield line theory of slabs - Application to square and rectangular slabs with simply supported or fixed boundary conditions subjected to uniformly distributed and central concentrated loads (by upper bound theorem). **(6)**

RETAINING WALLS

Design of cantilever and counterfort retaining walls for level surface filled with/without uniform surcharge - stability requirements - Description of inclined backfill (no problems) **(6)**

BUILDING FRAMES

Difference between multi-storeyed load bearing and framed structures-Elastic analysis using substitute frames for gravity loadings-approximate analysis of single and two bay frames up to 3 storeys for lateral loads using portal and cantilever methods. **(6)**

GROUND AND UNDER GROUND WATER TANK

Classifications- IS code provision - Design of on ground square and rectangular tanks- Design of underground rectangular tank. **(6)**

OVERHEAD WATER TANK

Design of overhead rectangular (with problems) and (no problems) circular tanks. Design of staging for rectangular tank - Descriptions of Intz type tank (no problems). **(6)**

TOTAL : 30 + 30 = 60

TEXT BOOKS

1. *Unnikrishna Pillai and Devados Menon, "Reinforced Concrete Design", Tata Mc Graw Hill Publishing Co, New Delhi, 2011.*

2. *Krishna Raju N., "Advanced Reinforced Concrete Design", CBS Publishers and Distributors, Delhi, 2003.*

3. *Jain, O.P.and Jaikrishna "Plain and Reinforced Concrete Vol.I and Vol.II", Nemchand and Brothers, Roorkee, 2007.*

4. *Vazirani V.N. and Ratwani, N.M.,"Concrete Structures", Khanna Publishers, New Delhi, 2004.*

REFERENCE BOOKS

1. *Design aids for Reinforced Concrete to IS : 456 -2000, Bureau of Indian Standards, New Delhi.*

2. *Reynolds C.E., "Reinforced Concrete Designer's Hand Book", Cement and Concrete Association, London, 2002.*

3. *Johnson Victor D., "'Essentials of Bridge Engineering", Oxford and IBH Publishing Company, New Delhi, 2003.*

4. *Krishna Raju N., "Advanced Reinforced Concrete Design", CBS Publishers and Distributors, Delhi, 2003.*

5. *Syal I.C. and Goel A.K., "Reinforced Concrete Structures", Wheeler and Company, Private Limited, New Delhi, 1998.*

6. *Ashok K Jain, "Reinforced Concrete Limit State Design", New Chand Brothers, Roorkee, 2012.*

7. *IS 456 - 2000 Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.*

8.   IS 3370 (Part I) - 1965 (Reestablished: 1999) - Code of Practice for Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.

9.   IS 3370 (Part II) - 1965 (Reestablished: 1999) - Code of practice for Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.

10. IS 3370 (Part III) - 1965 (Reestablished: 1999) - Code of practice for Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.

11. IRC:5 - 1998 - Standard Specification and Code of Practice for Road Bridges (Section I), Bureau of Indian Standards, New Delhi.

12. IRC:6 - 1966 - Standard Specification and Code of Practice for Road Bridges (Section II), Bureau of Indian Standards, New Delhi.

13. IRC: 21 - 2000 - Standard Specification and Code of Practice for Road Bridges (Section III), Bureau of Indian Standards, New Delhi.

15CE65 - QUANTITY SURVEYING AND PROJECT PLANNING LABORATORY

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOME

At the end of this laboratory, the students will be able to

CO1 : *List items of work and prepare specifications.*

CO2 : *Prepare the detailed estimate and abstract to arrive the quantity of items of work.*

CO3 : *Estimate the cost and quantity of materials and Resources for items of work.*

CO4 : *Evaluate the value of existing civil engineering structures and project planning tools.*

ESTIMATING AND COSTING

Methods of Estimating and costing -Preparation of specifications - preparation of Detailed Estimate using Excel - Data sheets - Requirements of labour, non labour and materials for different types of work -Abstract Estimate using Excel - Estimation of quantities and rate Abstract for Single storey building, two storey building and other Civil Engineering structures.

PROJECT PLANNING USING MS PROJECT AND PRIMAVERA

Introduction to project planner and project management - defining Administrative categories- setting up OBS,WBS and EPS- creating calendars- defining activity duration predecessor - successor- positive and negative lag- relationships -float- defining resources and roles- managing base lines - preparing activity areas and bar/Gantt chart areas- updating and tracking projects using base line- producing reports -layout- filter - formatting, printing layout and reports.

TEXT BOOKS

1. *Dutta B.N., "Estimating and Costing in Civil Engineering", UBS Publishers and Distributors (P) Ltd., New Delhi, 2003.*

2. *Rangwala S.C., "Elements of Estimating and Costing", Charotar Publishing House, Anand - 388001.*

3. *Dr. P. Vinayagam and Dr. A. Vimala, "Planning and managing Projects with P6 Project Planner", I. K. International Publishing House Pvt. Ltd., New Delhi, 2015.*

REFERENCE BOOKS

1. *Jagannathan, G., "Getting more at less cost - The value Engineering way", Tata McGraw Hill Publishing Company, New Delhi, 2000.*

2. *Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S.Chand & Company Ltd., 2004.*

15CE66 - SOIL MECHANICS LABORATORY

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOME

At the end of this laboratory, the students will be able to

CO1 : *Prepare soil samples for testing, performing the test, collecting and analyzing data*

CO2 : *Practice common soil tests to identify physical and mechanical properties of soils*

CO3 : *Demonstrate the ability to write clear technical reports*

CO4 : *Apply the laboratory results to problem identification and basic soil mechanics related design problem*

LIST OF EXPERIMENTS

1. Grain Size analysis of soil
2. Determination of Specific Gravity
3. Atterberg limits (liquid, Plastic and Shrinkage limits)
4. Determination of coefficient of permeability
5. Determination of field density
6. Proctor Compaction Test
7. Consolidation Test
8. Direct Shear Test
9. Unconfined compression Test
10. Vane shear Test
11. CBR Test
12. Triaxial test (Demonstration only)

REFERENCE BOOKS

1. *"Soil Engineering Laboratory Instruction Manual", Published by the Department of Civil Engineering. CIT, Coimbatore, 2008.*
2. *Head, K. H, "Manual of Soil Laboratory Testing (Vol-1 to 3)", John Wiley and Sons, Chichester, 1998.*
3. *Lambe T. W., "Soil Testing for Engineers", John Wiley & Sons, New York, 1990.*
4. *IS Code of Practice 2720 - Indian Standard Code of Practice for Methods of Tests for soil.*
5. *Saibaba Reddy, E. and Rama Sastri, K., "Measurement of Engineering Properties of Soils", New Age International, 2002.*

15CE67 - MINI PROJECT

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOME

At the end of this course the students will be able to

CO1 : *Apply design techniques in simple plan.*

CO2 : *Develop the knowledge in practical and technical know how of the construction industry through case study / industrial visit.*

CO3 : *Develop the knowledge of practical aspects of Civil Engineering industry / field.*

CO4 : *Communicate and collaboratively work in peer groups to develop optimized solutions for problems in Civil Engineering field.*

15CE71 - CONSTRUCTION MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After the completion of course, the students will be able to

CO1 : Apply business and management practices in planning for resources of a construction project.

CO2 : Employ the procedure for contractors selection through tendering process.

CO3 : Develop a realistic schedule for the optimum use of resources in construction projects.

CO4 : Prepare construction project estimates and exhibit construction accounting and cost control techniques.

CO5 : Develop and demonstrate leadership, teamwork, motivation and communication skills.

PLANNING

Importance - Scope of construction management - Functions of management - Management levels - Types of business organizations - Objectives of planning- steps in planning - Principles of planning - Advantages and Limitations of planning - Planning for materials, labour, equipments and organisation - Collection of field data - Approval and sanction of estimates - Budget   **(9)**

PROCUREMENT AND CONTRACTING MANAGEMENT

Construction contracts - contract documents - Types of contract - Contractual obligations - specifications - Tender - Tender notice - Types of tenders - Tender documents - Earnest money deposit - Security deposit - Scrutiny and acceptance of tender - Contract agreements   **(9)**

PROJECT MANAGEMENT

Bar charts - Milestone charts - Network analysis - CPM Network - PERT Network - Resource allocation - resource smoothing - levelling of resources according to constraints - Time cost optimization - Direct and indirect cost related to time - Activity crashing - Normal and crashed duration and corresponding cost - Cost slope- Crashing of network to optimize cost and duration of a project - time and motion studies.   **(9)**

FINANCING MANAGEMENT

Costs associated with constructed facilities -Estimates - Design estimates, Bid estimates, Control estimates - Effect of scale on construction cost - Means of financing - Cost control- Financial accounting systems - Financial control   **(9)**

PERSONNEL MANAGEMENT

Introduction to the field of people management - basic individual psychology - Relationship between labour and management - Motivation - Motivation theories- leadership - Theories of leadership - Functions of leadership - Communication - Barriers in communication- Group Dynamics.   **(9)**

TOTAL : 45

TEXT BOOKS

1. *Dr.M.R.Sharma, "Fundamentals of construction planning and management", Kataria and Sons, New Delhi, 2015.*

2. *Seetharaman S., "Construction Engineering and Management", Umesh publications, New Delhi, 1997*

3. *Chris Hendrickson, "Project Management for Construction", Prentice Hall, 2000.*

REFERENCE BOOKS

1. *Kumar Neeraj Jha, "Construction Project Management", Pearsons Education India, 2011.*

2. *Memoria, C.B., and S.V.Kankar, "Personnel Management", Himalaya publishing co, 1997.*

3. *Harpal Singh, "Construction Management and Accounts", Tata McGraw Hill, New Delhi, 1981.*

4. *P.K. Joy, "Handbook of Construction Management", Macmillan Publishers India ltd, 2005.*

15CE72 - ENGINEERING ECONOMICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

Upon successful completion of this course, student will be able to

CO1 : *Recognize the fundamental economic concepts applicable to engineering.*

CO2 : *Find the techniques of incorporating inflation factor in economic decision making.*

CO3 : *Apply the basics of economics and cost analysis to engineering.*

CO4 : *Identify economically sound decisions.*

INTRODUCTION TO ECONOMICS

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics - Engineering efficiency, Economic efficiency, Scope of engineering economics - Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis - V ratio, Elementary economic Analysis - Material selection for product Design selection for a product, Process planning. **(9)**

VALUE ENGINEERING

Make or buy decision, Value engineering - Function, aims, Value engineering procedure. Interest formulae and their applications -Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor - Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods. **(9)**

CASH FLOW

Methods of comparison of alternatives - present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods. **(9)**

REPLACEMENT AND MAINTENANCE ANALYSIS

Replacement and Maintenance analysis - Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset - capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely. **(9)**

DEPRECIATION

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions - procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset. **(9)**

TOTAL : 45

TEXT BOOKS

1. *PanneerSelvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.*

2. *Khanka S.S., "Entrepreneurial Development", S.Chand & Co. Ltd, New Delhi, 1999.*

3. *Hisrich R. D. and Peters M. P., "Entrepreneurship", 5th Edition, Tata McGraw-Hill, 2002.*

4. *Naidu N.V.R., "Management of Entrepreneurship", I.K. International Pvt Ltd., New Delhi.*

REFERENCES BOOKS

1. *Chan S. Park, "Contemporary Engineering Economics", Prentice Hall of India, 2011.*

2. *Donald G. Newman, Jerome P. Lavelle, "Engineering Economics and Analysis," Engg. Press, Texas, 2010.*

3. *Degarmo E.P., Sullivan W.G and Canada J.R., "Engineering Economy", Macmillan, New York, 2011.*

4. *Zahid A khan, "Engineering Economy", Dorling Kindersley, 2012.*

5. *Rabindra N. Kanungo, "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.*

15CE73 - EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : *Explain the concepts of structural dynamics*

CO2 : *Explain the elements of engineering seismology and behaviour of structures in past earthquakes*

CO3 : *Analyze structures by static and dynamic methods to determine seismic parameters as per Indian Standards*

CO4 : *Design the beams, columns, joints, connections and shear walls for earthquake forces as per Indian Standards*

CO5 : *Illustrate ductile detailing of structural elements as per Indian Standards*

CO6 : *Design the masonry structures as per Indian standards and concept of base isolation*

STRUCTURAL DYNAMICS

Introduction -Basic Concepts of vibration - Static and dynamic equilibrium- Equation of motion- D'Alemberts Principle- Single degree of freedom system - Free vibration - forced vibration - Damping -Measurement of damping by logarithmic decrement method-Simple problems on SDOF System- Introduction to multi-degree of freedom system. **(9)**

ENGINEERING SEISMOLOGY

Elements of Engineering seismology - Definitions - Reid's Elastic rebound theory- Plate tectonics - Seismic waves - Earthquake History - Behavior of Structures in past earthquakes- Seismograph and Accelerograph - Seismic Zoning map of India. **(9)**

SEISMIC ANALYSIS

Calculation of base shear as per IS 1893-2002 - Static and Dynamic method -Equivalent Static Lateral force method and Response spectrum method- Seismic Design concepts. **(9)**

EARTHQUAKE RESISTANT DESIGN

Design of Beams, Columns, Joints and Connections- Shear wall - Types of Shear wall - Design of Rectangular Shear wall with boundary elements as per IS 13920 -2016. **(9)**

IS CODE PROVISIONS

Ductility - Assessment of Ductility - Member / Element Ductility - Structural Ductility - Factors affecting Ductility- Ductile detailing of beams, column, joint and footings and special confining reinforcements - as per IS 13920 - 2016. Behaviour and Design of Masonry Structures as per IS 13827 and IS13828. Modern Concepts- Base Isolation **(9)**

TOTAL : 45

TEXT BOOKS

1. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of structures," PHI Learning Pvt. Ltd., New Delhi, 2009

2. Duggal.S.K., "Earthquake Resistant of Structures", Oxford University Press, New Delhi,2007.

REFERENCE BOOKS

1. Anil K.Chopra, "Dynamics of Structures - Theory and Applications to Earthquake Engineering", Prentice Hall of India Pvt. Ltd., New Delhi, 2003.

2. Pauley and Priestly, "Seismic Design of Reinforced Concrete and Masonry Buildings", John Wiley & Sons, 1992.

3. IS 1893 -2002, Indian Standard Code of Practice for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi.

4. IS 13920 - 2016, Indian Standard Code of Practice for Ductile Detailing of RC Structures, Bureau of Indian Standards, New Delhi.

15CE74 - PRESTRESSED CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : *Explain the concepts of Prestress and determine the losses in prestressed concrete members due to shrinkage, creep, relaxation and friction*

CO2 : *Design of prestressed concrete beams or flexure and shear using Limit State method of Design and Check for deflection*

CO3 : *Design of end blocks, tension and compression members*

CO4 : *Design of composite prestressed concrete beams and shear connectors.*

CO5 : *Analyze the continuous prestressed concrete beams*

CO6 : *Discuss the concept of partial and circular prestressing*

CONCEPTS OF PRESTRESSING AND LOSSES

Basic concepts, Advantage, Principles of prestressing, Material required - Methods and systems of prestressing - Classification of prestressed concrete structures - Materials - High strength concrete and High strength steel, Losses in prestress,Losses in pretensioned and post tensioned beams. Loss due to elastic shortening, creep, shrinkage, relaxation, friction - Approximate percentage of various losses in pretensioned and post tensioned beams. **(9)**

DESIGN OF BEAMS

Theory and behaviour of prestressed concrete beams in bending - Design of prismatic prestressed concrete members for bending for working loads by Magnel's graphical method - Check for ultimate load stage (Limit State Design), calculation of deflections, Design of beams for shear in working and ultimate loads **(9)**

END BLOCK DESIGN, TENSION AND COMPRESSION MEMBERS

Design of Anchorage Zone by Guyon's method (simple problems) - Concept of Magnel's method, IS 1343 recommendations. Design of tension and compression members - Columns subjected to bending moment and axial compression. **(9)**

COMPOSITE BEAMS

Composite prestressed concrete beams - Design procedure - Calculation of stresses at important stages both for propped and unpropped constructions - Design of shear connectors - Differential Shrinkage stresses. **(9)**

STATICALLY INDETERMINATE STRUCTURES

Statically indeterminate structures - continuous beams - Concept of concordant cable and linear transformations - Sketching of pressure lines (simple problems). Partial and circular prestressing (Principles only), prestressed concrete water tank - concept (no problem). **(9)**

TOTAL : 45

TEXT BOOKS

1. *Sinha N.C. and Roy S.K.,"Fundamentals of Prestressed Concrete", S.Chand and Co., 1987.*

2. *Krishna Raju, N. "Prestressed Concrete", Tata McGraw Hill, New Delhi, 2012.*

3. *IS 1343:1980 - Code of Practice for Prestressed Concrete, Bureaus of Indian Standards, New Delhi.*

REFERENCE BOOKS

1. Lin T.Y. & Burns N., "Design of Prestressed Concrete Structures". John Wiley & Sons, 1992.

2. Dayaratham N, "Prestressed Concrete Structures". Oxford & IBH Company, New Delhi, 2004.

3. Kachaturian N. and Gurfinkel,G, "Prestressed Concrete", McGraw Hill Book Co., Newyork, 1975.

4. Antoine E. Naaman, "Prestressed Concrete Analysis and Design - Fundamentals", McGraw Hill Book Co., Newyork, 1982.

5. Rajagopalan, "Prestressed Concrete", Narosa Publishers, New Delhi, 2013.

6. Edward G Nawy, "Prestressed Concrete", A Fundamental Approach, 3rd Edition, Prentice Hall, Upper Saddle river, NewJersy, 2000

7. Mallik S. K. and Gupta A. P., "Prestressed Concrete", Oxford & IBH Publishing Co., Pvt. Ltd., India, 2nd Edition, 1986.

15CE75 - COMPUTER APPLICATIONS LABORATORY

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOME

At the end of this laboratory, the student will be able to

CO1 : Modeling, Analysis and Design of frames and trusses using STAAD Pro

CO2 : Modeling, Analysis and Design of Bridge decks for moving loads using STAAD Pro

CO3 : Modeling, Analysis and Design of circular and rectangular water tanks using STAAD Pro

CO4 : Design of slab, beams, columns & Footings using EXCEL

ANALYSIS AND DESIGN PACKAGES

Introduction to STAAD Pro - Need for computer analysis - Analysis of basic structural elements like simply supported beams, cantilever beams, propped cantilever beams, continuous beams, sinking of supports and fixed beams. Analysis and design of 2D and 3D frames.

Analysis and design of 2D and 3D trusses - Analysis and design of space frame subjected to wind load and seismic load - Analysis, design and modelling of 2D frames and bridge deck with moving load-Analysis and design of rectangular and circular-ground level, underground and elevated water tank with and without bracings.

Design of structural elements like slab, beams, columns and footings Using Excel.

REFERENCE BOOKS

1.   *STAAD Pro - Manual, volume 1 and 2, Bentley Systems India private limited, New Delhi.*

2.   *Dr.P.Vinayagam, "Analysis and Design of Structures using STAAD Pro", Vaghai Publishers, Coimbatore, 2011.*

15CE76 - CONCRETE LABORATORY

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : Assess the properties on fresh and hardened concrete.

CO2 : Compute the mix design for the required grade of concrete as per Indian Standard codes of practice.

CO3 : Evaluate the properties of materials under various loading conditions such as tension, compression and bending.

CO4 : Assess the properties of hardened concrete by performing NDT tests

LIST OF EXPERIMENTS

Study of Equipment & Mix Design

1. Study of Concrete Mixer, Needle Vibrator, Table vibrator, Moulds, Proving ring, Jacks & Dial gauges

2. Concrete Mix Design as per IS : 10262 - 2009

Tests on Cement

3. Normal Consistency and Setting Time of Cement

4. Compressive Strength Test for cement

5. Soundness Test on cement

Tests on Fresh Concrete

6. Slump Test

7. Compacting Factor Test

8. Vee - Bee Consistometer test

9. Kelly Ball Test

10. Flow Test on Mortar

Tests on Hardened Concrete

11. Compressive Strength of Concrete on Cube and Cylinder

12. Modulus of Rupture of concrete

13. Split Tensile Strength of Concrete on Cylinder

Non - Destructive Testing

14. Ultrasonic Pulse Velocity Method

15. Rebound Hammer Method

16. Windsor Pin System

17. Demo of Core Cutting Machine

TEXT BOOK

1.   Shetty M.S., "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2005.

REFERENCE BOOKS

1.   Neville.A.M., "Properties of Concrete", ELBS, 2011.

2.   Santhakumar A.R., "Concrete Technology" Oxford University Press, New Delhi, 2012

3.   Krishnasamy K.T., "Concrete Technology", Dhanpat Rai, New Delhi, 2012.

4.   Gambhir M.L., "Concrete Technology", Tata McGraw Hill Publishing Company Limited, New Delhi, 2009.

5.   IS 456- 2000, Indian Standard Code of Practice for Plain and Reinforced Concrete, BIS, New Delhi.

15CE81 - PROJECT WORK & VIVA VOCE

L	T	P	C
0	0	10	5

ASSESSMENT : PRACTICAL

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : Apply design techniques in the project and experience their outcome in their own project scenario.

CO2 : Develop the management skills to achieve the project goal by working as a team.

CO3 : Develop the technical writing skills to achieve the project goal.

CO4 : Demonstrate the technical skills acquired to provide feasible solutions for real life problems.

CO5 : Communicate and collaboratively work in peer groups to develop optimized solutions for problems in Civil Engineering Field.

15CEE01 - ADVANCED SURVEYING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1   : Determine the distance, angles, area by tacheometry and Geodetic Survey

CO2   : Identify the errors in measurements and determine most probable values of given quantities

CO3   : Determine true meridian, latitude, longitude and time corrections using astronomical survey

CO4   : Interpret the aerial photographs to find ground co-ordinates

CO5   : Prepare topographical area map of given larger field using Electronic total station and scanner

CO6   : Create map through interpretation techniques using Remote Sensing, GPS and GIS

TACHOMETRIC SURVEYING AND THEORY OF ERRORS

Introduction, purpose, principle, instruments, stadia constants, methods of tacheometry, anallatic lens, reduction of readings-Problems.

Introduction, types of errors, definitions, laws of accidental errors, laws of weights, theory of least squares, rules for giving weights and distribution of errors to the field observations, determination of the most probable values of quantities - Problems.

(9)

FIELD ASTRONOMY

Introduction, purposes, astronomical terms, determination of azimuth, latitude, longitude and time corrections to the observations.-Problems. **(9)**

AERIAL PHOTOGRAMMETRY AND MODERN SURVEYING INSTRUMENTS

Introduction, Principle, Uses, Aerial camera, Aerial photographs, Definitions, Scale of vertical and tilted photograph, Ground Co-ordinates, Displacements and errors, Ground control, Procedure of aerial survey, Photomaps and mosaics, Stereoscopes, Parallax bar

Electromagnetic spectrum, Digital self-leveling levels, scanners for topographical survey. **(9)**

CONSTRUCTION SURVEYING

Marking a control station(Establishing a point) - Marking Building Corner-Marking a line-Marking grades-Slopes Stakes- Setting out of works for large structures-Vertical controls-Setting out a Building

Setting out of grades of Sewer, Pipelines, Roads and Railways-Setting out slopes in embankments and cutting- Setting out of culverts and bridges-Use of laser beams in Setting works- Setting out of tunnels **(9)**

HYDROGRAPHIC SURVEYING

Horizontal and vertical control- Shoreline Survey-Tides and Mean sea level- Tide gauges- Sounding- Eqipment for sounding-Sounding Party- Making Sounding- Locating Sounding- Plotting of Sounding. **(9)**

TOTAL : 45

TEXT BOOKS

1.   *Agor R., "Advanced Surveying", Khanna Publishers, New Delhi, 2002.*

REFERENCE BOOKS

1.   *Dr. B.C. Punmia, "Surveying, Vol. I, II and III", Laxmi Publishers, New Delhi*

2.   *Kanetkar T.P. and Kulkarni S.V., "Surveying and Levelling, Vol. I and II", Vidhyarthi Gruh, Pune*

3.   *Dr. K.R. Arora, "Surveying, Vol. I, II and III", Standard Book House, New Delhi*

4. Duggal S. K., "Surveying, Vol. I and II", Tata Mcgraw Hill, New Delhi

5. Basak N.N., "Surveying and Levelling", Tata Mcgraw Hill, New Delhi

6. Agor R., "Surveying and Levelling", Khanna Publishers, New Delhi

7. Roy S.K., "Fundamentals of Surveying", Prentice Hall of India, New Delhi

8. Subramanian, R., "Surveying and Leveling", Oxford University Press, New Delhi

9. Bhatia B., "Remote Sensing and GIS", Oxford University Press, New Delhi.

10. Lillesand T.M., Kiefer R.W., and Chipman J.W., "Remote sensing and Image interpretation", 5th edition, John Wiley and Sons, India

11. James M Anderson and Adward M Mikhail, "Surveying : theory and practice", 7th Edition, Tata McGraw Hill Publication.

15CEE02 - ADVANCED CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Design the arches and domes based on limit state method*

CO2 : *Design the grid slab as per code requirements*

CO3 : *Design the chimney as per IS code*

CO4 : *Design the under-ground water tanks by limit state method*

CO5 : *Design the raft and pile foundations*

DESIGN OF COLUMN SUBJECTED TO BIAXIAL BENDING

Design of long column subjected to biaxial bending moment and axial load SP 16. Behavior of deep beams - Designs as per IS 456 - 2000. **(9)**

CHECK FOR SERVICIBILITY

Limit State of Serviceability - calculation of deflection and cracking - Check for deflection and cracking as per IS 456 - 2000.
(9)

DESIGN OF FLAT SLAB AND GRID FLOOR

Grid and coffered floors, general features, rigorous and approximate method of analysis and design of grid floor - Design of flat slab, column and middle strip, proportioning of flat slab element as per IS 456-2000 **(9)**

LIMIT ANALYSIS

Limit Analysis of RCC structures - Fundamental principles, concept of moment redistribution - moment rotation characteristics - permissible rotation capacity - Cambridge method - A.L.L. Baker's method of Limit analysis. **(9)**

TALL STRUCTURES

Analysis of R.C. Chimneys by Elastic theory - Design by LSD. Design of square bunker using Rankine's theory. Design of circular Silo using Jansen's theory and Airy's theory(Derivation not required for both theories). **(9)**

TOTAL : 45

TEXT BOOKS

1. *Ashok K.Jain., "Reinforced concrete - Limit State Design", Nem Chand Brothers, Roorkee, 2006.*

2. *Krishnaraju N., "Advanced Reinforced Concrete Design", C.B.S Publishers and Distributors, New Delhi, 2013.*

REFERENCE BOOKS

1. *Jain and Jai Krishna., "'Plain and Reinforced Concrete", Nem Chand Brothers, Roorkee, 2007.*

2. *Mallick and Gupta., "Reinforced Concrete Design", Oxford and IBH, Publishers, Delhi, 1996.*

3. *IS456 - 2000, Code of "Practice for Plain and Reinforced Concrete" Bureau of Indian Standards, New Delhi.*

15CEE03 - ADVANCED STEEL STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Ascertain the element to find the load carrying capacity for stiffened and unstiffened member for a given section.*

CO2 : *Examine the necessary connections for structural steel members*

CO3 : *Determine the forces accompanied with Transmission line and Micro Wave towers.*

CO4 : *Design and develop structural members associated with industrial buildings.*

CO5 : *Diagnose the forces acting on bunkers and silos in their structural design.*

LIGHT GAUGE STEEL MEMBERS

Light gauge sections - types of sections, material - local buckling of thin elements - stiffened and multiple stiffened compression members - Unstiffened elements - Laterally supported and unsupported flexural members - connections.   **(9)**

CONNECTIONS

Connections - flexible, semi-rigid and rigid or moment resisting connections. Multistoreyed framed structures - Analysis for Vertical and lateral loads for frames with moment resistant connections only - Design for composite construction.   **(9)**

STEEL TOWERS

Transmission line towers - Micro Wave Towers - Loads on Towers - Shape, Sag and Tension in Uniformly loaded conductors - Analysis of towers - Design of member in towers - Design of tower foundations   **(9)**

INDUSTRIAL BUILDINGS

Requirements of Industrial Structures - Design of Gantry Girder. Industrial Building frames - General, framing, bracing, Crane Girders and columns - Welded Plate Girder - Elements of Plate Girder - Deign - Curtailment of Flange - Stiffeners and Splices - Analysis and Design of Single Bay Gable Frame with Knee Bent.   **(9)**

BUNKERS AND SILOS

Pressure on side walls of bunkers and silos - Jansen's and Airy's theories - complete design of circular silos   **(9)**

TOTAL : 45

TEXT BOOKS

1. *Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.*

2. *Duggal.S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publication, 2011.*

3. *Jayagopal.L.S & Tensing.D. "Design of Steel Structures", Vikas Publications House Ltd, Noida.*

REFERENCE BOOKS

1. *Bhavikatti.S.S, "Design of Steel Structures by Limit State Design", I.K International Pvt. Ltd., New Delhi 2011.*

2. *Ramachandra, Virendra Gehlot, "Limit State Design of Steel Structures", Scientific Publishers. Jodhpur, 2010.*

3. *Shiyekar.M.R. "Limit State Design in Structural Steel", PHI learning Pvt. Ltd., Delhi, 2013.*

4. *IS 800 - 2007, "Code of Practice for use of Structural Steel in General Building Construction, Bureau of Indian Standards, New Delhi.*

5. *SP6 : Part 1 : 1964, Handbook for Structural Engineers - Structural Steel Sections*

6. Ramchandra, "Design of Steel Structures" - Vol. I and II, Standard Publishers Distributers, New Delhi, 2002.

7. Bresler and Lin, "Design of Steel Structures", Wiley Eastern Pvt. Ltd., New Delhi. 1980.

8. Vazirani, V.N. and Ratwani, N.M., Honey Mehra "Design and Analysis of Steel Structures", Khanna Publishers, New Delhi, 2000.

9. IS 801: 1975, "Code of Practice for use of cold formed light gauge steel structural members in general construction," Bureau of Indian Standards, New Delhi.

10. IS 802: Part 1 Section - 1, "Code for Practice for use of Structural Steel in Overhead Transmission line Towers, Materials and Loads and Permissible Stresses," Bureau of Indian Standards, New Delhi, 1995.

11. IS 6533-2 (1989), "Code of Practice for Design and Construction of Steel Chimney," Bureau of Indian Standards, New Delhi, 1989.

15CEE04 - STRUCTURAL DESIGN AND DRAWING

L	T	P	C
2	2	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : Draw details of connections, splices, columns, column bases and plate girders as per IS code requirements

CO2 : Describe and write the design procedures for concrete and steel elements and structures

CO3 : Draw the different concrete and steel elements and structural components to appropriate scale as per appropriate code and design requirements

CO4 : Draw details of slabs, beams, columns, footings, joints, water tanks and retaining walls as per IS code requirements

STEEL

Detailed design and drawing of the following structure

1. Bolt Connections - framed, stiffened seat & unstiffened seat connections

2. Welded Connections - framed, stiffened seat & unstiffened seat connections

3. Tension and column splices

4. Battened and Laced Columns

5. Column bases

6. Welded plate girders

CONCRETE

Detailed design and drawing of the following structure

1. One way floor slab and two way floor slab.

2. Continuous beams.

3. Column with footing

4. Joints (Beam to Column and Column to Footing)

5. Dog legged staircase

6. Water tanks.

7. Retaining walls.

TOTAL : 60

TEXT BOOKS

1. *Krishnamurthy,D., "Structural Design and Drawing", CBS Publishers and Distributors, Delhi, 2010.*

2. *Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.*

3. *Duggal.S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publication, 2011.*

4. *Jayagopal.L.S & Tensing. "Design of Steel Structures", Vikas Publications House Ltd, Noida.*

5. *Krishnaraju, N., "Structural Design and Drawing", Oxford University Press, 2014.*

REFERENCE BOOKS

1. *Bhavikatti.S.S, "Design of Steel Structures by Limit State Design", I.K International Pvt. Ltd., New Delhi 2011.*

2. *Ramachandra, Virendra Gehlot, "Limit State Design of Steel Structures", Scientific Publishers. Jodhpur, 2010.*

3. *Shiyekar.M.R., "Limit State Design in Structural Steel", PHI learning Pvt. Ltd., Delhi, 2013.*

4. IS 800 - 2007, "Code of Practice for use of Structural Steel in General Building Construction", Bureau of Indian Standards, New Delhi.

5. SP6 : Part 1 : 1964, Handbook for Structural Engineers - Structural Steel Sections

6. Ramchandra, "Design of Steel Structures" - Vol. I and II, Standard Publishers Distributers, New Delhi, 2002.

7. Bresler and Lin,"Design of Steel Structures", Wiley Eastern Pvt. Ltd., New Delhi. 1980.

8. Vazirani, V.N. and Ratwani,N.M., Honey Mehra "Design and Analysis of Steel Structures", Khanna Publishers, New Delhi, 2000.

9. IS 801:1975, "Code of Practice for use of cold formed light gauge steel structural members in general construction," Bureaus of Indian Standards, New Delhi.

10. IS 802 : Part 1 Section - 1,"Code for Practice for use of Structural Steel in Overhead Transmission line Towers, Materials and Loads and Permissible Stresses", Bureau of Indian Standards, New Delhi, 1995.

11. IS 6533-2 (1989), "Code of Practice for Design and Construction of Steel Chimney," Bureau of Indian Standards, New Delhi, 1989.

12. S. N. Sinha, "Reinforced Concrete Design", Tata McGraw Hill Edition, 2012

13. M. L. Gambhir, "Design of Reinforced Concrete Structures", PHI Learning Pvt. Ltd., 2011

14. IS 456 - 2000, "Code of practice for Plain and Reinforced Concrete" Bureau of Indian Standards, New Delhi.

15. SP16 - 1980, "Design Aids for Reinforced Concrete" Bureau of Indian Standards, New Delhi.

16. SP34 - 1987, "Handbook on Concrete Reinforcement and Detailing", Bureau of Indian Standards, New Delhi.

15CEE05 - HEALTH MONITORING OF STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : Evaluate the strength of existing structures by Non destructive testing methods and distresses in structures

CO2 : Express the facets, importance of maintenance and various aspects of inspection

CO3 : Diagnose various distresses in structures and its effects due to climate, temperature, chemicals and corrosion

CO4 : Distinguish the types of cracks in structures by its occurrence

CO5 : Choose suitable materials for repair in damaged structures

CO6 : Identify repair techniques for rehabilitation of structures

SERVICEABILITY AND DURABILITY OF CONCRETE

Quality assurance for concrete construction - concrete preparation - strength, permeability, thermal properties - effects due to climate, temperature, chemicals, corrosion - strength evaluation of existing structures by NDT (Rebound, UPV, Flaw detector).
(9)

MAINTENANCE AND REPAIR STRATEGIES

Maintenance, Repair and Rehabilitation, facets of maintenance, importance of maintenance - various aspects of inspection, Assessment procedure for evaluating a damaged structures, causes of deterioration. **(9)**

CRACKS

Cracks in concrete - intrinsic cracking and structural cracking - causes and remedies - plastic cracks and remedies - Thermal contraction cracks - Long term drying shrinkage cracks - Sulphate attack cracks - Alkali aggregate reaction cracks. **(9)**

MATERIALS FOR REPAIR

Material for Repair: Concrete chemicals, special elements for accelerated strength gain - Expansive cement - Polymer concrete - Sulphur infiltrated concrete - Ferro cement - Fibre reinforced concrete. **(9)**

REPAIR TECHNIQUES

Repair techniques : Rust eliminators and polymer coating for steel bars during repairs - formed concrete, mortar and dry pack - Vacuum concrete - Gunite, shotcrete and Grouting - Epoxy injection - Mortar repair for cracks - shoring and under pinning.

Demolition Techniques : Engineered demolition techniques for dilapidated structures - Case studies. **(9)**

TOTAL : 45

TEXT BOOK

1. *DensionCampell, Allen and Harold Roper., "Concrete Structures", Materials, Maintenance and Repair", Longman Scientific and Technical, U.K. 1987.*

REFERENCE BOOKS

1. *Allen R.T., and Sc Edwards., "Repair of Concrete Structures", Blakie and sons", U.K. 1987.*

2. *Neville A.M., "Properties of Concrete", The English Language Book Society and Pitman publishing, London, 2000.*

3. *Guha P.K.,"Maintenance and Repairs of Building", New Central Book Agency (P) Ltd., Calcutta, 1998.*

15CEE06 - EARTHQUAKE RESISTANT DESIGN OF TIMBER AND MASONRY STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : *Recognize the basic concepts of structural design of timber and masonry structures*

CO2 : *Design the brick masonry structures as per Indian standards*

CO3 : *Design the timber structures as per Indian standards*

CO4 : *Seismic Resistant Design the brick masonry and timber structures as per Indian standards*

FUNDAMENTALS OF STRUCTURAL DESIGN

Classification of structures-function, material and shape- different structural systems- requirements of structures- stability, strength and stiffness-design methods-working stress method- limit state method of design- Different types of load- Codes of practice. Engineering Seismology-Terms associated with earthquakes-Characteristics of ground motion- Seismic zones of India.   **(9)**

DESIGN OF BRICK MASONRY STRUCTURES

Classification of brick masonry structures- Design considerations of brick masonry-Permissible stresses- Load bearing walls- Design of load bearing walls and columns- Pressure calculation of masonry walls.   **(9)**

EARTHQUAKE RESISTANT DESIGN OF BRICK MASONRY STRUCTURES

General planning and design- recommendations for masonry wall-behaviour of unreinforced and reinforced masonry wall under gravitational and lateral loading-limit state design of reinforced brick masonry- lintel band- Free standing walls- Behaviour of masonry structures during past earthquakes- Codal provisions.   **(9)**

DESIGN OF TIMBER STRUCTURES

Properties and strength of timber used in constructions- Permissible Stresses- Grading of timber. Joints in timber structures- Design of bolted and nailed joints. Timber beams (rectangular) - Solid columns- Combined bending and direct stress.   **(9)**

EARTHQUAKE RESISTANT DESIGN OF TIMBER STRUCTURES

Review of structural timber element design-Introduction to design of shear walls and flexible diaphragm walls- seismic design considerations- Connections to resist the lateral forces- Behaviour of timber structures during past earthquakes- Codal provisions.   **(9)**

TOTAL : 45

TEXT BOOKS

1. *Anand S. Arya, "Masonry and Timber Structures including Earthquake Resistant Design", Nemchand & Bros., Roorkee, 2006.*

2. *Dayarathnam, P., "Brick and Reinforced Brick Structures", Oxford & IBH Publishing House, 1997.*

REFERENCE BOOKS

1. *Unnikrishna Pillai, S. and Devadass Menon, "Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd., 2007.*

2. *Duggal, S.K., "Earthquake Resistant Design of Structures", Oxford University Press, 2007.*

15CEE07 - PREFABRICATED STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : *Get an outline of industrial structures of Engineering, Textile, Chemical industries*

CO2 : *Practice the functional requirements of pre fabricated industrial structures*

CO3 : *Evaluate the principle of prefabrication towards economy, standardization, structural behavior and handling*

CO4 : *Employ Standard practices and techniques involved in precast concrete manufacture and handling*

CO5 : *Explain joints and connections involved in precast concrete structures*

BASIC REQUIREMENTS

Specific requirements for industries like Engineering, Textile, Chemical-site layout and external facilities- classification of industries minimum standards, internal circulation-materials-works. **(9)**

FUNCTIONAL REQUIREMENTS

Selection of site, Lighting - Natural and Artificial-Protection from the sun and sky, Services, layout, wiring fixtures, cable and pipe bridges-electrical installations-lighting substations-Effluent, Ventilation and fire protection, air conditioning and air ventilation, Fire escapes and chutes, fire alarms, Extinguishers and hydrants. **(9)**

GENERAL PRINCIPLES OF PREFABRICATION

Types of prefabrication - Advantages of prefabrication - Site and plant prefabrication - Economy of prefabrication - Modular coordination - Standardisation - Disuniting of structures - Structural behaviour of pre cast structures- Handling and erection stresses -Various prefabricated elements- roof and floor panels-wall panels. **(9)**

PRECAST CONCRETE - MANUFACTURING TECHNIQUES

Cycle of precasting - Preparation and transportation of concrete, Reinforcement - Preparation of moulds-Production tolerances -Transportation & erection- Erection of R.C. Structures-Equipments for handling the precast elements - Standard practices and techniques of handling. **(9)**

JOINTS AND CONNECTIONS

Types of precast connections - Joints for different structural connections -Dimensioning and detailing of joints for different structural connections- Expansion joints in precast construction. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Haas A.M, "Precast Concrete- Design and Applications", Applied Science Publishers, London and NewYork, 1995.*

2. *Promyslov, V., "Design and Erection of Reinforced concrete structures", MIR Publishers, Moscow, 1998.*

REFERENCE BOOKS

1. *Levit M., "Precast concrete materials, Manufacture properties and usage", Applied Science Publishers, London, 2000.*

2. *Glover C.W, "Structural Precast Concrete", Asia Publishing House, Bombay. 1967.*

3. *Dunham, "Planning of industrial Structures", Metropolitan Book Company, 1980.*

4. *SP32-1986, HandBook on Functional Requirements of Industrial Buildings (Lighting and Ventilation) Bureau of Indian Standards, New Delhi, 1990.*

5. *Structural Design Manual, Precast concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland, 2009.*

6. *Koncz T., "Manual of Precast Concrete Construction", Vol. I, II and III, Bauverlag, GMBH, 1976.*

15CEE08 - DESIGN OF BRIDGES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : Analyze various types of bridges and bridge components

CO2 : Design of tee beam and deck slab bridges by Courbon's theory and Pigeaud's curves

CO3 : Design of components in Prestressed concrete bridges

CO4 : Design of stringers, cross girders and main girders of through type and deck type steel highway bridges by IRC guidelines

CO5 : Design of Steel and RC bearings of bridges

REINFORCED CONCRETE DECK SLAB BRIDGES

Introduction - Classification of Bridges - Types of IRC loadings - Design of solid deck slab bridges for IRC loading -Concept of design of skew slab bridges **(9)**

REINFORCED CONCRETE TEE BEAM AND DECK SLAB BRIDGES

Design of tee beam and deck slab bridges- Courbon's theory - Pigeaud's curves -Concept of balanced cantilever and continuous bridges. **(9)**

PRESTRESSED CONCRETE BRIDGES

Design of prestressed concrete bridges - Design of girder section - Maximum and minimum prestressing forces - Eccentricity - Check for stresses at various sections -Design of End block **(9)**

STEEL BRIDGES

Design of through type and deck type steel highway bridges for IRC loading - Design of stringers, cross girders and main girders **(9)**

BRIDGE BEARINGS

Types of bearings - Design of steel roller and rocker bearings - Design of RC rocker bearing - Design of elastomeric pad bearing **(9)**

TOTAL : 45

TEXT BOOKS

1. Johnson Victor D., "Essentials of Bridge Engineering", Oxford and IBH Publishing Co., New Delhi, 2007.
2. Ponnuswamy S., "Bridge Engineering", Tata McGraw-Hill, New Delhi, 2008.

REFERENCE BOOKS

1. Phatak D.R., "Bridge Engineering", SatyaPrakashan, New Delhi, 1994.
2. Krishna Raju, N., "Design of Bridges", Oxford & IBH Publishing Co., Pvt., Ltd., New Delhi, 2015.

15CEE09 - THEORY OF PLATES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : Explain theory of plates and its behaviour

CO2 : Application of theory of plates for circular plates with different loading and end conditions

CO3 : Formulate equations for solution of structural response for plate bending problems using different approximate methods

CO4 : Analysis of plates using Finite element and finite difference Method

CO5 : Demonstrate different shapes of plates and its applications

SMALL DEFLECTION THEORY AND CLASSICAL METHODS

Thin and thick plates - Plate behaviour - Material behaviour - Isotropic and orthotropic Materials - Differential equation of plates in Cartesian co-ordinate system - boundary conditions - Rigorous solution - Navier's Method - Levy's Method. **(9)**

SYMMETRICAL BENDING OF CIRCULAR PLATES

Differential equation for symmetrical bending of laterally loaded circular plates - Simply supported edges - Clamped edges - Circular plate with a circular hole at the centre - Circular plate carrying the concentrically load **(9)**

APPROXIMATE METHODS

Energy methods - Galerkin's Method - Ritz Method, Method of Images - Plate strip - Influence surfaces - Membrane and Various Analogies - Simultaneous Bending and Stretching. **(9)**

NUMERICAL METHODS

Finite difference method - Matrix displacement analysis of Grids - Finite Element Method. **(9)**

ADVANCED TOPICS

Triangular plates - Elliptic plates - Sector plates - Skew plates - Plates on elastic foundation - Large Deflection theory - Thermal stresses - Multilayered plates. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Rudolph Szilard, "Theory and Analysis of Plates - Classical and Numerical Methods", Prentice Hall, 2010.*
2. *Timoshenko.S and Krieger.S.W, "Theory of Plates and Shells", Mc-Graw Hill Book Company, New York, 1990.*

REFERENCE BOOKS

1. *Donnel L.H, "Beams, Plates and Shells", McGraw Hill Inc., US, 1976.*
2. *Chandrashekhara K., "Theory of plates", University Press(India) limited, Hyderabad, 2001*
3. *Bairagi N.K., "A Text Book of Plate Analysis", Khanna Publishers, New Delhi, 2009*

15CEE10 - FINITE ELEMENT METHOD

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Identify and define the basic concepts, shape functions and methods of discretization in finite element method*

CO2 : *Ascertain the principles and methods utilized for solving finite element problems*

CO3 : *Calculate and ascertain the combinations of plane stress and strain problems involving finite element analysis*

CO4 : *Derive and assemble the stiffness matrix to evaluate the output element stresses and forces for trusses.*

CO5 : *Derive and assemble the stiffness matrix to evaluate the output element stresses and forces for beams and frames*

BASICS OF FINITE ELEMENT METHOD

General description - Basic element shapes - Discretization process - Node numbering - Mesh generation - Steps involved in finite element method - Application of finite element method - Advantages and disadvantages of finite element method. **(9)**

APPROXIMATE METHODS OF ANALYSIS

Energy principles - Variational methods - Rayleigh Ritz method - Method of collocation - Subdomain method - Galerkin Method - Least squares approach. **(9)**

PLANE STRESS AND PLANE STRAIN PROBLEMS

Basic concepts of plane stress and plane strain - derivation of stiffness matrix for constant - strain, linear strain triangular elements - rectangular elements - Iso-parametric elements - Lagrange and Serendipity elements - static condensation - axisymmetric elements. **(9)**

ANALYSIS OF TRUSSES

Stiffness matrix for an axial element - Direct stiffness approach - Element assembly into global stiffness matrix -two dimensional trusses - displacement of joints - forces in the members. **(9)**

ANALYSIS OF BEAMS AND FRAMES

Beam stiffness - Direct stiffness approach - Element assembly into global stiffness matrix -solution for beam problems - Two Dimensional beam element - rigid plane frames. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Reddy J N, "An Introduction to Finite Element Method", McGraw Hill, Singapore, 2006.*
2. *Daryl L.Logan, "Finite Element Method", Thomson Canada Ltd., India Edition, 2007.*

REFERENCE BOOKS

1. *Singiresu S. Rao, "The Finite Element Method in Engineering", Butterworth-Heinemann, India Edition, 2001.*
2. *Krishnamoorthy C.S, "Finite Element Analysis", Tata McGraw Hill Publishing Co., New Delhi, 2008.*
3. *Rajasekaran S, "Finite Element Analysis in Engineering Design", S.Chand and Company Ltd., 2003.*
4. *Larry J.Segerlind, "Applied Finite Element Analysis", John Wiley and Sons, New York, 2010.*
5. *Robert D.Cook, David S.Malkus, "Concepts and Applications of Finite Element Analysis", John Wiley and Sons, India Edition, 2007.*

15CEE11 - EXPERIMENTAL STRESS ANALYSIS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Employ the Electrical strain gauges in stress analysis*

CO2 : *Estimate the stresses in structures by force and vibration measurements*

CO3 : *Infer the stresses in structural elements by photo elastic principles*

CO4 : *Estimate the corrosion in concrete structures by half cell construction.*

CO5 : *Determine the stresses in structures by model analysis*

STRAIN GAUGES

Definition of gauge length, sensitivity and range - Characteristics of an ideal strain gauge - Different types of mechanical strain gauges (Huggenberger tensometer, Amslers' Extensometer, Amslers' mirror extensometer, Unwins compressometer) - Mechanical optical strain gauges (Tuckermans' gauge) - Optical strain gauge - Acoustic strain gauge - Pneumatic strain gauge - Merits and demerits. **(9)**

ELECRICAL STRAIN GAUGES

Inductance, capacitance and piezo electric gauges -Electrical resistance gauges and their application in stress analysis - Fixing techniques and measurement of strains - Rosettes - Determination of principal stresses using rosettes - Construction of stress, strain circles - Analytical solution. **(9)**

FORCE AND VIBRATION MEASUREMENTS

Hydraulic jacks and pressure gauges - Load cells - Proving rings - Transducer for velocity and acceleration measurements - Vibration meter - Vibration analyzer - Display and recording of signals - Digital data acquisition systems. **(9)**

PHOTO ELASTICITY

Basics of optics and stress optic law - Plane and circularly polarised light and their use in photo elasticity - Polariscopes - Diffusion type polariscope - Isoclinics and Isochromatics - Calibration methods for finding material fringe values - Model fringe values - Examples of beam flexure and diametrically loaded circular plates. **(9)**

MODEL ANALYSIS AND DISTRESS MEASUREMENT

Direct and indirect models - Laws of structural similitude - Choice of scales - Limitation of model studies - Model materials - Begg's deformeter and its use - Simple design of direct and indirect models - Crack observation and measurement - Corrosion of reinforcement in concrete - Half cell, construction and use. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Srinath L. S, "Experimental Stress Analysis", Tata McGraw Hill Book Company, New Delhi., 2007.*

2. *Roy T. K, "Experimental Analysis of Stress and Strain", S Chand & Co, New Delhi, 2006.*

REFERENCE BOOKS

1. *Dally J.W. and Riley W.F., "Experimental Stress Analysis", McGraw Hill Book Co., 1985.*

2. *Dove and Adams, "Experimental Stress Analysis and Modern Measurement", Prenice Hall of India Ltd., 1986.*

3. *Hetenyi M, "Hand Book of Experimental Stress Analysis", John Wiley and Sons, Inc. Newyork, 1980.*

15CEE12 - OPTIMIZATION IN CIVIL ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : Apply various optimization techniques in real world problems related to civil engineering.

CO2 : Solve the linear programming problems for minimizing project cost and maximizing its profit.

CO3 : Formulate multi-objective problems and analyze the non linear methods of optimization.

CO4 : Solve multi-stage decision problems to get optimal solution.

CO5 : Solve transportation, assignment and simulation problem in an easy way.

LINEAR PROGRAMMING

Formulation of problems - Graphical solution- Standard form - Slack, surplus and artificial variables - Canonical form - Basic feasible solution - Simplex method - Two phase method - Z_i- C_j method - Big M method - Duality Theory - Primal and Dual algorithm. **(9)**

NON - LINEAR PROGRAMMING

One dimensional minimization - search methods - Exhaustive search - Dichotomous search - Fibonacci method - Golden section method - Descent methods - Cauchy's method - Fletcher - Reeves method. Constrained optimization - Penalty Function method. **(9)**

GEOMETRIC PROGRAMMING

Posynomial - degree of difficulty - reducing G.P.P to a set of simultaneous equations - unconstrained and constrained problem with zero difficulty - concept of solving problem with one degree of difficulty. **(9)**

DYNAMIC PROGRAMMING

Bellman's principle of optimality - Representation of a multi stage decision problem - concepts of suboptimazion problems using classical and tabular methods. **(9)**

ALLOCATION MODELS AND SIMULATION IN CONSTRUCTION SYSTEM

Transportation models - Assignment models - Sequencing problems - Simulation approach and models - generation of data - Monte carlo simulation. **(9)**

TOTAL : 45

TEXT BOOKS

1. Rao S.S., "Optimization Theory and Applications", New Age International Publishers, New Delhi, 1999.

2. Vohra N.D., "Quantitative Techniques in Management", Tata Mcgraw Hill Education Private Limited, 2011

REFERENCE BOOKS

1. Stark R.M. and Nichols, "Mathematical Foundation for Design of Civil Engineering Systems", Mc Graw Hill, Newyork, 1995.

2. Ossenbruggen P.J., "Systems Approach to Civil Engineering Planning and Design", John Wiley & Sons, Canada , 1987.

3. Jewell T.K., "Systems Approach to Civil Engineering Planning and Design", Harper & Row, Publishers, New York, 1991.

15CEE13 - SMART MATERIALS AND STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1   : Define the role of actuators and sensors in smart structures.

CO2   : Define the engineering principles underlying the behaviour of smart materials

CO3   : Define the control methods used in smart structures

CO4   : Define the role of actuators and sensors in smart structures.

CO5   : Define the signal processing, control systems and biometrics used in smart structures

SMART MATERIALS

Introduction to Smart Materials and Structures -definitions and implications - Instrumented structures functions and response - Sensing systems - Self-diagnosis - Signal processing consideration - Actuation systems and effectors.   **(9)**

PROPERTIES OF MATERIALS

Materials used in smart systems - Piezoelectric Materials - Piezoelectric properties - Actuation of structural components - Shape Memory Alloys - Constitutive modeling of the shape memory effect - vibration control - Embedded actuators -Applications of shape memory alloys. Electro rheological and magneto rheological fluids - Mechanisms and Properties - Applications of ER and MR fluids - Fiber Optics - Fiber characteristics - Fiber optic strain sensors - Applications of optical fibers.   **(9)**

CONTROL OF STRUCTURES

Control modeling of structures - Control strategies and limitations - classification of control systems Classical control - Modern control - Optimal control and Digital control - Active structures in practice.   **(9)**

SENSORS AND ACTUATORS

Sensing Technology -Characteristics of sensors - Types of Sensors - Physical Measurement using Piezo Electric Strain measurement - Inductively Read Transducers - The LVOT - Fiber optic Techniques.Chemical and Bio-Chemical sensing in structural Assessment - Absorptive chemical sensors Spectroscopes - Fibre Optic Chemical Sensing Systems and Distributed measurement.Actuator Techniques - Actuator and actuator materials - Piezoelectric and Electrostrictive Material -Magnetostructure Material - Shape Memory Alloys - Electro rheological Fluids- Electromagnetic actuation- Role of actuators and Actuator Materials.
(9)

SIGNAL PROCESSING AND CONTROL SYSTEMS AND BIOMIMETICS

Features - Active systems - Adaptive system - Characteristics of control system - Application examples. Characteristics of natural structures, Biomimetic structural design, Biomimetic sensing, Challenges and opportunities for Biomimetics, Chemical and biochemical sensing in structural assessment, Absorptive chemical sensors, Spectroscopes.   **(9)**

TOTAL : 45

TEXT BOOKS

1.   *Brain Culshaw, "Smart Structure and Materials", Artech House, Borton, London, 1996.*

2.   *Srinivasan, A.V., and Michael McFarland. D., "Smart Structures - Analysis and Design", Cambridge University Press, 2001.*

REFERENCE BOOKS

1.   *Brian Culshaw, "Smart Structures and Materials", Artech House, Boston, 1996*

2.   *Gandhi.M.V and Thompson.B.S, "Smart Materials and Structures", Chapman and Hall, NewYork, 1992*

3.   *L.S.Srinath, "Experimental stress Analysis", Tata McGraw-Hill, 1998.*

4.   *Michelle Addington and Daniel L. Schodeck, "Smart Materials and Technology", Elsevier, 2005.*

5.   *Yoseph Bar Cohen, "Smart Structures and Materials," The international society for optical Engineering, 2003.*

15CEE14 - ADVANCED CONSTRUCTION TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to:

CO1 : *Demonstrate the specialized construction techniques.*

CO2 : *Identify suitable techniques for underground constructions.*

CO3 : *Explain the equipments and methods used for offshore construction.*

CO4 : *Identify the methods and techniques for bridge construction.*

CO5 : *Discuss pre-fabrication construction techniques.*

SPECIALIZED CONSTRCTION TECHNIQUES

Construction aspects and procedures of specialized construction techniques like box pushing - Box type retaining walls - Slip form for chimney and silo construction - Sheet piling and diaphragm walls - Well and caisson - Underpinning - Shotcreting & guniting - Vacuum dewatering - Finishing & curing methods. **(9)**

UNDERGROUND CONSTRUCTION

Site investigation and geological studies - Drilling - Pneumatic breakers - Explosives - Blasting. Tunnelling technology: mechanized shield, micro, special methods - Hazards and safety. **(9)**

OFFSHORE CONSTRUCTION

Equipments: Crane barges derrick barges, drilling vessels - Underwater construction - Stages of offshore structure, construction, facilities and methods of fabrication. **(9)**

BRIDGE CONSTRUCTION AND ERECTION TECHNIQUES

Types, bridge construction methods: in-situ and pre-cast construction methods, balanced cantilever methods, span-by-Span method, incremental launching method. **(9)**

PRE-CAST AND PRE-FABRICATION CONSTRUCTION

Planning, analysis and design considerations for pre-cast and pre-fabrication constructions. Materials, moulds and modular co-ordination, standardization. Joints in pre-cast & pre-fabrication constructions, curing techniques. Industrial structures with skeletal and large panels. Handling, transportation and erection techniques. Pre-cast and pre-fabricating technology for low cost and mass housing schemes, case studies. Fabrication and erection of steel structural elements. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Roy Chudley and Roger Greeno, "Advanced construction techniques," Pearson Prentice Hall, 2006.*

2. *Beer, G., "Technology innovation in underground construction", CRC Press, 2009.*

3. *Gerwick, B., "Construction of marine and offshore structures", CRC Press, 2007.*

REFERENCE BOOKS

1. *Levitt, "Precast concrete - Materials, manufacture properties and usage", Taylor & Francis, 2007.*

2. *Hurd M. K., "Formwork for concrete", Detroit American Concrete Institute, 1995.*

3. *Chew Yit Lin, Michael, "Construction Technology for Tall Buildings", Singapore University Press, World Scientific, 2009.*

4. *Richardson, J.G., "Pre-cast concrete Production", Cement and Concrete Association, 1973.*

15CEE15 - TOWN PLANNING AND ARCHITECTURE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1   :   Outline the geometric forms and aesthetic qualities of Architecture

CO2   :   Review the various elements of architecture and orientation of buildings

CO3   :   Discuss the development plans and planning regulations

CO4   :   Explain the development control rules in town planning

PRINCIPLES OF TOWN PLANNING

Evaluation of planning - Objects of town planning - principles of town planning- origin of towns - growth of towns - origin - direction - various forms of planning **(9)**

ELEMENTS OF ARCHITECTURE

Introduction of architecture - definition - Evaluation of geometric forms - function and history - Sphere, Cube, Pyramid, Cylinder and Cone - aesthetic qualities of Architecture - Proportion, Scale, Balance, Symmetry, Rhythm and axis - Contrast in Form - Harmony. **(9)**

PRINCIPLES OF ORIENTATION AND PLANNING OF BUILDINGS

Factors affecting orientation - Sun-Wind-Rain - Orientation criteria for Indian conditions - Principles governing the theory of planning - Planning of residential buildings. **(9)**

DEVELOPMENT PLAN

Principles of city planning - levels of planning- scope and contents of regional plan, master plan, detailed development plan and structure plan - preparation and implementation - planning of new towns - slum clearance and urban renewal. **(9)**

PLANNING LEGISLATION AND DEVELOPMENT CONTROL RULES

Planning legislation and administration - Tamil Nadu Town and Country planning Act, Tamil Nadu Housing Board Act, Tamil Nadu slum clearance and Improvement Act. Zoning regulations - sub division regulations - building regulations - Floor Space Index - minimum plot sizes and building frontage - open spaces - minimum standard dimensions of building elements **(9)**

TOTAL : 45

TEXT BOOKS

1.   *RangwalaS.C., "Town Planning", Charotar Publishing House, Anand, 2013.*

2.   *Francis D.K., Ching, "Architecture Form, Space and Order" , Oxford University Press, 2005.*

REFERENCE BOOKS

1.   *Donald Helper and Wallach, "Architectural Drafting and Design", McGraw Hill Book Company, New Delhi, 2004.*

2.   *Arnold Whittick., "Encyclopedia of Urban Planning", McGraw Hill Book, Company, New Delhi, 2003.*

3.   *Pickering E., "Architectural Design", John Wiley & Sons, London, 2012.*

4.   *Hiraskar G.K, "Fundamentals of Town Planning", DhanpatRai and Sons, Delhi, 2005.*

5.   *Arthur B.Gallion and Simon Eisner, "The Urban Pattern - City Planning and Design", CBS Publishers and Distributors, Delhi, 1980.*

6.   *G.K.Hiraskar, "The Great Ages of World Architecture," DhanpatRai Publications (P) Ltd., New Delhi, 2010.*

15CEE16 - CONSTRUCTION EQUIPMENTS AND TECHNIQUES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Apply engineering fundamentals and analysis to the planning, selection, utilization of earthwork and material handling equipment.*

CO2 : *Describe Concreting and aggregate production equipment, its application and utilization.*

CO3 : *Demonstrate various Equipment for Construction and Rehabilitation works.*

CO4 : *Identify Sub-structure construction techniques and explain their utilization in Construction Industry.*

CO5 : *Apply appropriate techniques for the construction of Super-structures.*

EARTHWORK AND MATERIAL HANDLING EQUIPMENTS

Fundamentals of earth work operations - Selection of equipment for earth work- Types of earth work equipment - Tractors, Motor graders, Scrapers , Front end waders, Earth movers. Material handling equipment - Forklifts and related equipment- Portable material bins - conveyors-hauling equipment.   **(9)**

EQUIPMENTS FOR AGGREGATE PRODUCTION AND CONCRETING

Crushers- Feeders- screening equipment - handling equipment- batching and mixing equipment- hauling, pouring and pumping equipment, RMC equipment.   **(9)**

OTHER CONSTRUCTION EQUIPMENTS

Equipment for Concreting, Equipment for Foundation, Pile driving equipment, micropiling - Equipment for compaction - Equipment for dewatering and grouting. Rehabilitation techniques.   **(9)**

SUBSTRUCTURE CONSTRUCTION

Techniques for box jacking, pipe jacking, diaphragm wall construction - piling techniques - driving well and caisson - cofferdam - sheet piles - dewatering and stand by plant equipment for underground open excavation.   **(9)**

SUPERSTRUCTURE CONSTRUCTION

Vacuum dewatering for concrete flooring - Techniques for continuous concreting operations - Concrete paving technology - Erection techniques of tall structures - pre stressing in high rise structures - aerial transporting.   **(9)**

TOTAL : 45

TEXT BOOKS

1. Sharma S.C, *"Construction equipment and Management"*, Khanna publishers, New Delhi 1988.
2. Peurifoy,R.L.,Ledbetter, W.B and Schexnayder, C., *"Construction Planning, Equipment and Methods"*, McGraw Hill, Singapore, 2006.
3. Arora S.P and Bindra S.P., *"Building construction, Planning and Techniques and Method of construction"*, Dhanpatrai and sons, 1997.
4. Varghese, P.C., *"Building construction"*, Prentice Hall of India Pvt. Ltd., New Delhi.
5. Deodhar, S.V. *"Construction Equipment and Management"* , Khanna publishers, New Delhi, 1988.

REFERENCE BOOKS

1. Peter.H.Emmons, *"Concrete repair and maintenance illustrated"*, Galgotia Publications Pvt. Ltd., 2001.
2. Sankar, S.K. and Saraswati, S., *"Construction Technology"*, Oxford University Press, New Delhi, 2008.
3. Dr. Mahesh Varma, *"Construction Equipment and its Planning and Application"*, Metro-politan Book Company, New Delhi, 1983.

15CEE17 - VALUATION OF IMMOVABLE PROPERTIES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1   : Value different types of land used for construction of buildings

CO2   : Value different types of buildings

CO3   : Apply appropriate method for valuation specific to the purpose

PRINCIPLES OF VALUATION AND VALUATION OF LAND & BUILDING

Definition - Cost, Price and Value - Types of Properties under Valuation - Various Purposes of Valuation - Different types of Value - Factors affecting Value - Different Methods of Valuation.

Types of Land - Location of Land and its Value - Belting Method of Valuation - Market Value and Guideline Value of Land - Building FSI - Plot Coverage - Types of Structure - Life of Various types of Building - Methods of Calculating Depreciation - Valuation by Land and Building Method. **(9)**

FREE HOLD AND LEASE HOLD PROPERTIES AND FIXATION OF FAIR RENT

Free hold and Lease hold Properties - Lease, Rent and License - Different forms of Lease - Lessor - Lessee - Sub-lessee - Reversion - Lessor' Rights - Lessee's Rights - Meaning of Different Rents - Fixation of Fair Rent - Principles of fixation of fair rent - Amenities to be considered - Rent fixation for Residential & Non-Residential purposes, Commercial Buildings, Apartments **(9)**

VALUATION OF APARTMENTS

FSI - Super Built-up Area - Undivided Share of Land - Different Methods of Valuation - Procedure of Valuation by Composite Rate Method - Valuation by Other Methods - Procedure for Valuation of Flat under Construction - Stage Value of a flat - Valuation of an existing flat - Joint Venture Agreement **(9)**

VALUATION FOR BANKS

Purposes - Security - Primary and Collateral - Present, Market, Forced Sale and Auction Value - Valuation of Building under Construction - Valuation of Ready Built House - Valuation of Ready built Flats - Valuation of Flats under construction - Valuation of Properties offered as Collateral Security - How to become a Panel Valuer of Banks - Problems involved in Bank Valuation - Precautions to be taken in Bank Valuation - Points to be remembered in Bank valuation. **(9)**

VALUATION FOR TAXATION

Direct and Indirect Taxes - Valuation for Income Tax - Estimation of Cost of Construction by Plinth area rate method - Valuation by CPWD and State PWD Rates - Cost of Construction by accounting method - Valuation for Capital Gains Tax - Fair Market Value as on 01.04.1981 and 01.04.2001 - Section 50C of Income Tax Act - Valuation for individual Property - Valuation of Apartment **(9)**

TOTAL : 45

REFERENCE BOOKS

1.   *Kanagasabapathy B., "Practical Valuation", Volumes I - X, No 1, Prestige Flats, Reynolds Road, Trichy.*

2.   *Ashok Nain, "Principles of Valuation", Tata McGraw Hill Publishing House, July 2010.*

3.   *Roshan H. Namavati, "Theory and Practice of Valuation", Lakhani Book Depot, Mumbai, 2009.*

4.   *Banerjee D. N., "Principles and Practice of Valuation", J.A. Parks, Eastern Law House, Delhi 5th Edition, 1998.*

15CEE18 - PROFESSIONAL PRACTICE IN CIVIL ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : Acquire the knowledge of Building by laws and regulations and plan approval methods

CO2 : Able to execute the Fundamentals of Tendering and contracting process

CO3 : Perform the municipal services for buildings

CO4 : Choose appropriate method for rent fixing and leasing

BUILDING BY LAWS RULES AND REGULATION AND PLAN APPROVAL PROCESS

Building by laws - importance - acts and rules of public interest - state and central - approval bodies-Metros - Corporation - Municipalities - Town Panchayats. Preparation and Submission of Drawings and Documents for Building Approval and Layout. Land use Classification in urban & Moffussil Areas-Related Regulatories and approvals.   **(9)**

TENDERING AND CONTRACTING

Interpretation of Tender Notice and Tender Documents - Prepartion of tender documents - Pre-Bid Meetings. Preparation of Bid documents - Submission Procedures. Award of contract - Contract document preparation -Contract -clauses.   **(9)**

MUNICIPAL SERVICES (WATER SUPPLY, SEWAGE AND ELECTRICAL CONNECTIONS)

Local approvals and clearances for residential, industrial and commercial Buildings - General specifications for water supply and sewers - Water Supply - Process for waste water connections to public Mains. Domestic water supply connection from public mains, types and sizes of pipes, special installation in multistoried buildings. Connections to Public sewers.

General Specifications - Electrical supply for residential, industrial and commercial Buildings - List of procedures - Standards - Local approvals and clearances for residential, industrial and commercial Buildings-Temporary - Permanent Services-Consumer Guidance TNEB.   **(9)**

DOCUMENTATION FOR PROJECT COMMENCEMENT AND CLOSURE AND TAX ASSESSMENT

Documentation for formal approval of work commencement - Procedures. Documentation for procurement and mobilization of resources - Record of works - Changes - Deviation - Preparation of running account bill & Final bill. Submission of project closure report. Handing over documents -Procedure for contract closure.   **(9)**

ESTABLISHMENT FOR PROFESSIONAL PRACTICE

Establishment of firm - Consultancy, Construction - Registration of firms with GST, CST, Companies -IT - Licensing from local bodies - Metros - Muncipalities, town panchayats - Obtaining Chartered Engineership, approved valuership, registered valuership with income tax, Bank empanelment-Membership of other professional bodies- BAI, ACCE(I) Etc., - Registration of contractors with Government Departments, Public undertakings & Private organizations.   **(9)**

TOTAL : 45

TEXT BOOKS

1.   Dutta B.N., "Estimating and Costing in Civil Engineering", UBS Publishers & Distributors Pvt. Ltd., 2010.

2.   Kohli D.D. and Kohli R.C., "A Text Book of Estimating and Costing (Civil)", Chand & Company Ltd., 2004.

REFERENCE BOOKS

1.   Hand Book of Consolidated Data - 8/2000, Vol.1, TNPWD.

2.   Tamil Nadu Transparencies in Tenders Act, 1998, Standard Data Book for Analysis and Rates, IRC, New Delhi, 2003.

15CEE19 - INFRASTRUCTURE PLANNING AND MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : Explain the basic concepts of infrastructure serving the society

CO2 : Describe the concepts, benefits, problems and challenges of infrastructure privatization and special economic zones

CO3 : Demonstrate a knowledge about the risks and challenges in infrastructure projects

CO4 : Formulate a system for successful infrastructure project implementation

CO5 : Generate innovative techniques for the effective implementation of infrastructure projects.

AN OVERVIEW OF INFRASTRUCTURE

Introduction to Infrastructure - An Overview of the Power Sector in India - An Overview of the Water Supply and Sanitation Sector in India - An overview of the Road, Rail, Air and Port Transportation Sectors in India - An overview of the Telecommunications Sector in India - An overview of the Urban Infrastructure in India - An overview of the Rural Infrastructure in India - The Stages of an Infrastructure Project Lifecycle - An Overview of Infrastructure Project Finance. **(9)**

PRIVATE INVOLVEMENT IN INFRASTRUCTURE

A Historical Overview of Infrastructure Privatization - The Benefits of Infrastructure Privatization - Problems with Infrastructure Privatization - Challenges in Privatization of Infrastructure - Privatization of Water Supply, Power, Telecommunication, Transportation, urban and rural infrastructure with case studies - Concepts of Special Economic Zones - Benefits, problems and challenges in Privatization of Special Economic Zones. **(9)**

CHALLENGES TO SUCCESSFUL INFRASTRUCTURE PLANNING AND IMPLEMENTATION

Mapping and Facing the Landscape of Risks in Infrastructure Projects - Economic and Demand Risks - Political Risks - Socio-Environmental Risks - Cultural Risks in International Infrastructure Projects - Legal and Contractual Issues in Infrastructure - Challenges in Construction and Maintenance of Infrastructure. **(9)**

STRATEGIES FOR SUCCESSFUL INFRASTRUCTURE PROJECT IMPLEMENTATION

Risk Management Framework for Infrastructure Projects - Shaping the Planning Phase of Infrastructure Projects to mitigate risks - Designing Sustainable Contracts - Introduction to Fair Process and Negotiation - Negotiating with multiple Stakeholders on Infrastructure Projects - Sustainable Development of Infrastructure - Information Technology and Systems for Successful Infrastructure Management. **(9)**

INFRASTRUCTURE MANAGEMENT

Innovative Design and Maintenance of Infrastructure Facilities - Infrastructure Modelling and Life Cycle Analysis Techniques - Capacity Building and Improving the Governments Role in Infrastructure Implementation - An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions. **(9)**

TOTAL : 45

TEXT BOOKS

1. Joshi P, "Law Relating to Infrastructure Projects", Taxmann Publishers, 2003.

2. Murty G R K, "Infrastructure Projects: Current Financing Trends", ICFAI University Press, 2006.

3. Alagiri D, "Infrastructure Growth in India and China: A Comparative Study", ICFAI University Press, 2006.

4. 3i Network, "India Infrastructure Report 2007: Rural Infrastructure", Oxford University Press, 2007.

REFERENCE BOOKS

1. 3i Network, "India Infrastructure Report 2006: Urban Infrastructure", Oxford University Press, 2006.

2. Raghuram G, "Infrastructure Development and Financing: Towards a Public Private Partnership", Macmillan, 2001.

3. NarindarJethi K, "Infrastructure Development In India", New Century Publications, 2007.

4. Alagiri D,"Infrastructure Development", ICFAI University Press, 2007.

5. Krishnamurthy G G, "Infrastructure Financing", ICFAI University Press, 2007.

6. 3i Network, "India Infrastructure Report 2008", Oxford University Press, 2008.

15CEE20 - ADVANCED FOUNDATION ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : Explain classification and selection of piles as per requirements.

CO2 : Compute load carrying capacity and settlements of pile and pile groups..

CO3 : Analyze behavior of piles subjected to lateral load and uplift loads.

CO4 : Analyze and design pile and pile group as per requirements

CO5 : Analyze stability of caissons for different influencing factors and understand IRC guidelines

PILE CLASSIFICATIONS

Function - classification of piles - Factors governing choice of pile foundation - Load transfer principles - piling equipments and methods - changes in soil condition during installation of piles - requirement of code of practice - responsibility of engineer and contractor. **(9)**

AXIALLY LOADED PILES AND PILE GROUPS

Allowable load evaluation of piles and pile groups - Static method - cohesive - cohesionless soil - time effects - Dynamic method - pile driving formulae - Wave equation application - modeling - theoretical analysis - Interpretation of field test results and pile load test results - Settlement of Piles and Pile groups. **(9)**

LATERAL AND UPLIFT LOAD EVALUATION

Piles subjected to Lateral loads - Broms method, elastic -p-y curve analyses - Batter piles - response to moment - pile subjected to uplift loads - load -deformation behaviour - Lateral and uplift load test data interpretation. Foundation on week compressible - collapsible soil - case studies **(9)**

STRUCTURAL DESIGN OF PILE AND PILE GROUPS

Pile foundation - structural design - pile cap analysis, pile - raft system basic interactive analysis - pile and pile groups subjected to vibrations - fundamental solutions. **(9)**

CAISSONS

Caissons types - Stability of caissons - principles of analysis and design, seismic influences - IRC Guidelines. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. Das B.M., "Principles of Foundation Engineering, Design and Construction", Fourth Edition, PWS Publishing, 1999.

2. Poulos H.G., Davis, E.H., "Pile foundation analysis and design", John Wiley and Sons, New York, 1980.

3. Tomlinson M.J., "Foundation Engineering", ELBS, Longman Group, U.K. Ltd., England 1995.

4. Cernica J.N., "Geotechnical Engineering Foundation Design", John Wiley and Sons, Inc. 1995.

5. Bowles J.E., "Foundation Analysis and Design", Fifth Edition, McGraw Hill, New York, 1996.

6. Donald P., Coduto, "Foundation Design Principles and Practices", Prentice Hall, Inc. Englewood Cliffs, New Jersey, 1996.

15CEE21 - SOIL STRUCTURE INTERACTION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : *Analyze the behaviour of soils and interaction with foundation through response models*

CO2 : *Analyze infinite and finite beam by understanding elastic half space and application packages*

CO3 : *Analyze plates and braced cuts by understanding numerical methods of analysis*

CO4 : *Analyze pile group with rigid cap*

CO5 : *Predict load deflection for laterally loaded piles through elastic and interaction analysis*

SOIL-FOUNDATION INTERACTION

Introduction to soil - Foundation interaction problems, Soil behaviour, Foundation behaviour, Interface, behaviour, Scope of soil-foundation interaction analysis, soil response models, Winkler, Elastic continuum, Two parameter elastic models, Elastic - plastic behaviour, Time dependent behaviour. **(9)**

BEAM ON ELASTIC FOUNDATION - SOIL MODELS

Infinite beam, Two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness - Analysis through application packages. **(9)**

PLATE ON ELASTIC MEDIUM

Infinite plate, Winkler, Two parameters, Isotropic elastic medium, Thin and thick plates, Analysis of finite plates, rectangular and circular plates, Numerical analysis of finite plates, simple solutions, Analysis of braced cuts - Application packages **(9)**

ELASTIC ANALYSIS OF PILE

Elastic analysis of single pile, Theoretical solutions for settlement and load distribution, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap - pile raft - Application packages.

(9)

LATERALLY LOADED PILE

Load deflection prediction for laterally loaded piles, subgrade reaction and elastic analysis, Interaction analysis, and pile raft system, solutions through influence charts and Application packages. **(9)**

TOTAL : 45

REFERENCE BOOKS

1.   Saran S, "Analysis and design of substructures", Taylor & Francis Publishers, 2006

2.   Hemsley J.A, "Elastic Analysis of Raft Foundations", Thomas Telford, 1998.

3.   Poulos H.G., and Davis E.H., "Pile Foundation Analysis and Design", John Wiley, 1980.

4.   Murthy V.N.S., "Advanced Foundation Engineering", CBS Publishers, New Delhi, 2007

5.   McCarthy D.F., "Essentials of Soil Mechanics and Foundations, Basic Geotechnics", Sixth Edition, Prentice Hall, 2002.

6.   Selvadurai A.P.S., "Elastic Analysis of Soil Foundation Interaction", Elsevier, 1979.

7.   Scott R.F., "Foundation Analysis", Prentice Hall, 1981.

8.   Structure Soil Interaction - State of Art Report, Institution of structural Engineers, 1978.

9.   ACI 336, Suggested Analysis and Design Procedures for Combined Footings and Mats, American Concrete Institute, Dehit, 1988.

15CEE22 - REMOTE SENSING AND GIS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Explain the principle and methods of remote sensing*

CO2 : *Integrate the basic elements of visual photo interpretation and aerial photography*

CO3 : *Illustrate the components of imageries and imaging devices*

CO4 : *Apply the concepts of Remote Sensing and GIS in the field of Civil Engineering*

PRINCIPLES AND CONCEPTS

Definition - Historical Importance of remote sensing - Principles and methods of remote sensing - Electromagnetic spectrum Electromagnetic Radiation and radiation sources - Interference -Atmospheric effects on remote sensing - Energy interaction with energy surface features. **(9)**

AERIAL PHOTOGRAPHY

Definition - Types of air photographs - Geometry of air photo - Parallax - pair of photos - Height determination - Flight planning - Stereoscopy - Monovision - Binocular vision - Aerial photo interpretation - Basic elements - Techniques of photo interpretation - photographs versus maps. **(9)**

IMAGERY

Landsat imagery - Digital image processing - Image Classification - Imaging devices - Aerial camera - Panoramic camera - Satellites - Geo Stationery - Sun Synchronous Satellites - Platforms - Sensors - Characteristics. **(9)**

GIS

GIS - Structure of GIS - various components of GIS - vector and raster data - analysis of data - Introduction to software - Georeferencing **(9)**

APPLICATIONS OF GIS AND REMOTE SENSING

Usage of remote Sensing and GIS softwares, Application of GIS and Remote Sensing in water resources engineering, land use studies, soil sciences, geology, agriculture, forestry and military and coastal management. **(9)**

TOTAL : 45

TEXT BOOK

1. *Bhatia S.C, "Fundamentals of remote sensing", New Delhi Atlantic Publishers, 2008.*

REFERENCE BOOKS

1. *Burrough.P.A., "Principles of GIS for Land Resources Assessment", Oxford Publication, 1998.*

2. *Floyd F.Sabins, J.R., WH, "Remote Sensing Principles Interpretation", Freeman and Company and Francis Conpany, France, 1996.*

3. *Lillesand, Thomas.M and RaiphW.Kiefer, "Remote Sensing and Image Interpretation", John Wiley Sons, 2003.*

15CEE23 - RAILWAY ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Describe the components of permanent way and organizational setup of Indian Railways.*

CO2 : *Design the geometric elements of a Railway track*

CO3 : *Outline the required components in railway stations and yards*

CO4 : *Classify the signals and controls for safe functioning of railway*

CO5 : *Explain the methods for track construction and maintenance*

ELEMENTS OF RAILWAY ENGINEERING

Comparison of railway and highway transport - organization of Indian railways - Railway board - Zonal railways, different production units, undertakings, organizations, divisions- railway terminology - MRTS - Monorail - Permanent way - Gauges - Railway Track cross section - coning of wheels - Rails - Sections - Length- failures, wear on rails - Long Welded Rails - Rail joints - Creep - effects- remedies - Sleepers - Track fitting and fastenings -Ballast - Sub grade and Embankment -Track alignment- Surveys. **(9)**

GEOMETRIC DESIGN OF RAILWAY TRACK

Gradients - speed, degree of curves, super elevation and cant deficiency - Negative super elevation- Curves - points and crossings -necessity -Turnouts - Switches - types of switches crossing-components, types - Sleeper at points and crossings. **(9)**

RAILWAY STATIONS AND YARDS

Stations and yards - requirements, classification, layout of station - Platform - Loops, siding and level crossing - Loco sheds - Derailing switches, Fouling marks, Buffer stop - Sand hump - rolling stock **(9)**

SIGNALS AND CONTROLS OF RAILWAY

Signalling -Object engineering principles - classification and types -Control of movement of Trains - Various Control Systems - interlocking of signals and points- Level crossings - Safety in Railways - Signalling during maintenance - Speed restrictions - Railway Accidents- causes and remedies. **(9)**

RAILWAY TRACK CONSTRUCTION AND MAINTENANCE

Methods and Considerations of Relaying track - Track Drainage -Significance -requirements- Drainage Systems - Drainage Problems and remedies. Necessity of Track maintenance - advantages of good maintenance -Daily maintenance - Periodic maintenance-maintenance of high speed track **(9)**

TOTAL : 45

TEXT BOOK

1. *Saxena S.C and Arora S.P, "A Text book of Railway Engineering", Dhanpat Rai Publications, New Delhi, 2005.*

REFERENCE BOOKS

1. *J. S. Mundrey, "Railway Track Engineering", Tata McGraw-Hill Education, New Delhi, 2010.*
2. *Clifford F. Bonnett, "Practical Railway Engineering", Imperial College Press, London, 2005.*

15CEE24 - TUNNEL ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Plan tunnels, rock support and grouting and evaluate the most important issues in the procedure.*

CO2 : *Evaluate tunnel excavation method from technical and production aspects.*

CO3 : *Analyse cost and time for ordinary tunnels based on risks and construction management principles.*

CO4 : *Design the tunnel drainage, ventilation and lighting.*

PLANNING

Introduction - consideration in tunnelling - necessity- advantages and disadvantages - types of tunnels - planning of tunnels - section, shape and size of tunnels - site investigation for tunnels - geological investigation - tunnel alignment and grade - location of centre line on ground and underground - preliminary exploration - approaches to tunnels. **(9)**

CONSTRUCTION

Classification of shafts - size - location - shape - construction of shaft -methods of tunnelling in hard rocks -Sequence of operations - methods of tunnelling in soft strata -firm, soft, running ground - compressed air methods **(9)**

DRILLING AND BLASTING

Types of drills - selection of drilling equipment - mounting of drills for small tunnels - selection of drilling pattern - rate of drilling - theory of drilling and blasting - number, direction and depth of holes - drilling pattern - types of explosives - quantity of explosives - precautions in handling and transporting - types of detonators - methods of blasting. Tunnel boring machine (TBM) - Muck disposal. **(9)**

LINING

Objects of lining - types of lining - advantages - sequence of lining - formwork for lining - curing of concrete - Grouting - Guniting. **(9)**

DRAINAGE, VENTILATION AND LIGHTING

General - drainage systems - predrainage - dewatering - permanent drainage - object of ventilation - methods of tunnel ventilation - dust control - lighting - service tunnel. **(9)**

TOTAL : 45

TEXT BOOKS

1. Rajam Iyengar, "Tunnel Engineering", Allied Publishers, New Delhi, 1963.

2. Vazirani V.N., and Chandola S.P., "Railways, Bridges and Tunnels", Khanna Publishers, New Delhi, 1986.

REFERENCE BOOKS

1. Ahuja T.D. and Birdi G.S., "Roads, Railways, Bridges and Tunnel Engineering", Standard Book House, New Delhi, 1985.

2. Gupta B.L., "Roads, Railways, Bridges and Tunnel Engineering", Standard Publishers Distributors, New Delhi, 1982.

15CEE25 - AIRPORT AND HARBOUR ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Identify the parameters required for planning and constructing an airport*

CO2 : *Design the runway and taxiway in airport as per geometrical standards*

CO3 : *Explain the air traffic controls, airfield pavement strength assessment, failures and maintenance for safe functioning of airport*

CO4 : *Outline the elements and components related to Harbour and Docks*

AIRPORT PLANNING

Regional planning - Planning Consideration- Airport Site evaluation - factors affecting airport location - Surveys - Drawings - Role of ICAO, FAA, DGCA and AAI - Airport capacity - Terminal area - Building and building area - facilities in terminal area- Vehicular circulation - Parking area - Apron - Hanger - other components   **(9)**

GEOMETRIC DESIGN OF RUNWAY AND TAXIWAY

Design of runway - Factors affecting setting - Orientation of Runway - windrose diagram - number of runways - factors affecting runway length - length of runway - stop ways - clear ways - take off length requirement - landing length requirement. Design of taxiways, aprons, holding bays- functional requirement - taxiway- width - curve - junction - intersection   **(9)**

AIR TRAFFIC CONTROL AND PAVEMENT MAINTENANCE

Aircraft Characteristics - Future trends in aircrafts design- Visual Aids - Airport Marking - Airport Lighting - Need for Air traffic control - Air traffic control network - Air traffic control Aids - ILS - Need for maintenance of pavement - Airfield Pavement failures - Maintenance - Strengthening of airfield pavements - Drainage - Characteristics and requirements   **(9)**

HARBOUR

Definitions: Harbour, port, marine terminal, offshore mooring, anchorage area, turning basin, length, beam, draft, load line, dead weight tonnage, warehouse, Transit shed - Planning, site selection - layout of harbours - classification of harbours   **(9)**

DOCKS

Break water - classification and sections of different types of break waters - Docks - Classification - Jetty, quay, quay wall - Dolphins - fenders - navigational aids- necessity and types.   **(9)**

TOTAL : 45

TEXT BOOKS

1. Khanna .S.K. and Arora M.G., "Airport Planning and Design", NemChand and Bros., Roorkee, 1994.

2. Oza and Oza., "Elements of Dock and Harbour Engineering", Charotar Publishing House, Anand, 1992.

REFERENCE BOOKS

1. Robert Horonjeff., "The Planning and Design of Airports", McGraw Hill Book Co., 1963.

2. Quinn, "Design and Construction of Port and Marine Structures", McGraw Hill, 1956.

15CEE26 - PAVEMENT DESIGN

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Describe the principles of rigid and flexible pavements along with their components*

CO2 : *Design the flexible pavement using IRC, CBR and plate bearing methods*

CO3 : *Design the rigid pavement using IRC and PCA methods*

CO4 : *Evaluate the pavements in structural and functional aspects*

PRINCIPLES OF PAVEMENT DESIGN

Types of pavement-flexible and rigid- Components of pavement and their functions, Provisions of IRC Guidelines for each component, Comparison between highway and airport pavements, Factors influencing pavement stability: Vehicle and traffic factors-ESWL and Wheel Load Factor- Moisture and climate, soil-CBR, Plate Bearing method for finding modulus of subgrade reaction stress distribution factor- Boussinesq and Burmister theories. **(9)**

DESIGN OF FLEXIBLE PAVEMENT

Empirical method based on classification-Group Index method- Methods based on arbitrary strength-CBR method-Provisions of IRC 37- North Dakota Cone method, Plate Bearing method (US Navy method for airfields), Theoretical and semi-theoretical methods- Burmister Design method. **(9)**

STRESSES AND JOINTS IN RIGID PAVEMENT

Advantages and Disadvantages of rigid pavement, Stresses in rigid pavement due to wheel load-Westergaard theory - Stresses due to change in temperature-warping stress- Critical combination of stresses. Types of joints, Types of rigid pavement based on reinforcement, Design of reinforcement in longitudinal and transverse direction, tie bars and dowel bars. **(9)**

DESIGN OF RIGID PAVEMENT

Modulus of Rupture of concrete, Design of airport pavement-Portland Cement Association method and Corps of Engineers method- Design of rigid highway pavement- IRC 58 method and PCA method. **(9)**

PAVEMENT DISTRESS, EVALUATION AND REHABILITATION

Flexible pavement distress - rigid pavement distress - condition surveys - Types of roughness - present serviceability index - skid resistance - structural evaluation - Bituminous and flexible overlays on rigid pavements - Pavement Management System. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Kadiyali L.R., "Principles and Practice of Highway Engineering", Khanna Tech Publications, New Delhi, 1989.*

2. *Sharma S. K," Principles, Practice and Design of Highway Engineering", S. Chand and Company Ltd., New Delhi, 1985.*

3. *Yoder E. J. and Witezak M. W., "Principles of Pavement Design", John Wiley and Sons Inc., New York, 1975.*

REFERENCE BOOKS

1. *IRC: 37-2001, Guidelines for the Design of Flexible pavements, Indian Road Congress, New Delhi, 2001.*

2. *IRC: 58-2002, Guidelines for the Design of Rigid Pavements for Highways, Indian Road Congress, New Delhi, 2002.*

15CEE27 - HYDRAULIC STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Select the hydraulic structure based on its purpose, location, function and materials used*

CO2 : *Explain the principles of design of a weir as a part of diversion headwork*

CO3 : *Demonstrate the procedure for the design of canal structures*

CO4 : *Develop the procedure for stability analysis and design of rigid and non rigid dams based on geological and hydrological data*

CO5 : *Illustrate the constructional features and the method of operation and maintenance of irrigation tanks*

RIVER STRUCTURES

Diversion Head Works - Brief description of component parts - their functions - Design principles -Seepage Theories - Weir, Barrage and impervious floor as a part of diversion head work and their design based on seepage theories - River training works - types (Theoretical aspects only) **(9)**

CANAL STRUCTURES

Canal regulators - Types - Functions - Parts of a regulator - Canal falls - Types - Brief Description - design aspects of notch-type canal fall - Cross Drainage works - Types - selection - Design aspects of syphon aqueducts - Canal outlets and fumes (Theoretical aspects only) **(9)**

STORAGE STRUCTURES - GRAVITY DAMS

Gravity Dams - Description -Forces acting - Elementary and Practical profile -Design (procedure only) of high and low gravity dam - Zoning of gravity dam - Galleries - Types - Joints, Waterstops and Keyways - Types- Spillways - Types - Functions. **(9)**

STORAGE STRUCTURES - EARTHEN DAMS

Earth dams -Various types of sections - Cross-sectional Details - Design data of components - Causes of failure - Typical cross sections to suit site conditions and available materials - Phreatic line - Determination by graphical method - Seepage control in earthen dams. **(9)**

OTHER STORAGE STRUCTURES

Arch Dams - Types (Description only) - Buttress dams - Types (Description only).

Tanks - Classification - Components of tanks - Types of bunds - Design aspects of bunds - Tank surplus weir - tower head sluice - wing wall type sluice (Description only) - Tank regulation arrangements. **(9)**

TOTAL : 45

TEXT BOOK

1. Garg S.K, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi, 2009.

REFERENCE BOOKS

1. Punmia B.C, Pande, B.B.Lal., "Irrigation and Water Power Engineering", Laxmi Publications, New Delhi, 2009.

2. SahasraBudhe S.R., "Irrigation Engineering and Hydraulic Structures Including Hydrology and Water Power Engineering", S.K.Kataria Publications, Sixth Edition, 1996(Reprint 2000).

15CEE28 - ENGINEERING HYDROLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : *Summarize the factors governing the movement of water through atmosphere, lithosphere and hydrosphere*

CO2 : *Collect, analyse and interpret the rainfall data over a basin*

CO3 : *Estimate the precipitation losses occurring due to evaporation, transpiration and infiltration*

CO4 : *Determine the flow in a river resulting from a storm of given duration through rainfall-runoff models*

CO5 : *Estimate the flood in a stream through flood routing techniques*

GENERAL HYDROLOGY

Hydrology - definition - development - hydrologic design - hydrologic failure - weather - general circulation - watershed hydrology - geomorphology - effect of land use in hydrology.   **(9)**

PRECIPITATION

Precipitation -Types of precipitation - forms of precipitation - rainfall measurement - gauges - recorders - processing precipitation data - check for consistency - supply of missing data - areal mean - mass curve technique - intensity duration, frequency curves.   **(9)**

EVAPORATION AND INFILTRATION

Process of evaporation, transpiration, infiltration - factors affecting evaporation and infiltration- measurement of evaporation and infiltration - Infiltration indices.   **(9)**

RUN-OFF

Factors affecting runoff - Rainfall-Runoff process - hydrograph theory and its applications - hydrograph components - hydrograph separation - unit hydrograph and its derivation - synthetic hydrograph - S curve Technique   **(9)**

FLOOD AND STREAM FLOW MEASUREMENTS

Flood estimation - flood routing routing through reservoir (ISD method) - routing through channels (Muskingham method) - flood control - flood forecasting. Stream flow measurements - methods- Stage Discharge Relation - Stream gauging Network.   **(9)**

TOTAL : 45

TEXT BOOKS

1. *Raghunath H.M., "Hydrology: Principles, Analysis and Design", New Age International (Pvt.) Ltd., New Delhi, 2nd Revised Edition 2007*

2. *Raghunath H.M., "Ground Water", New Age International (P) Ltd., New Delhi, 2nd Edition, Reprint 2003*

REFERENCE BOOKS

1. *Jayarami Reddy P., "A Text Book of Hydrology" University Science Press, (Unit of Laxmi Publications) New Delhi, 3rd Edition, 2011*

2. *David Keith Todd and Larry W. Mays, "Ground Water Hydrology" John Wiley Publications, 3rd Edition, 2005*

3. *Subramanya K., "Engineering Hydrology", Tata McGraw Hill Publishing Company Ltd., 2000*

4. *Chow V.T., "Applied Hydrology", Tata McGraw Hill Publishing Company Ltd., 1988*

15CEE29 - WATER POWER ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : Summarize the sources of energy and the methods of power generation

CO2 : Demonstrate the types of power plants based on location, availability of water and power demand

CO3 : Describe the components of water conveyance

CO4 : Illustrate the operation of tidal power plant

CO5 : Plan and describe the power house based on environmental impact and economy

WATER POWER

Introduction - Sources of energy - Status of power in world - Hydro Power - Transmission voltages and Hydro power - Estimation of Water Power Potential.

Electrical Load on Hydro Turbines **:** General - Load curve - Load factor - capacity factor - Utilisation factor - Diversity factor - Load duration curve - Firm power - Secondary power - Prediction of load - Illustrative examples. **(9)**

HYDRO POWER PLANTS

Classification of hydel plants - Run-of-River Plants - General arrangements - Valley dam plants - Diversion canal plants - High head diversion plants - storage and pondages. Pumped storage plants - Types - Advantage - two unit arrangement, Three unit arrangement - Reversible pump turbines - Problems in operation - Efficiency of pumped storage plants. **(9)**

WATER CONVEYANCE

Penstock - Types - Design criteria - Anchor Blocks - Valves, Bends and Manifolds - Intakes - Types - Losses - Aeration - Forebays - canals - Tunnels - Water Hammer - Surge tanks. **(9)**

TIDAL POWER

Tidal Phenomenon - Tidal power - Basic principle - Location - Difficulties - Components - Modes of generation - Constructional aspects - Estimation of energy and power - Regulation of power output - Corrosion control and quality of concrete. **(9)**

POWER HOUSE PLANNING

Surface power stations - Power House structure - Dimensions - Lighting and ventilations - Design variations - Underground power stations - Location - Types - Advantages - Components - Layout types - Limitations - Environmental impact of Hydel power projects - Introduction to economic analysis of Hydro Power projects. **(9)**

TOTAL : 45

TEXT BOOK

1. *Dandekar M.M. and Sharma K.N., "Water Power Engineering", DandekarVikas Publishing House Pvt Ltd., New Delhi, 1998.*

REFERENCE BOOKS

1. *Creager W.P. and Justin J.D., "Hydro Electric Hand Book", John Wiley Sons, London, 1981.*
2. *Desmukh M.M., "Water Power Engineering", Dhanpat Rai Publications, New Delhi, 1977.*

15CEE30 - INDUSTRIAL WASTEWATER TREATMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : Identify the characteristics and available biological treatment of Wastewater from Industries and infer the possible impacts on the Environment.

CO2 : Describe the need for Wastewater minimization techniques.

CO3 : Illustrate the importance of Advanced Wastewater Treatment systems.

CO4 : Describe the manufacturing processes of industries.

CO5 : Compare the characteristics of Industrial effluents and treatment processes.

CO6 : Choose the suitable treatment process for the industries based on the characteristics of Wastewater.

INDUSTRIAL WASTEWATER PERSPECTIVES

General characteristics of industrial wastewaters - Objectives and management of industrial wastewaters - Effluent and stream standards for disposal of wastewaters - Sewer ordinance - Effects of untreated and/or partially treated wastewaters on disposal into land, rivers, sea and ocean-zero discharge, effluent treatment - individual and common effluent treatment plant-biological treatability of waste. **(9)**

WASTEWATER MINIMIZATION AND ADVANCED WASTEWATER TREATMENT

Volume and strength reductions - Reduce, Reuse and Recycle concepts - waste auditing - Objectives, principles and process description of equalization, neutralization, floatation process, types of aeration system -Chemical oxidation, chemical precipitation, adsorption, membrane filtration process, gas stripping and ion exchange process- evaporators. **(9)**

CASE STUDIES -1

Process description, wastewater characteristics and effluent treatment for iron and steel, thermal power plants, sugar and paper and pulp industry. **(9)**

CASE STUDIES - 2

Process description, wastewater characteristics and effluent treatment for tannery, distilleries, diary and textiles. **(9)**

CASE STUDIES - 3

Process description, wastewater characteristics and effluent treatment for oil refineries, pharmaceutical plants, corn starch industry and food processing industry. **(9)**

TOTAL : 45

TEXT BOOKS

1. Rao, M.N and Datta, A.K. "Waste Water Treatment", Oxford and IBH Publishers Co, New Delhi, 1995.

2. Metcalf and Eddy, "Wastewater Engineering Treatment, Disposal and Reuse", McGraw-Hill Publishing Co, Indian Edition, New Delhi, 2005.

REFERENCE BOOKS

1. Eckenfelder (jr), "Industrial Water Pollution Control", McGraw-Hill Book Co, New York, 2000.

2. Nemerow N. L., "Industrial Water Pollution", Addison - Wesley Publishing Company Inc., USA, 1996.

3. Mahajan S. P. "Pollution Control in process industries", Tata McGraw Hill Publishing Co Ltd., New Delhi, 1989.

4. World Bank Group, "Pollution Prevention and Abatement Handbook - Towards Cleaner Production", World Bank and UNEP, Washington D.C., 1998

15CEE31 - AIR POLLUTION AND CONTROL

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : Outline the quality of air and its impact on the environment based on the national air quality standards.

CO2 : Design the effective stack height to disperse the plume generated from industries in a given locality.

CO3 : Demonstrate the procedure for air sampling and reporting the extent of air pollutant in a locality.

CO4 : Interpret the procedure for controlling the air pollution through controlling methods.

CO5 : Evaluate the level of air pollution inside a building based on indoor air quality standards

CLASSIFICATION AND EFFECTS OF AIR POLLUTION

Sources and classification of air pollutants - major emissions from global sources, importance of Anthropogenic sources - effect on human health, vegetation, animals, property, aesthetic value and visibility- Photochemical smog - green house gases - ozone layer depletion - Ambient Air Quality and Emission standards - Air Pollution Indices - Emission Inventories.

(9)

METEOROLOGY AND SAMPLING

Effects of meteorology on Air Pollution - horizontal atmospheric motion, vertical motion in atmosphere, Atmospheric stability,Temperature Inversion, Wind rose diagram and stack plume patterns- Atmospheric Diffusion Theories - Dispersion models, Plume rise -Design of effective stack height - Air pollution sampling and measurement - Types of pollutant sampling and measurement, ambient air sampling, collection of gaseous air pollutants, collection of particulate pollutants, stack sampling, analysis of air pollutants - sulphur dioxide, nitrogen oxides, carbon monoxide, oxidants and ozone, hydrocarbons, particulate matter. **(9)**

CONTROL OF PARTICULATE CONTAMINANTS

Air pollution control methods and equipment - Control methods, source correction methods, Factors affecting Selection of Control Equipment - particulate emission control - working principle, design and application of gravitational settling chambers, cyclone separators, electrostatic precipitators and depth filters. **(9)**

CONTROL OF GASEOUS CONTAMINANTS

Factors affecting Selection of Control Equipment - Control of gaseous emissions -Dry methods, wet scrubbing methods, combustion, biological methods - Control of specific gaseous pollutants -Control of sulphur dioxide emission, desulphurisation of flue gases, Control of nitrogen oxides, Modification of operating conditions, effluent gas treatment methods, Carbon monoxide control, control of hydrocarbons-Carbon monoxide poisoning - Hydrogen Sulphide poisoning. **(9)**

INDOOR AIR QUALITY MANAGEMENT

Sources, indoor and outdoor concentration - models -simple box model, complex model - control of indoor air Quality- indoor emission - sick building syndrome types - Radon Pollution and its control - Membrane process - UV photolysis - risk related to poor indoor air quality - strategies for creating premium indoor air quality (IAQ) - indoor air quality (IAQ) and green building rating systems - LEED rating system. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Noel de Nevers, "Air Pollution Control Engineering", McGraw Hill, New York, 1995.*

2. *Lawrence K. Wang, Norman C. Parelra, YungTse Hung, "Air Pollution Control Engineering", Tokyo, 2004.*

3. *C.S.Rao., "Environmental Pollution Control Engineering", Wiley Eastern Ltd, Delhi.*

REFERENCE BOOKS

1. *David H.F. Liu, Bela G. Liptak "Air Pollution", Lweis Publishers, 2000.*

2. *Anjaneyulu. Y., "Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India, 2002.*

15CEE32 - THEORY OF ARCHITECTURE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Present architectural designs associated with spaces, mass, visual and emotional effects.*

CO2 : *Explain the design components and 3D structural concepts*

CO3 : *Explain components of building circulation, space requirements.*

CO4 : *Present the Design of buildings based on harmony, colour and punctuation effect.*

CO5 : *Present the acoustical design of buildings, classrooms, concert halls with suitable absorption materials.*

OVERVIEW OF ARCHITECTURE

Definition of Architecture - Elements of Architecture - need and fulfilment - Architecture design - An analysis - Integration of aesthetic and function - Mass and space, visual and emotional effects of geometric forms & their derivatives.   **(9)**

COMPONENTS OF DESIGN

Space - Form - Composition - Dimension - proportion, scale, balance, rhythm, symmetry, hierarchy, pattern and axis with building examples. Concept development - 3D design structural concept - structural arrangement, stability and load paths - rule of thumb sizing - Designing from a brief for specific user needs - Role of Brief and Basic brief development.   **(9)**

CIRCULATION

Function of building circulation - components of building circulation - The building approach, the building entrance, configuration of the path, Path space relationship, form of circulation space with examples. Simple circulation diagram for building.

Congregate living - housing - neighborly space outside dwelling - Integrated architecture design of medium depth space - Hierarchies of public / private space. Relationships between structure, Construction and spatial order. Understanding and meeting standards.   **(9)**

PRINCIPLES OF COMPOSITION

Unity, harmony & specific qualities of design to include dominance ,punctuating effect, dramatic effect, fluidity, climax accentuation and contrast with building examples. - Rendering - Developing an understanding the importance of colour schemes in design presentation as well as its application on built forms to create pleasing environment.   **(9)**

ARCHITECTURE ACOUSTICS

Sound waves - frequency - Intensity - wavelength - Decibel scale - Tone structure - Outdoor noise levels - Acceptable indoor noise levels - absorption co-efficient - measurement - Choice of absorption materials - Treatment for interior surfaces - basic principles in designing open air theatres- Cinemas - Broadcasting studios - Concert halls - Classrooms - Lecture halls and Theatres.   **(9)**

TOTAL : 45

REFERENCES

1. *Sir Bannister Fletcher, "A History of Architecture", Butterworths, London, 1987.*

2. *Fransis D.K. Ching, "Architecture - Form, Space and Order", Van Nostrand Publications, New York, 1979.*

3. *Ven Meiss, "Elements of Architecture", Van Nostrand Publications, London, 1986.*

15CEE33 - BUILDING SERVICES AND SYSTEMS ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *State the different provisions and rules applicable for equipment and machinery used in building construction and building services*

CO2 : *Explain with examples the different electrical systems based on specifications, methods, usage and code regulations used in building services*

CO3 : *Illustrate and draw the different illumination and design of lighting systems based on code and NBC regulations used in building services.*

CO4 : *Choose and apply the principles of refrigeration for building types as per code and NBC guidelines*

CO5 : *Choose the appropriate fire safety system as per the NBC for buildings*

MACHINERIES

Hot Water Boilers - Lifts and Escalators - Special features required for physically handicapped and elderly - Conveyors - Vibrators - Concrete mixers - DC/AC motors - Generators - Laboratory services - Gas, water, air and electricity **(9)**

ELECTRICAL SYSTEMS IN BUILDINGS

Basics of electricity - Single / Three phase supply - Protective devices in electrical installations - Earthing for safety - Types of earthing - ISI specifications - Types of wires, wiring systems and their choice - Planning electrical wiring for building - Main and distribution boards - Transformers and switch gears - Layout of substations **(9)**

PRINCIPLES OF ILLUMINATION & DESIGN

Visual tasks - Factors affecting visual tasks - Modern theory of light and colour - Synthesis of light - Additive and subtractive synthesis of colour - Luminous flux - Candela - Solid angle illumination - Utilisation factor - Depreciation factor - MSCP - MHCP - Lans of illumination - Classification of lighting - Artificial light sources - Spectral energy distribution - Luminous efficiency - Colour temperature - Colour rendering.

Design of modern lighting - Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types. **(9)**

REFRIGERATION PRINCIPLES & APPLICATIONS

Thermodynamics - Heat - Temperature, measurement transfer - Change of state - Sensible heat - Latent heat of fusion, evaporation, sublimation - saturation temperature - Super heated vapour - Subcooled liquid - Pressure temperature relationship for liquids - Refrigerants - Vapour compression cycle - Compressors - Evaporators - Refrigerant control devices - Electric motors - Starters - Air handling units - Cooling towers - Window type and packaged air-conditioners - Chilled water plant - Fan coil systems - Water piping - Cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C. Systems **(9)**

FIRE SAFETY INSTALLATION

Causes of fire in buildings - Safety regulations - NBC - Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types - Heat and smoke detectors - Fire alarm system, snorkel ladder - Fire lighting pump and water storage - Dry and wet risers - Automatic sprinklers **(9)**

TOTAL : 45

TEXT BOOKS

1. E.R. Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York, 1968.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. Philips, Derek "Lighting in Architectural Design", McGraw-Hill, New York, 1964.

REFERENCE BOOKS

1. R.G. Hopkinson and J.D. Kay, "The Lighting of buildings", Faber and Faber, London, 1969.
2. William H. Severns and Julian R. Fellows, "Air-conditioning and Refrigeration", John Wiley and Sons, London, 1988.
3. A.F.C. Sherratt, "Air-conditioning and Energy Conservation", The Architectural Press, London, 1980.
4. SP7 : 2005, National Building Code of India.

15CEE34 - ENGINEERING RISK AND BENEFIT ANALYSIS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *List a variety of techniques to identify, assess, manage and monitor risk*

CO2 : *Demonstrate reliability analysis on engineering systems*

CO3 : *Develop contingency and consequence assessment plans.*

CO4 : *Develop a framework and process for management of risk in decision making.*

CO5 : *Examine the role of insurance in risk management*

CO6 : *Describe and evaluate the use of structural forensics in construction projects*

ENGINEERING RISK

Knowledge and Ignorance, Information Uncertainty in Engineering Systems, Introduction and overview of class; definition of Engineering risk; overview of Engineering risk analysis. Risk Methods: Risk Terminology, Risk Assessment, Risk Management and Control, Risk Acceptance, Risk Communication, Identifying and structuring the Engineering risk problem; developing a deterministic or parametric model. **(9)**

SYSTEM DEFINITION AND STRUCTURE

System Definition Models, Hierarchical Definitions of Systems, System Complexity. Reliability Assessment: Analytical Reliability Assessment, Empirical Reliability Analysis Using Life Data, Reliability Analysis of Systems. **(9)**

CONSEQUENCE ASSESSMENT

Types, Cause-Consequence Diagrams, Microeconomic Modelling, Value of Human Life, Flood Damages, Consequence Propagation. Engineering Economics: Time Value of Money, Interest Models, Equivalence. **(9)**

DECISION ANALYSIS

Risk Aversion, Risk Homeostasis, Influence Diagrams and Decision Trees, Discounting Procedures, Decision Criteria, Tradeoff Analysis, Repair and Maintenance Issues, Maintainability Analysis, Repair Analysis, Warranty Analysis, Insurance Models.**(9)**

FORENSIC ENGINEERING

Forensic - linguistics, materials engineering, polymer engineering and vehicular accident reconstruction. **(9)**

TOTAL : 45

TEXT BOOK

1. *B. M. Ayyub, "Risk Analysis in Engineering and Economics", Chapman-Hall/CRC Press, 2003.*

REFERENCES

1. *Ayyub & McCuen, "Probability, Statistics, and Reliability for Engineers and Scientists", 2003.*

2. *H. Kumamoto and E. J.Henley, "Probabilistic Risk Assessment and Management for Engineers and Scientists", Second Edition, IEEE Press, New York, 1996.*

3. *Bedford, T. and Cooke, R., "Probabilistic Risk Analysis: Foundations and Methods", Cambridge University Press, New York, 2001.*

4. *C. Perrow, "Normal Accidents, Living with High-Risk Technologies", Princeton University Press, 1999.*

5. *Kunreuther, Howard C, Vicki M. Bier and James R. Phimister, eds, "Accident Precursor Analysis and Management : Reducing Technological Risk Through Diligence", National Academy of Engineering, National Academies Press, Washington, DC, 2004.*

15CEE35 - DISASTER MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : *Identify natural and manmade disasters*

CO2 : *Explain in detail about causes and effects of natural and manmade disasters.*

CO3 : *Apply geospatial techniques (including GIS) that can enhance vulnerability assessments*

CO4 : *Identify and analyse the factors that give rise to differential vulnerabilities and levels of community resilience and suggest necessary mitigation plans*

CO5 : *Assess and manage these vulnerabilities through disaster planning and policy-making.*

NATURAL DISASTERS

Cyclones, Floods, Drought and Desertification - Earthquake, Tsunami, Landslides and Avalanche. **(9)**

MAN MADE DISASTERS

Chemical industrial hazards, major power breakdowns, traffic accidents, Fire, War, Atom bombs, Nuclear disaster- Forest Fire-Oil fire -accident in Mines. **(9)**

GEOSPATIAL TECHNOLOGY

Remote sensing, GIS and GPS applications in real time disaster monitoring, prevention and rehabilitation- disaster mapping.
(9)

RISK ASSESSMENT AND MITIGATION

Hazards, Risks and Vulnerabilities - Disasters in India, Assessment of Disaster Vulnerability of a location and vulnerable groups- Preparedness and Mitigation measures for various Disasters- Mitigation through capacity building -Preparation of Disaster Management Plans. **(9)**

DISASTER MANAGEMENT

Legislative responsibilities of disaster management- Disaster management act 2005- post disaster recovery & rehabilitation, Relief & Logistics Management; disaster related infrastructure development- Post Disaster, Emergency Support Functions and their coordination mechanism. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Khanna B K, "All You Wanted To Know About Disasters", New India Publishing Agency, New Delhi, 2005.*

2. *Ramana Murthy, "Disaster Management", Dominant, New Delhi, 2004.*

3. *Rajdeep Dasgupta, "Disaster Management and Rehabilitation", Mittal Publishers, New Delhi, 2007.*

REFERENCES

1. *Disaster Management in India- A Status Report- Published by the National Disaster Management Institute, Ministry of Home Affairs, Govt. of India, 2004.*

2. *Murthy D. B. N., "Disaster Management: Text and Case Studies", Deep and Deep Publications (P) Ltd., New Delhi, 2007.*

3. *Sundar I. and Sezhiyan T., "Disaster Management", Sarup and Sons, New Delhi, 2007.*

15CEE36 - RENEWABLE ENERGY RESOURCES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : Explain the current energy scenario and future energy usage in India.

CO2 : Explain the concepts of solar energy, wind energy, tidal energy and biomass energy.

CO3 : Compare the energy utilization from wind energy, solar energy, biomass energy and tidal energy.

CO4 : Discuss the challenges and problems associated with the use of energy sources.

ENERGY PERSPECTIVES

Conventional and non conventional energies - Energy and sustainable development - Global energy scenario - Energy scenario in India - Energy consumption pattern in rural and urban regions in India - Energy efficiency and economy - Energy losses and its control - Renewable energy potential mapping - Plant load factor **(9)**

SOLAR ENERGY PERSPECTIVES

Concept of solar energy - Solar energy to light and to thermal conversions - Total energy and necessary infrastructure - Units and measurement of solar radiation - Temperature dependent collecting devices and their efficacies - Design aspects - Typical applications: heating, cooling, lighting, power generation and cooking. **(9)**

WIND ENERGY PERSPECTIVES

Wind potential in India - Wind turbines and their types - Merits and demerits - Wind power and appropriate coefficient - Efficiency and performance of wind machines -Energy conversion and storage - Synchronous invertors - Various storage aspects: battery, fly wheel, hydrogen and compressed air. **(9)**

BIOMASS ENERGY PERSPECTIVES

Biomass potential in India - Gobar gas and producer gas - Characteristics of biomass - Operation and design of biogas plants - Objectives, principles and operational aspect of biogassifiers - Pyrolysis and incineration - Power generation from municipal solid waste and industrial Sludges - Application of biodiesel plants - Fuel cells. **(9)**

TIDAL ENERGY PERSPECTIVES

Tidal aspects in coastal India - Tidal energy conversion system: mechanical to electrical and thermal to electrical - Tidal force calculation and power generation - conceptualization and potential of geothermal energy - Geothermal vents. **(9)**

TOTAL : 45

TEXT BOOK

1. *Sukathme, S.P, "Solar Energy", Tata McGraw-Hill Book Co., New Delhi, 1993.*

REFERENCE BOOKS

1. *Rai, G.D., "Solar Energy Utilization", Khanna Publishers, New Delhi, 1993.*
2. *Angrist, S.W, "Direct Energy Conversion", Allied Publishers Ltd., Boston, 1971.*

15CEE37 - CONSTRUCTION PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : *Explain the life cycle approach to construction project management and address specific needs at the individual, team and organization level.*

CO2 : *Demonstrate an understanding of the contribution of design and construction discipline's processes.*

CO3 : *Assemble construction estimates using various techniques assessing quantities and costs.*

CO4 : *Employ appropriate practices to organize and manage men, materials, time, cost, quality and productivity of a construction project.*

CO5 : *Apply management process to monitor and control the project performance.*

CONSTRUCTION PROJECT PERSPECTIVES

Construction Project Life Cycle - Types of Construction - Selection of Professional Services - Stake-holders in Construction Project - Structure of Project Organization - Perspectives of Owners & Builders - Turnkey Operation - Leadership and Motivation for the Project Team - Role of Project Managers - Financing of Constructed Facilities - Evaluation of Alternative Financial Plans - Loans, Bonds, Mortgages, Debentures and Shares. **(9)**

DESIGN AND CONSTRUCTION PROCESS

Design and Construction as an Integrated System - Innovation and Technological Feasibility - Innovation and Economic Feasibility -Value Engineering and Management in Construction - Construction Site Environment **(9)**

PROJECT COST ESTIMATION & MANAGEMENT

Various Types of Project Cost - Costs Associated with Constructed Facilities - Method of Structuring Project Cost - Clients' Estimate of Project Cost - Contractors Estimation of Project Cost - Type of Construction Cost Estimates - Methods for Allocation of Joint Costs - Historical Cost Data - Cost Indices - Applications of Cost Indices to Estimating - Estimate Based on Engineer's List of Quantities - Estimation of Operating Costs - Construction Economics - Economic Decision Making - Time Value of Money - Evaluating Alternatives. **(9)**

RESOURCE PLANNING AND MANAGEMENT

Types of Project Plans - Work Breakdown Structure - Resources Levelling - Resource Allocation - Importance of Project Scheduling - Various Types of Project Scheduling - Labour Productivity - Factors Affecting Job-Site Productivity - Labour Relations in Construction - Materials Management - Material Procurement and Delivery - Inventory Control - Trade offs of Costs in Materials Management - Construction Equipment - Choice of Equipment and Standard Production Rates - Construction Processes Queues and Resource Bottlenecks - Introduction to Network Analysis and Network Crashing. **(9)**

PROJECT MONITORING AND CONTROL

Project Progress Control - Updating of Project Progress using Bar Chart, PERT/CPM, Precedence Network - Progress Reports - Monthly Progress Report - Measuring Progress at Site - Typical Reports to aid Progress Review - Stage-wise Completion Cost - Standard costing - Earned Value Methods for Schedule Performance and Cost Control - Profit/Loss at Completion - Disputes and Claims - Project Closure - Construction Closure - Financial Closure - Contract Closure - Project Managers' Closure - Lessons Learnt from the Project. **(9)**

TOTAL : 45

REFERENCES

1. *Kumar Neeraj Jha, "Construction Project Management - Theory and Practice", Pearson Publications - Dorling Kindersley (India) Pvt. Ltd., 2012.*

2. *Chris Hendrickson and Tung Au, "Project Management for Construction - Fundamental Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pittsburgh, 2000.*

3. *Chitkara, K.K., "Construction Project Management: Planning, Scheduling and Control", Tata McGraw-Hill Publishing Company, New Delhi, 1998.*

4. *Frederick E. Gould, "Construction Project Management", Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000.*

5. *Choudhury, S., "Project Management", Tata McGraw-Hill Publishing Company, New Delhi, 1988.*

6. *George J.Ritz , "Total Construction Project Management", McGraw-Hill Inc, 1994.*

15CEE38 - ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : *Outline the overall perspectives of Environmental Impact Assessment.*

CO2 : *Design the necessary tools pertaining to assessment of various impacts.*

CO3 : *Recognize and synthesis the diversified socio-economic impacts on the society.*

CO4 : *Design and develop the significant protocols for Environment Management Plan.*

CO5 : *Synthesize and discretise the various impacts originating from typical developmental projects.*

ENVIRONMENTAL IMPACT ASSESSMENT PERSPECTIVES

Impact assessment introduction -Historical perspective -Scope and goals of EIA - Legal and Regulatory aspects in India - Types and limitations of EIA - Scope studies for Environmental Impact Studies (EIS). Preparation for EIS Planning, Public Participation and Review of EIS. **(9)**

ASSESSMENT AND MONITORING

Environmental setting - environmental impact assessment methodology- cost benefit analysis, environmental indices and indicators for describing affected environment, Life cycle assessment. Role of remote sensing and GIS in Environmental Impact Assessment **(9)**

SOCIO-ECONOMIC IMPACT ASSESSMENT

Types, steps in performing socio economic impact assessment, analysis of public services and facilities impacts, social impacts, impacts of economic profile of the community. **(9)**

ENVIRONMENTAL MANAGEMENT PLAN

Environmental Management Plan - preparation, implementation and review - Mitigation and Rehabilitation Plans - Policy and guidelines for planning and monitoring programmes - Post project audit - Ethical and Quality aspects of Environmental Impact Assessment. **(9)**

SECTORAL ENVIRONMENTAL IMPACT ASSESSMENT

EIA related to the following sectors - Infrastructure -construction and housing Mining - Industrial - Thermal Power - River valley and Hydroelectric projects-Nuclear Power- EIA for coastal projects. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Canter.R.L, "Environmental Impact Assessment", McGraw Hill, New Delhi, 1996.*

2. *Shukla,S.K., Srivastava.P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.*

REFERENCE BOOKS

1. *Rao, J.G., and Wotten, D.C., "Environmental Impact Analysis, Handbook", McGraw-Hill, 1980.*

2. *Van Nostr, and Reinhold, J.E. Heer, Hagerty,D. J., "Environmental Assessment and Statement", 1977.*

3. *Canter, L.W., "Environmental Impact Assessment", McGraw-Hill, New York, 1996.*

4. *"Environmental Assessment Source book", Vol. I, II &III, The World Bank, Washington, D.C, 1991.*

15CEE39 - SOLID AND HAZARDOUS WASTE MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : Outline the salient features of solid waste management and handling.

CO2 : Deduce the source reduction, recycling and reuse techniques of solid waste.

CO3 : Analyze the collection systems and method of transfer of solid waste.

CO4 : Describe the processing techniques for solid and hazardous waste.

CO5 : Select the suitable methods for disposal of solid and hazardous waste.

CO6 : Interpret the legislation for management, handling and disposal of solid and hazardous waste.

CHARACTERISTICS AND SOURCE REDUCTION OF SOLID WASTE

Definition, sources, and types of solid waste - Composition, physical, chemical and biological Properties of solid wastes - Per capita generation rates - Sampling and characterization of solid waste - Source reduction of wastes -Waste exchange - Recycling and reuses - Salient features of Indian legislations on management and handling of municipal solid wastes. **(9)**

COLLECTION AND TRANSPORT OF SOLID WASTE

Estimation of solid waste and factors affecting generation rates - On-site handling, storage, and processing- Collection services: municipal and commercial - Industrial services - Collection systems: Hauled-container system (HCS) and stationary container system (SCS) - Vehicle and labour assessment - Assessment of collection route - Transfer and transport - Transfer station location- Means and methods of transfer. **(9)**

PROCESSING AND DISPOSAL OF SOLID WASTE

Objective of processing - material separation and processing technologies- biological, chemical and thermal conversion technologies- disposal in Landfills: site selection methods and operations, leachate and gas generations and movement and control of gas and leachate techniques - Composting: aerobic and anaerobic - Resource and energy recovery schemes. **(9)**

HAZARDOUS WASTE CHARACTERIZATION AND MANAGEMENT

Definitions and Identifications of hazardous waste - Origin and characterization of hazardous solid waste- Typical hazardous wastes in MSW - Hazardous waste management: minimization, collection, storage, handling, transport, and disposal - design of hazardous waste landfills - TCLP tests - National and International legislation for hazardous waste management - Atomic Energy Regulatory Board -International Atomic Energy Agency - Department of Atomic Energy - Nuclear Power Corporation - Nuclear power plants in India. **(9)**

NUCLEAR WASTEAND e-WASTE

Sources - classification - effects of nuclear waste- initial treatment of nuclear waste - vitrification, ion exchange, synroc - long term management - above ground disposal, geological disposal, ocean dumping, transmutation, space disposal - reuse of waste - nuclear safety and waste regulation - case study on nuclear disaster - source of e- waste - material composition of e - waste - recycling and recovery - integrated approaches to e - waste recycling - socio economic factors - treatment option - disposal option - e - waste legislation. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Tchobanoglous, G. et al., "Integrated Solid Waste Management", McGraw-Hill Publication., New York,1993.*

2. *Ronald E. Hester,Roy M. Harrison "Electronic Waste Management", Royal Society of Chemistry, 2009.*

REFERENCE BOOKS

1. *Peavy, SH, Rowe, RD and Tchobanoglous, G, "Environmental Engineering", McGraw-Hill Inter Edition,1985.*

2. *Charles, A.W., "Hazardous Waste Management", McGraw-Hill Publications, 2002.*

15CEE40 - PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : *Outline the concepts, components and factors affecting Sustainable development.*

CO2 : *Discuss the significance of International summits, conventions and agreements on Sustainable development.*

CO3 : *Describe the necessity and importance of Indian and International legal aspects in Sustainability.*

CO4 : *Illustrate the socio economic policies and public participation in Sustainable development.*

CO5 : *Discuss the role and commitment of developed countries in Sustainable development.*

CO6 : *Describe the concepts of Life cycle Assessment and Environmental Standards.*

CONCEPTS OF SUSTAINABLE DEVELOPMENT

Sustainable development- Evolution of Environmental awareness and Sustainable development, global Sustainable development goals -components and factors affecting Sustainable development-Demographic dynamics and sustainability- Environmental issues and crisis- ozone layer depletion, global warming and climate change -International Environmental summits, conventions and agreements- Action plan for Sustainable development- Transboundary issues - Role of developed and developing countries in sustainable development. **(9)**

ENVIRONMENTAL ASPECTS

Biodiversity- Types of biodiversity-Threats to biodiversity- Ecological indicators- Ecological foot print- Carbon foot print- Conservation biology- Strategic species concepts- Ecological economics- Environmental impact of agriculture, animal husbandry, fishery and land use- Habitat fragmentation- Desertification- Natural disasters, geological, hydrological, meteorological and health- Nuclear issues. **(9)**

ECONOMIC ASPECTS

Production, Consumption, Investment and Exchange of Goods and Services Macroeconomic Aggregates, Circular Flow of Income and its Criticism- Methods of Calculating National Income- GNP and GDP- The Goods Market: determination of equilibrium output -Financial Markets: demand for money and interest rates- Goods and Financial markets: IS-LM Model- General Overview of Fiscal and Monetary Policies-relative effectiveness- International Transactions and exchange rates- Market failure & Incomplete markets Externalities -UN Sustainable development policies through trade- World Trade Organization- International monetary fund and World bank. **(9)**

SOCIAL ASPECTS

Indigenous Knowledge and Natural Resource Management (NRM) -Commodification, marginalization and degradation - Indigenous knowledge and its relevance to sustainable development - Biopiracy and Biopolitics over Traditional Ecological knowledge (TEK) - Environmental Degradation in developing countries - Overview of development - Globalisation and the structural adjustments - Governance and welfare state- Development processes and social justice -Social inequality as a global challenge-marginalized/vulnerable groups, indigenous people, resettlement & rehabilitation and development. **(9)**

STRATEGIES FOR SUSTAINABLE DEVELOPMENT

Economic growth, carrying capacity- Resource depletion and resource protection-Sustainable Management of Forest, Land, water, fishery, agriculture, energy and ecosystem- Natural Disaster management- Cleaner Production, definition, aim, application- Generic process of Cleaner Production Assessment- Life cycle Assessment - definition, necessity and elements- ISO Environmental standards- Environmental Audit. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Brian Snowdon and Howard R. Vane, "Modern Macroeconomics", Edward Elgar, USA, 2005*

2. *Gupta N.K., "Macroeconomics", National Council of Educational Research and Training, New Delhi, 2012*

3. *Arun Kumar, "Macroeconomic Aspects of Goods and Services Tax", Economic and Political Weekly, 2015*

4. *Ramakrishnan, P. S., "Ecology and Sustainable Development", National Book Trust, New Delhi, 2001*

5. *Paul Robbins, John Hintz, and Sarah A. Moore, "Environment and Society: A Critical Introduction", Wiley-Blackwell, 2014*

REFERENCE BOOKS

1. *Nick Hanley, Jason F. Shogren and Ben White, "Environmental Economics in Theory and Practice", Macmillan Publishers, UK, 1997*

2. *Tietenberg T. and Lynne Lewis, "Environmental and Natural Resource Economics", Harper Collins, Routledge, 2016*

3. *Kolstad Charles D., "Environmental Economics", Oxford University Press, 2003*

15CEE41 - SAFETY ENGINEERING IN BUILDINGS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Demonstrate the safety concepts, policy and techniques.*

CO2 : *Demonstrate the issues related to physical and chemical hazards and control methods to reduce hazards.*

CO3 : *Outline the fire engineering and explosion control.*

CO4 : *Identify the method of safety provision in execution of civil works.*

CO5 : *Identify the safety consideration in erection and closing operations and material handling in civil construction works.*

CONCEPTS OF SAFETY ENGINEERING

Concept of safety - Evolution of modern safety concept- Safety policy - Safety Organization - line and staff - functions for safety- Safety Committee- budgeting for safety. Techniques- Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit. **(9)**

OCCUPATIONAL HEALTH AND HYGIENE

Physical hazards - Noise, noise exposure regulation, occupational damage, risk factors, and permissible exposure limit. Ionizing radiation, types, effects, monitoring instruments, control programs, control measures. Chemical hazards - Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. dose, Methods of Control. Concept and spectrum of health - functional units and activities of occupational health services, pre employment and post-employment medical examinations - occupational related diseases, levels of prevention of diseases. **(9)**

FIRE ENGINEERING AND EXPLOSION CONTROL

Fire chemistry - Dynamics of fire behavior - Fire properties of solid, liquid and gas - Fire spread - Toxicity of products of combustion. Building evaluation for fire safety - Fire load -Fire resistance materials and fire testing -Structural Fire protection - Exits and egress. Statutory Rules and Techniques of fire fighting - Indian Explosive acts and rules -Techniques of fire fighting and demonstration. **(9)**

SAFETY IN CONSTRUCTION

General safety consideration - analyzing construction jobs for safety - Contract document -Safety certificate for statutory authorities for old building and construction. Safety in Erection and closing operation - Construction materials -Specifications - suitability - Limitations. Safety in typical civil structures - Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring. **(9)**

SAFETY IN MATERIAL HANDLING

General safety consideration in material handling - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears. Selection, operation and maintenance of Industrial Trucks - Mobile Cranes - Tower crane -Checklist - Competent persons. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Krishnan N.V., "Safety Management in Industry", Jaico Publishing House, Bombay, 1997.*

2. *"Accident Prevention Manual for Industrial Operations", N.S.C.Chicago, 1982.*

REFERENCES

1. *"Handbook of Occupational Health and Safety", NSC Chicago, 1982.*

2. *James, D., "Fire Prevention Handbook", Butterworths, London, 1986.*

3. *Gupta R.S., "Handbook of Fire Technology", Orient Longman, Bombay, 1997.*

4. *Fulman, J.B., "Construction Safety, Security, and Loss Prevention", John Wiley and Sons, 1979.*

5. *Alexandrov, M.P., "Material Handling Equipment", Mir Publishers, Moscow, 1981.*

6. *Rudenko N., "Material Handling Equipments", Mir Publishers, Moscow, 1981.*

15CEE42 - PROBABILITY AND STATISTICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : *Solve the problems involving random variables*

CO2 : *Solve the problems involving two dimensional random variables*

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

CO4 : *Calculate the experimental error and hence to control the extraneous variables involved in the experiment*

CO5 : *Define the fundamentals of quality control and the methods used for quality control*

STATISTICAL MEASURES

Measures of Central tendency - Mean Median, Mode, Geometric Mean and Harmonic Mean - simple problems.

Measures of Dispersion - Range, Quartile Deviation, Mean Deviation, Standard Deviation and Co-efficient of Variation - Simple problems.

Skewness - Meaning and Scope - Measures of Skewness - Kurtosis. **(9)**

CORRELATION AND REGRESSION

Correlation - Meaning and scope of Correlation - Scatter diagram, Karl Pearson's co-efficient of Correlation, Spearman's Rank Correlation, Multiple Correlation and partial correlation - simple problems.

Regression Analysis - Meaning and Scope of regression- Regression in two variables - Uses of Regression. **(9)**

TESTING OF HYPOTHESIS

Sampling distributions - Testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions - Tests for independence of attributes and Goodness of fit. **(9)**

THEORY OF PROBABILITY

Sample Space, Events, Axioms of probability, Conditional probability, Independent events, Theorem of total probability, Baye's Theorem. **(9)**

PROBABILITY DISTRIBUTIONS

Definition of Discrete and Continuous random Variables.

Discrete distributions: Binomial, Poisson and Geometric - Properties and simple problems.

Continuous distributions: Normal, Uniform Exponential - Properties and simple problems. **(9)**

TOTAL : 45

TEXT BOOKS

1. S.C. Gupta and V.K. Kapoor , "Fundamental of Mathematical Statistics", Tenth revised edition , 2002.

2. Rohatgi V.K., "Introduction to Mathematical Statistics", Wiley, 2002.

3. Bhat B. R., "Modern Probability Theory - An Introductory Text Book", Third Edition, New Age International, 2005.

4. Cochran W.G., "Sampling Techniques", Wiley Eastern Private Limited, 1972.

5. Sukhatme P.V. and Sukhatme, B.V., "Sampling Theory of Survey with Applications", Asia publishing House, 1977.

6. Venkataraman M.K., "Higher Mathematics for Engineering and Science", National Publishing Company, 2000.

7. Veerarajan T., "Probability, Statistics and Random Processes", Second Edition, TataMcGraw-Hill, 2007.

REFERENCE BOOKS

1. Feller W., "Introduction to Probability Theory and its Applications", Vol. II, Second Edition, Wiley Eastern, 1972.

2. Hogg R.V, Craig A and Mckean W.J., "Introduction to Mathematics Statistics", Sixth Edition, Pearson, 2005.

3. Johnson and Kotz, "Distributions in Statistics", Princeton University Press, 1972.

15CEE43 - ENTREPRENEURSHIP IN CIVIL ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1   : Define the concepts of entrepreneurship

CO2   : Define the industrial enterprises

CO3   : State the business taxation laws

CO4   : State the business and corporate laws

CO5   : Define the banking financial services, auditing and insurance for enterprises.

CONCEPT OF ENTREPRENEURSHIP

Entrepreneur- Qualities of an Entrepreneur - Functions of Entrepreneurs -Classification of Entrepreneurs -Entrepreneurship - Meaning - Factors influencing Entrepreneurship - Intrapreneurship-Corporate Entrepreneurship/Intrapreneurship- Entrepreneurial Organizations and Strategic Management- Innovation and Entrepreneurial Marketing- Managerial Competencies as an Entrepreneurial Manager- Business idea generation techniques - Identification of Business opportunities - Feasibility study - Preparation of Project Report - Tools of Appraisal.   **(9)**

INDUSTRIAL ENTERPRISES

Classification of industries - large, Micro, Small and Medium small (MSME), heavy, light, private, public, joint cooperative sector, multinational, cottage, tiny, village, ancillary, basic, capital intensive, labour intensive industries. Institution for the development of small scale industries - NSIC, SIDCO, SIDO, SISI - TANSI, DIC, Directorate of Industries and Commerce, Concessions, rebates, incentives and subsidies to small scale units- All India Financial Institutions -Commercial Banks - Startup India, Stand Up India, Mudra Loan - Industrial Estates-Special Economic Zones(SEZ)-Export Oriented Units(EOU) Procedures in setting of small scale units - Licensing - Registration - Financing - Working   **(9)**

BUSINESS TAXATION

Direct and indirect taxes-Income Tax- Income Tax Act 1961 - Basic Concepts and Definitions - Income, Assessee, Person, Previous Year, Assessment Year, Gross Total Income, Total Income. Meaning of Permanent Account Number, Return of Income, TDS, Advance Tax, Rates of Taxation, Assessment Procedure. Service Tax-Customs Duty, Excise Duty -Goods And Services Tax (GST)-Definitions- computations- Deductions-exemptions-- Registration of an Assessee- Payment of Tax- Furnishing of Return- Interest as Delayed Payment of Tax- Punishments/ Penalties Relating to Taxes- Appeal before the respective Commissioners- Appeal before Appellate Tribunal.   **(9)**

BUSINESS AND CORPORATE LAW

Indian Contract Act - Formation - Terms of contract - Forms of contract - Offer and Acceptance Considerations. Capacity - Flaw in consent, Void agreements - Illegal agreements. Memorandum of Association - Contents and Alteration - Doctrine of Ultra Vires - Articles of Association - Contents - Distinction between the Two - Share Capital - Kinds of Shares - Voting Rights - Borrowing powers of companies -Membership in a company - Directors - Legal position - Appointment, removal, Rights, Duties and Powers - Qualification and Disqualification. Meetings and Resolutions - Statutory Meeting - Annual General Meeting - Extra - Ordinary General Meeting - Resolutions - Ordinary & Special. Definition of Audit - Difference between auditing and accountancy - Scope of auditing -Objectives of auditing - Nature and Scope of internal audit - Financial vs. operational audit - Internal control; nature and scope - Verification of evidence - Detailed checking vs. sample checking - Internal audit and statutory audit - Interface between internal auditor and statutory auditor.   **(9)**

BANKING FINANCIAL SERVICES AND AUDITING

Central Banking and Role of RBI and their functions. Commercial Banks - E - Banking -ATM Cards, Debit cards, Personal Identification Number - Electronic Fund Transfer-Electronic Clearing System. Negotiable Instruments - Promissory Note - Bills of Exchange, Cheque, Draft - Definitions, Features - Crossing - Endorsement - Material Alteration - Paying Banker - Rights and Duties - Statutory Protection - Dishonour of Cheques - Merchant Banking - Functions - Issue Management - Managing of new

issues - Underwriting - Capital market - Stock Exchange - Role of SEBI-Leasing and Hire purchase - Concepts and features - Types of lease Accounts-Factoring - Functions of Factor - Consumer finance - Venture capital - Mutual Funds - Credit Rating. Insurance - Different types - Life, marine, fire, motor, health, pension plan, annuity, rural insurance. **(9)**

TOTAL : 45

REFERENCE BOOKS

1.   *Srinivasan N.P, C.B Gupta., "Entrepreneurial Development", Sultan Chand and Sons Publishers, 2014.*

2.   *J.S. Saini, S.K. Dhameja., "Entrepreneurship and Small Business", Rawat Publications, 1998.*

3.   *B.N. Tandon, S. Sudharsanam, S. Sundharabahu., "A Handbook of Practical Auditing", S.Chand Limited, 2006.*

4.   *B. Santhanam., "Banking and Financial Systems", Margham Publishers, 2012.*

5.   *B. Santhanam., "Financial Services", Margham Publishers, 2016.*

6.   *Dr. M.N. Mishra., "Law of Insurance", Central law agency.*

7.   *H.P. Machiraju., "Indian Financial System", Vikas Publishing House Pvt. Ltd, 2007.*

8.   *S. Badre Alam ., P. Saravanavel ,"Mercantile Law".*

9.   *Vinod K. Singhania .,"Indirect Tax".*

15CEE35 - DISASTER MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1   :   Identify natural and manmade disasters

CO2   :   Explain in detail about causes and effects of natural and manmade disasters.

CO3   :   Apply geospatial techniques (including GIS) that can enhance vulnerability assessments

CO4   :   Identify and analyse the factors that give rise to differential vulnerabilities and levels of community resilience and suggest necessary mitigation plans

CO5   :   Assess and manage these vulnerabilities through disaster planning and policy-making.

NATURAL DISASTERS

Cyclones, Floods, Drought and Desertification - Earthquake, Tsunami, Landslides and Avalanche.   **(9)**

MAN MADE DISASTERS

Chemical industrial hazards, major power breakdowns, traffic accidents, Fire, War, Atom bombs, Nuclear disaster- Forest Fire- Oil fire -accident in Mines.   **(9)**

GEOSPATIAL TECHNOLOGY

Remote sensing, GIS and GPS applications in real time disaster monitoring, prevention and rehabilitation- disaster mapping.   **(9)**

RISK ASSESSMENT AND MITIGATION

Hazards, Risks and Vulnerabilities - Disasters in India, Assessment of Disaster Vulnerability of a location and vulnerable groups- Preparedness and Mitigation measures for various Disasters- Mitigation through capacity building -Preparation of Disaster Management Plans.   **(9)**

DISASTER MANAGEMENT

Legislative responsibilities of disaster management- Disaster management act 2005- post disaster recovery & rehabilitation, Relief & Logistics Management; disaster related infrastructure development- Post Disaster, Emergency Support Functions and their coordination mechanism.   **(9)**

TOTAL : 45

TEXT BOOKS

1.   *Khanna B K, "All You Wanted To Know About Disasters", New India Publishing Agency, New Delhi, 2005.*

2.   *Ramana Murthy, "Disaster Management", Dominant, New Delhi, 2004.*

3.   *Rajdeep Dasgupta, "Disaster Management and Rehabilitation", Mittal Publishers, New Delhi, 2007.*

REFERENCES

1.   *Disaster Management in India- A Status Report- Published by the National Disaster Management Institute, Ministry of Home Affairs, Govt. of India, 2004.*

2.   *Murthy D. B. N., "Disaster Management: Text and Case Studies", Deep and Deep Publications (P) Ltd., New Delhi, 2007.*

3.   *Sundar I. and Sezhiyan T., "Disaster Management", Sarup and Sons, New Delhi, 2007.*

15CEE36 - RENEWABLE ENERGY RESOURCES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : Explain the current energy scenario and future energy usage in India.

CO2 : Explain the concepts of solar energy, wind energy, tidal energy and biomass energy.

CO3 : Compare the energy utilization from wind energy, solar energy, biomass energy and tidal energy.

CO4 : Discuss the challenges and problems associated with the use of energy sources.

ENERGY PERSPECTIVES

Conventional and non conventional energies - Energy and sustainable development - Global energy scenario - Energy scenario in India - Energy consumption pattern in rural and urban regions in India - Energy efficiency and economy - Energy losses and its control - Renewable energy potential mapping - Plant load factor **(9)**

SOLAR ENERGY PERSPECTIVES

Concept of solar energy - Solar energy to light and to thermal conversions - Total energy and necessary infrastructure - Units and measurement of solar radiation - Temperature dependent collecting devices and their efficacies - Design aspects - Typical applications: heating, cooling, lighting, power generation and cooking. **(9)**

WIND ENERGY PERSPECTIVES

Wind potential in India - Wind turbines and their types - Merits and demerits - Wind power and appropriate coefficient - Efficiency and performance of wind machines -Energy conversion and storage - Synchronous invertors - Various storage aspects: battery, fly wheel, hydrogen and compressed air. **(9)**

BIOMASS ENERGY PERSPECTIVES

Biomass potential in India - Gobar gas and producer gas - Characteristics of biomass - Operation and design of biogas plants - Objectives, principles and operational aspect of biogassifiers - Pyrolysis and incineration - Power generation from municipal solid waste and industrial Sludges - Application of biodiesel plants - Fuel cells. **(9)**

TIDAL ENERGY PERSPECTIVES

Tidal aspects in coastal India - Tidal energy conversion system: mechanical to electrical and thermal to electrical - Tidal force calculation and power generation - conceptualization and potential of geothermal energy - Geothermal vents. **(9)**

TOTAL : 45

TEXT BOOK

1. Sukathme, S.P, "Solar Energy", Tata McGraw-Hill Book Co., New Delhi, 1993.

REFERENCE BOOKS

1. Rai, G.D., "Solar Energy Utilization", Khanna Publishers, New Delhi, 1993.
2. Angrist, S.W, "Direct Energy Conversion", Allied Publishers Ltd., Boston, 1971.

15CEE38 - ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the student will be able to

CO1   : Outline the overall perspectives of Environmental Impact Assessment.

CO2   : Design the necessary tools pertaining to assessment of various impacts.

CO3   : Recognize and synthesis the diversified socio-economic impacts on the society.

CO4   : Design and develop the significant protocols for Environment Management Plan.

CO5   : Synthesize and discretise the various impacts originating from typical developmental projects.

ENVIRONMENTAL IMPACT ASSESSMENT PERSPECTIVES

Impact assessment introduction -Historical perspective -Scope and goals of EIA - Legal and Regulatory aspects in India - Types and limitations of EIA - Scope studies for Environmental Impact Studies (EIS). Preparation for EIS Planning, Public Participation and Review of EIS. **(9)**

ASSESSMENT AND MONITORING

Environmental setting - environmental impact assessment methodology- cost benefit analysis, environmental indices and indicators for describing affected environment, Life cycle assessment. Role of remote sensing and GIS in Environmental Impact Assessment **(9)**

SOCIO-ECONOMIC IMPACT ASSESSMENT

Types, steps in performing socio-economic impact assessment, analysis of public services and facilities impacts, social impacts, impacts of economic profile of the community. **(9)**

ENVIRONMENTAL MANAGEMENT PLAN

Environmental Management Plan - preparation, implementation and review - Mitigation and Rehabilitation Plans - Policy and guidelines for planning and monitoring programmes - Post project audit - Ethical and Quality aspects of Environmental Impact Assessment. **(9)**

SECTORAL ENVIRONMENTAL IMPACT ASSESSMENT

EIA related to the following sectors - Infrastructure -construction and housing Mining - Industrial - Thermal Power - River valley and Hydroelectric projects-Nuclear Power- EIA for coastal projects. **(9)**

TOTAL : 45

TEXT BOOKS

1. Canter.R.L, "Environmental Impact Assessment", McGraw Hill, New Delhi, 1996.

2. Shukla,S.K., Srivastava.P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.

REFERENCE BOOKS

1. Rao, J.G., and Wotten, D.C., "Environmental Impact Analysis, Handbook", McGraw-Hill, 1980.

2. Van Nostr, and Reinhold, J.E. Heer, Hagerty,D. J., "Environmental Assessment and Statement", 1977.

3. Canter, L.W., "Environmental Impact Assessment", McGraw-Hill, New York, 1996.

4. "Environmental Assessment Source book", Vol. I, II &III, The World Bank, Washington, D.C, 1991.

15CEE39 - SOLID AND HAZARDOUS WASTE MANAGEMENT

ASSESSMENT : THEORY

L	T	P	C
3	0	0	3

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Outline the salient features of solid waste management and handling.*

CO2 : *Deduce the source reduction, recycling and reuse techniques of solid waste.*

CO3 : *Analyze the collection systems and method of transfer of solid waste.*

CO4 : *Describe the processing techniques for solid and hazardous waste.*

CO5 : *Select the suitable methods for disposal of solid and hazardous waste.*

CO6 : *Interpret the legislation for management, handling and disposal of solid and hazardous waste.*

CHARACTERISTICS AND SOURCE REDUCTION OF SOLID WASTE

Definition, sources, and types of solid waste - Composition, physical, chemical and biological properties of solid wastes - Per capita generation rates - Sampling and characterization of solid waste - Source reduction of wastes -Waste exchange - Recycling and reuses - Salient features of Indian legislations on management and handling of municipal solid wastes. **(9)**

COLLECTION AND TRANSPORT OF SOLID WASTE

Estimation of solid waste and factors affecting generation rates - On-site handling, storage, and processing- Collection services: municipal and commercial - Industrial services - Collection systems: Hauled-container system (HCS) and stationary container system (SCS) - Vehicle and labour assessment - Assessment of collection route - Transfer and transport - Transfer station location- Means and methods of transfer. **(9)**

PROCESSING AND DISPOSAL OF SOLID WASTE

Objective of processing - material separation and processing technologies- biological, chemical and thermal conversion technologies- disposal in Landfills: site selection methods and operations, leachate and gas generations and movement and control of gas and leachate techniques - Composting: aerobic and anaerobic - Resource and energy recovery schemes. **(9)**

HAZARDOUS WASTE CHARACTERIZATION AND MANAGEMENT

Definitions and Identifications of hazardous waste - Origin and characterization of hazardous solid waste- Typical hazardous wastes in MSW - Hazardous waste management: minimization, collection, storage, handling, transport, and disposal - design of hazardous waste landfills - TCLP tests - National and International legislation for hazardous waste management - Atomic Energy Regulatory Board -International Atomic Energy Agency - Department of Atomic Energy - Nuclear Power Corporation - Nuclear power plants in India. **(9)**

NUCLEAR WASTE AND e-WASTE

Sources - classification - effects of nuclear waste- initial treatment of nuclear waste - vitrification, ion exchange, synroc - long term management - above ground disposal, geological disposal, ocean dumping, transmutation, space disposal - reuse of waste - nuclear safety and waste regulation - case study on nuclear disaster - source of e- waste - material composition of e - waste - recycling and recovery - integrated approaches to e - waste recycling - socio economic factors - treatment option - disposal option - e - waste legislation. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Tchobanoglous, G. et al., "Integrated Solid Waste Management", McGraw-Hill Publication., New York, 1993.*

2. *Ronald E. Hester, Roy M. Harrison "Electronic Waste Management", Royal Society of Chemistry, 2009.*

REFERENCE BOOKS

1. *Peavy, SH, Rowe, RD and Tchobanoglous, G, "Environmental Engineering", McGraw-Hill Inter Edition, 1985.*

2. *Charles, A.W., "Hazardous Waste Management", McGraw-Hill Publication, 2002*

15CEE40 - PRINCIPLES OF SUSTAINABLE DEVELOPMENT

ASSESSMENT : THEORY

L	T	P	C
3	0	0	3

COURSE OUTCOME

At the end of this course, the student will be able to

CO1 : Outline the concepts, components and factors affecting Sustainable development.

CO2 : Discuss the significance of International summits, conventions and agreements on Sustainable development.

CO3 : Describe the necessity and importance of Indian and International legal aspects in Sustainability.

CO4 : Illustrate the socio economic policies and public participation in Sustainable development.

CO5 : Discuss the role and commitment of developed countries in Sustainable development.

CO6 : Describe the concepts of Life cycle Assessment and Environmental Standards.

CONCEPTS OF SUSTAINABLE DEVELOPMENT

Sustainable development- Evolution of Environmental awareness and Sustainable development, global Sustainable development goals -components and factors affecting Sustainable development-Demographic dynamics and sustainability- Environmental issues and crisis- ozone layer depletion, global warming and climate change -International Environmental summits, conventions and agreements- Action plan for Sustainable development- Transboundary issues - Role of developed and developing countries in sustainable development. **(9)**

ENVIRONMENTAL ASPECTS

Biodiversity- Types of biodiversity-Threats to biodiversity- Ecological indicators- Ecological foot print- Carbon foot print- Conservation biology- Strategic species concepts- Ecological economics- Environmental impact of agriculture, animal husbandry, fishery and land use- Habitat fragmentation- Desertification- Natural disasters, geological, hydrological, meteorological and health- Nuclear issues. **(9)**

ECONOMIC ASPECTS

Production, Consumption, Investment and Exchange of Goods and Services - Macroeconomic Aggregates, Circular Flow of Income and its Criticism- Methods of Calculating National Income- GNP and GDP- The Goods Market: determination of equilibrium output -Financial Markets: demand for money and interest rates- Goods and Financial markets: IS-LM Model- General Overview of Fiscal and Monetary Policies-relative effectiveness- International Transactions and exchange rates- Market failure & Incomplete markets Externalities -UN Sustainable development policies through trade- World Trade Organization- International monetary fund and World bank. **(9)**

SOCIAL ASPECTS

Indigenous Knowledge and Natural Resource Management (NRM) - Commodification, marginalization and degradation - Indigenous knowledge and its relevance to sustainable development - Biopiracy and Biopolitics over Traditional Ecological knowledge (TEK)- Environmental Degradation in developing countries - Overview of development- Globalisation and the structural adjustments- Governance and welfare state- Development processes and social justice -Social inequality as a global challenge- marginalized/vulnerable groups, indigenous people, resettlement & rehabilitation and development. **(9)**

STRATEGIES FOR SUSTAINABLE DEVELOPMENT

Economic growth, carrying capacity- Resource depletion and resource protection-Sustainable Management of Forest, Land, water, fishery, agriculture, energy and ecosystem- Natural Disaster management- Cleaner Production, definition, aim, application- Generic process of Cleaner Production Assessment- Life cycle Assessment- definition, necessity and elements- ISO Environmental standards- Environmental Audit.

(9)

TOTAL : 45

TEXT BOOKS

1. Brian Snowdon and Howard R. Vane, "Modern Macroeconomics", Edward Elgar, USA, 2005

2. Gupta N.K., "Macroeconomics", National Council of Educational Research and Training, New Delhi, 2012

3. Arun Kumar, "Macroeconomic Aspects of Goods and Services Tax", Economic and Political Weekly, 2015

4. Ramakrishnan, P. S., "Ecology and Sustainable Development", National Book Trust, New Delhi, 2001

5. Paul Robbins, John Hintz, and Sarah A. Moore, "Environment and Society: A Critical Introduction", Wiley-Blackwell, 2014

REFERENCE BOOKS

1. Nick Hanley, Jason F. Shogren and Ben White, "Environmental Economics in Theory and Practice", Macmillan Publishers, UK, 1997

2. Tietenberg T. and Lynne Lewis, "Environmental and Natural Resource Economics", Harper Collins, Routledge, 2016

3. Kolstad Charles D., "Environmental Economics", Oxford University Press, 2003

15CEE41 - SAFETY ENGINEERING IN BUILDINGS

ASSESSMENT : THEORY

L	T	P	C
3	0	0	3

COURSE OUTCOME

After successful completion of the course, student will be able to

CO1 : *Demonstrate the safety concepts, policy and techniques.*

CO2 : *Demonstrate the issues related to physical and chemical hazards and control methods to reduce hazards.*

CO3 : *Outline the fire engineering and explosion control.*

CO4 : *Identify the method of safety provision in execution of civil works.*

CO5 : *Identify the safety consideration in erection and closing operations and material handling in civil construction works.*

CONCEPTS OF SAFETY ENGINEERING

Concept of safety - Evolution of modern safety concept- Safety policy - Safety Organization - line and staff - functions for safety- Safety Committee- budgeting for safety. Techniques- Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit. **(9)**

OCCUPATIONAL HEALTH AND HYGIENE

Physical hazards - Noise, noise exposure regulation, occupational damage, risk factors, and permissible exposure limit. Ionizing radiation, types, effects, monitoring instruments, control programs, control measures. Chemical hazards - Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. dose, Methods of Control. Concept and spectrum of health - functional units and activities of occupational health services, pre-employment and post-employment medical examinations - occupational related diseases, levels of prevention of diseases. **(9)**

FIRE ENGINEERING AND EXPLOSION CONTROL

Fire chemistry - Dynamics of fire behavior - Fire properties of solid, liquid and gas - Fire spread - Toxicity of products of combustion. Building evaluation for fire safety - Fire load -Fire resistance materials and fire testing -Structural Fire protection - Exits and egress. Statutory Rules and Techniques of fire fighting - Indian Explosive acts and rules -Techniques of fire fighting and demonstration. **(9)**

SAFETY IN CONSTRUCTION

General safety consideration - analyzing construction jobs for safety - Contract document -Safety certificate for statutory authorities for old building and construction. Safety in Erection and closing operation - Construction materials -Specifications - suitability - Limitations. Safety in typical civil structures - Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring. **(9)**

SAFETY IN MATERIAL HANDLING

General safety consideration in material handling - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears. Selection, operation and maintenance of Industrial Trucks - Mobile Cranes - Tower crane -Checklist - Competent persons. **(9)**

TOTAL : 45

TEXT BOOKS

1. Krishnan N.V., *"Safety Management in Industry"*, Jaico Publishing House, Bombay, 1997.

2. *"Accident Prevention Manual for Industrial Operations"*, NSC Chicago, 1982.

REFERENCES

1. *"Handbook of Occupational Health and Safety"*, NSC Chicago, 1982.

2. James, D., *"Fire Prevention Handbook"*, Butterworths, London, 1986.

3. Gupta R.S., *"Handbook of Fire Technology"*, Orient Longman, Bombay, 1997.

4. Fulman, J.B., *"Construction Safety, Security, and Loss Prevention"*, John Wiley and Sons, 1979.

5. Alexandrov, M.P., *"Material Handling Equipment"*, Mir Publishers, Moscow, 1981.

6. Rudenko N., *"Material Handling Equipments"*, Mir Publishers, Moscow, 1981.

15MEOE01 - ROBOTICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : *Examine the configuration of a robot and suggest a robot for a particular operation (pick and place, welding, vision, climbing etc..).*

CO2 : *Calculate the position, velocity and acceleration for a robot manipulator and solve the forward and inverse kinematics for a specific robot.*

CO3 : *Calculate mass and inertia for the links of a robot manipulator and also find its forward and inverse dynamics.*

CO4 : *Choose appropriate vision system for the robot and extract images for the desired output.*

CO5 : *Write a program to determine a path for obstacle avoidance for a specific task using matrix laboratory software.*

INTRODUCTION

Brief history of robots, robot definitions, today's practical importance of robot applications, challenges faced by robots in industrial situations, future scope of robotics. **(6)**

GENERAL CONSIDERATION OF ROBOTIC MANIPULATORS

Introduction - Brief history of robotics- Robot geometrical configurations - wrist and gripper subassemblies - robot drive systems - robot software. **(7)**

KINEMATICS OF ROBOT MANIPULATORS

Homogeneous representation of objects, robot manipulator joint coordinate system, Euler angles and Euler transformations, Denavit- Hartenburg (D-H) representations, direct kinematics in robotics, inverse kinematic solutions, geometrical approach in inverse Kinematics, Jacobian of transformation in robotic manipulation. **(13)**

ROBOT WORKSPACE AND MOTION TRAJECTORY DESIGN

General Structure of robotic workspaces, robotic workspace performance index, extreme reach of robotic hands, robotic task description, robotic motion, trajectory design, general design considerations on trajectories, 4-3-4 trajectory, 3-5-3 trajectory, simulation of robotic workspaces. **(9)**

ROBOT SENSING AND ROBOT VISION SYSTEM

Desirable features of sensor- range sensors - proximity sensors - tactile sensors-force sensors, torque sensing detectors - TV cameras - illumination techniques - fundamentals of image processing visual data acquisition - image enhancement - image segmentation - image extraction and recognition- object and model matching - image

extraction. Typical vision systems, robot programming languages - characteristics of robot- level languages - characteristics of task level languages, simulation languages. **(10)**

TOTAL : 45

TEXT BOOK

1. *Fu.K S, Gonzales.R.C., and Lee.C.S.G., "Robotic Control, Sensing, Vision and Intelligence", McGraw Hill International, 2006.*

REFERENCE BOOKS

1. *Mikell.P.Groover, MitchellWeiss, Tooger.N.Nager, and NicholasG.Odrey, "Industrial Robotics Technology, Programming and Applications", McGraw Hill International, 2004.*

2. *Richard.D.Klafter, Thomas.A.Chmielewski, and Michaelnegin, "Robotic Engineering - An Integral Approach", Prentice Hall of India, 2002.*

15MEOE02 - LOW COST AUTOMATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : *Design and control simple automation systems using fluidics.*

CO2 : *Carry out design, selection and enhance existing automated system using fluidics.*

CO3 : *Demonstrate the importance of using electro mechanical systems in automation.*

CO4 : *Analysis and design of hydraulic circuits and some safety precautions in such circuits.*

INTRODUCTION

Fluid Power - Hydraulic and Pneumatic fluids - properties and selection. Advantages and applications of Fluid Power.   **(2)**

HYDRAULIC PUMPS AND MOTORS

Symbolic representation of fluid power elements. Hydraulic pumps and motors- principle of working, calculation of discharge, power and efficiency - simple problems.   **(8)**

HYDRAULIC VALVES

Pressure, flow and direction control valves, Electro hydraulic elements, accumulators, intensifiers, power calculations, size of accumulators - fluid seals - types and constructional details.   **(8)**

BASIC HYDRAULIC CIRCUITS

Unloading, speed control, regenerative and sequencing circuits. Servo systems, typical hydraulic circuits for machine tools and other industrial applications. Circuit design for given functional requirements.   **(9)**

PNEUMATICS

Air preparation units - Filter, Regulator and Lubricator. Valve configuration and controls. Pneumatic actuators, diaphragm actuators, back pressure sensors. Pneumatic circuits design - Cascade method.   **(7)**

HYDRO PNEUMATICS AND ELECTRO PNEUMATICS

Hydro-pneumatics and electro-pneumatic elements and circuits, KV map method and Ladder diagram   **(5)**

FLUIDICS

Fluidics - Coanda effect, wall attachment devices, digital and proportional devices. Fluidic amplifiers, typical application of fluidics for control in fluid power circuits.   **(6)**

TOTAL : 45

TEXT BOOKS

1. Anthony Esposito, *"Fluid Power with Application"*, Prentice Hall,2008.
2. Stewart, *"Practical Guide to Fluid Power"*, Taraporevala Sons & Co., Bombay, 2002.

REFERENCE BOOKS

1. Subir Kar, *"An Introduction to Fluidics"*, Oxford and IBH Publishing Co., New Delhi, 1984.
2. Fitch, E.C. Jr., *"Fluid Power and Control Systems"*, McGraw Hill Book Co., 1966.
3. Pippenger, J.J. and Hicks, T.G., *"Industrial Hydraulics"*, McGraw Hill Book Co., 1979.
4. Andrew Parr, *"Hydraulics and Pneumatics"*, Jaico Publishing House, 2008.

15MEOE03 - ADAPTIVE CONTROL AND PROCESS DYNAMICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : *Explain the different computer process control systems and its application.*

CO2 : *Develop the different digital controllers to suitable processes with or without time delay systems.*

CO3 : *Evaluate the advanced control concepts, system identification and process modeling.*

REVIEW OF SYSTEMS

Basic equation - Integral and instantaneous balances - Material and Energy balances - General form of dynamic models. Linearization of nonlinear systems in state space form - Response of lead-lag modules- Self-regulating system - transfer function analysis of higher order systems. **(6)**

SECOND ORDER SYSTEMS

A second order system - Pole-Zero cancellation - Systems in series - Blocks in parallel - linear boundary value problems - Parameter estimation of discrete linear systems. Phase plane analysis - generalization of phase plane behavior - nonlinear systems - Introduction to nonlinear dynamics - bifurcation behavior of systems **(9)**

APPLICATIONS

Stirred tank heaters, Absorption-isothermal, continuous stirred tank chemical reactors, Biochemical reactors - adiabatic continuous stirred tank reactor - ideal binary distillation columns. **(6)**

LINEAR DYNAMIC SYSTEM IDENTIFICATION

System Identification: Introduction, dynamic systems, models, system identification procedure. Simulation and Prediction. Non-parametric time and frequency domain methods. Linear dynamic system Identification: Overview, excitation signals, general model structure, time series models, models with output feedback, models without output feedback. Convergence and consistency. **(9)**

ADAPTIVE CONTROL

Parameter estimation methods, minimizing prediction errors, linear regressions and Least squares method, Instrumental - variable method, prediction error method. Recursive algorithms.Closed-loop Identification. Adaptive Control: Close loop and open loop adaptive control. Self-tuning controller. Auto tuning for PID controllers: Relay feedback, pattern recognition, and correlation technique. **(9)**

ADAPTIVE ADVANCED CONTROL

Adaptive Smith predictor control: Auto-tuning and self-tuning Smith predictor. Adaptive advanced control: Pole placement control, minimum variance control, generalized predictive control. **(6)**

TOTAL : 45

TEXT BOOKS

1. Bequette B.W., "Process Dynamics - Modeling, Analysis and Simulation", PHIPE, New Delhi, 1998.

2. Stephanopoulos G., "Chemical Process Control: An Introduction to Theory and Practice", Prentice Hall of India (P) Ltd., New Delhi, 2009.

REFERENCE BOOKS

1. *Shinsky F.G., "Process Control Systems: Application, Design and Adjustment", 3rd Edition, McGraw Hill Book Co., New York, 1988.*

2. *Nelles O., "Nonlinear System Identification", Springer Verlag, Berlin, 2011.*

3. *Ljung L., "System Identification: Theory for The User", Prentice Hall, Englewood Cliffs, 1999.*

4. *Astrom K., "Adaptive Control", Second Edition, Pearson Education Asia Pvt. Ltd., 2002.*

15MEOE04 - PROJECT PLANNING AND MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : *Evaluate and select the most desirable projects.*

CO2 : *Identify desirable characteristics of effective project managers.*

CO3 : *Apply appropriate approaches to plan a new project and develop a project schedule.*

CO4 : *Develop a suitable budget for a new project and Identify important risks.*

CO5 : *Apply appropriate techniques to assess ongoing project performance.*

INTRODUCTION

Project management- an overview, project identification and Screening; Project Appraisal. Introduction to Production Systems and a Generalized Model of Production. Life cycle of a Production System and Major managerial Decisions.   **(7)**

PROJECT PLANNING

Project Planning- Development of Project Network; Project Representation; Consistency and Redundancy in Project Networks; Project Scheduling- Basic Scheduling with A-O-A Networks; Basic Scheduling with A-O-N Networks; Project Scheduling with Probabilistic Activity Times.   **(7)**

TIME MANAGEMENT

Time/Cost Tradeoffs in Projects -Linear Time - Cost Tradeoffs in Projects: A Heuristic Approach; Resource Considerations in Projects - Resource Profiles and leveling. Limited Resource Allocation.   **(8)**

PROJECT IMPLEMENTATION

Project Monitoring and Control with PERT / Cost. Team Building and Leadership in Projects; Project Completion, Review and Future directions.   **(8)**

DECISION MAKING IN MANAGEMENT

Financial Evaluation of Production Related Decisions- Performance Measures of a Production System. Financial Evaluation of Capital Decisions. Decision Trees and evaluation of risk; Designing Products & Services - Introducing New Products and Services, Product Mix Decisions.   **(8)**

MANAGEMENT CONTROLS

Fundamentals of MRP I & MRP-II, Toyota production system - evolution of JIT - Waste elimination techniques - Pull control - kanban, kaizen. Lean manufacturing - agile manufacturing, Value chain analysis, Theory of Constraints (TOC) - bottleneck vs constrained resource - bottleneck identification and elimination - drum buffer rope systems.   **(7)**

TOTAL : 45

TEXT BOOKS

1. Shtub A., Bard J. F. &Globerson S., "Project management: engineering, technology, and implementation", 2nd Edition Prentice Hall, 2004.

2. Lock D., "Project management", Gower Publishing Ltd., 9th Edition, 2007.

3. Kerzner H., "Project Management: A Systems Approach to Planning, Scheduling and Controlling", John Wiley & Sons, 11th Edition, 2013.

REFERENCE BOOKS

1. Murthy P.R., "Production and Operations Management", New Age International (P) Ltd. Publishers,2nd Edition, 2006.

2. Mayer R.R., "Production management", McGraw-Hill, 1968.

3. Harding H.A., "Production management", Macdonald and Evans Ltd, 1974.

15MEOE05 - SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of this course, the students will be able to

CO1 : *Outline the manufacturing and product life cycle management process involved in a product.*

CO2 : *Formulate the forecasting methods and inventory modelling*

CO3 : *Estimate the right procurement and logistics strategy based on the supply chain and product criterion requirements.*

CO4 : *Design and analyze the right supply chain structure for the product along with distribution network*

CO5 : *Produce the supply chain network diagram incorporating supply chain strategy and competitive strategies involving material and information flow lines*

INTRODUCTION

Supply Chain, Objectives & Stages, power of SCM - Process views of a supply chain - Strategic planning, Achieving a strategic fit in a supply chain and factors affecting the strategic fit - Value chain, supply chain flow lines - Understanding a product, Product life cycle, Fishers classification of products - Effective and efficient supply chain - case studies on products.   **(9)**

SUPPLY CHAIN PROCESS

Forecasting in supply chain, forecast error distribution order quantity and reorder point characteristics & components of forecasting - time series methods of forecasting, Demand Management in MPC - MTS - ATO - MTO. Inventory, role of cycle inventory, economies of scale to exploit fixed costs, Economies of scale to exploit quantity discounts, Short term discounting and trade promotions Managing multi-echelon cycle inventory - Bullwhip effect - Product substitution, Postponement.   **(9)**

PRODUCT PROCUREMENT & TRANSPORTATION

Procurement process, EOQ - Sourcing in a supply chain - deciding factors for in-house or outsourcing -Supplier selection - auctions and negotiations, risk management in sourcing Freight management, Transportation networks, Milk run, Cross Docking, tailored transportation, 3PL - 4 PL, Risk management in transportation.   **(9)**

DESIGNING A SUPPLY CHAIN

Supply chain drivers - Supply chain performance measures - SCOR Model - Network design in a supply chain, factors influencing design, Framework for network design network, models for facility location and capacity allocation - Uncertainty in network design - Discounted cash flow analysis, Decision trees in evaluating network design - Distribution, factors influencing distribution, design options for a distribution network.   **(9)**

INFORMATION TECHNOLOGY IN SUPPLY CHAIN

Lean Supply Chain, agile supply chain, Dynamic supply chain design, Impact of technology on SCM, Key trends in SCM, IT in supply chain coordination and design - MRP, ERP, CRM, ISCM - Performance metrics.Discussion on supply chain adopted by primary industrial sectors and case studies.   **(9)**

TOTAL : 45

TEXT BOOK

1.   *Ayers J., "Hand Book of Supply Chain Management", The St. Lencie Press/ APICS Series on Resource Management, 2000.*

REFERENCE BOOKS

1. *Burt N.D., Dobler. W.D. and Starling L.S., World Class Supply Chain Management, The Key to Supply Chain Management", Tata McGraw Hill Publishing Company Limited, 2005.*

2. *Chopra S., Meindl P. and Kalra, D.V., "Supply Chain Management, Strategy, Planning and Operation", Pearson Education, Inc., 2008*

3. *Fredendall D.L. and Hill E., "Basics of Supply Chain Management", The St. Lucie Press / APICS Series on Resource Management, 2001.*

4. *Monczka R., Trent R. and Handfield R., "Purchasing and Supply Chain Management", 3rd edition, Thompson Learning Inc., 2007.*

5. *Sople V.V, "Supply Chain Management", Pearson Education, 2012*

6. *Vollmann T.E., Berry L.W., Whybark D.C. and Jacobs, R.F., "Manufacturing Planning and Control for Supply Chain Management", Tata McGraw Hill Publishing Company Limited, 2008.*

7. *Wild T., "Best Practice in Inventory Management", Butterworth - Heinmann, Elsevier Science Ltd.,2002.*

ADDITIONAL READING

1. *European Journal of Innovation Management*

2. *Logistics Information Management an International Journal*

3. *Supply Chain Management an International Journal*

4. *Sethi P.S., Yan H. and Zhang H., "Inventory and Supply Chain Management with Forecast Updates", Springer International Series, 2006.*

5. *Mohantry P.R. and Deshmukh G.S., "Supply Chain Management, Theories and Practices", Published by Biztantra Innovations in Management, 2005.*

6. *Kulkarani S and Sharma A., "Supply Chain Management", Tata McGraw Hill Publishing Company Limited, 2008.*

15MEOE06 - RESOURCE MANAGEMENT TECHNIQUES

L	T	P	C
2	2	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of the course, the students will be able to

CO1 : *Mathematically formulate a given engineering problem as a linear programming problem, and apply Graphical, Simplex, Two-Phase or Big-M methods to obtain the optimal solution.*

CO2 : *Construct or modify objective functions and constraints using primal and dual relationship, and apply the Dual Simplex Method to obtain optimal solutions.*

CO3 : *Justify the determined feasible solution (processing time and transportation cost) as optimal solution using MODI method and Hungarian method.*

CO4 : *Determine the optimal project duration and cost using CPM and PERT technique, also construct complex project network and control the complex project.*

CO5 : *Categorize (Inventory, Game Theory, Sequencing and Queuing) and solve various decision making problems using mathematical modeling.*

LINEAR PROGRAMMING

Linear programming formulation, graphical solutions, the essence of simplex method, setting up the simplex method, the simplex method in tabular form, Theory of simplex method, Big M Method, Two Phase Method. **(3+3)**

DUALITY AND SENSITIVITY ANALYSIS

Primal - Dual construction, Symmetric and Asymmetric Dual, Weak Duality Theorem, Complimentary Slackness Theorem, Main Duality Theorem, Dual Simplex Method, Sensitivity Analysis. **(4+4)**

TRANSPORTATION AND ASSIGNMENT

Formulation of Transportation Problem, Initial Feasible Solution Methods, Optimality Test, Degeneracy in Transportation Problem; Assignment Problem, Hungarian Method, Traveling Salesman Problem. **(4+4)**

NETWORK MODELS

Definition of network models - minimal spanning tree algorithm, shortest route algorithm, maximal flow algorithms, PERT, CPM - LP formulation of minimal spanning, maximum flow and PERT, CPM calculations. **(5+5)**

INVENTORY AND MODELS

Classical EOQ Models, EOQ Model with Price Breaks, EOQ with Shortage, Probabilistic EOQ Model, Newsboy Problem. **(3+3)**

GAME THEORY AND SEQUENCING

Two Person Zero Sum Game, Pure and Mixed Strategies, Algebraic Solution Procedure, Graphical Solution, Solving by Linear Programming; Sequencing Problem, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem. **(6+6)**

QUEUING AND SIMULATION

Elements of Queuing Model, Pure Birth Death Model, Single Server and Multi-server Markovian Models with Infinite and Finite Capacity, Machine Repair Model, Networks of Queues. System concepts - Types of systems and models - system simulation procedure - Monte- Carlo simulation method (simple problems) - Introduction to simulation languages. **(5+5)**

TOTAL : 30+30 = 60

TEXT BOOKS

1. Mohan, C. and Deep, Kusum: "Optimization Techniques", New Age, 2009.

2. Mittal, K. V. and Mohan, C. "Optimization Methods in Operations Research and Systems Analysis", Fourth Edition, New Age, 2016.

3. Taha, H. A, "Operations Research - An Introduction", Pearson, (9th Edition), 2014.

REFERENCE BOOKS

1. Ravindran, A., Phillips, D. T and Solberg, J. J. "Operations Research: Principles and Practice", John Willey and Sons, 2nd Edition, 2014.

2. Hiller, F. S. and Liebermann, G. J. "Introduction to Operations Research", Tata McGraw Hill, 2015.

3. S. S. Rao, "Engineering Optimization: Theory and Practice", 4th Edition, John Wiley & Sons, 2009.

15MEOE07 - SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of the course, the students will be able to

CO1 : *Infer environmental sustainability and to implement in more suitable ways to the society.*

CO2 : *Identify methods for reducing energy consumption and to implement lower carbon technologies to achieve sustainable society.*

CO3 : *Collect and organize information about historical perspectives of sustainability and for further development of sustainable industries.*

CO4 : *Compare the balance between food production and population growth to plan the optimal usage of water resources and to evaluate the solution for the problems of urban sprawl.*

CO5 : *Explore the fossil fuels formation of oil, natural gas and coal, environmental effects of mining and metals processing and it's time to depletion.*

INTRODUCTION

The concept of environmental sustainability, Examples of non-sustainability and sustainability. The special role of engineers in helping society transition to a more sustainable state. Definitions, principles, and indicators of sustainability. Overall criteria for development that is sustainable. Indicator studies. **(12)**

THE RISE OF SUSTAINABILITY

Historical perspectives in Europe and in the US. Modern debates: Sustainability extremists, Environmentalists, Traditional Engineers, and Anti-sustainability extremists. "Tragedy of the commons" and the ethics of sustainability. Models for achieving sustainable industries. **(12)**

POPULATION GROWTH ON A FINITE EARTH

Population models, population growth, exponential and logistic growth, variation in population among nations,population policy, Food production,Protecting and Promoting Human Health - Food security and nutrition and sustainable agriculture- Water resources, Urban sprawl. **(9)**

NON-RENEWABLE RESOURCES

Fossil fuels - Formation of fossil fuels: oil, natural gas, coal. Modelling of oil reserves. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies-Time-to-depletion. **(12)**

TOTAL : 45

TEXT BOOKS

1. *Tatyana P. Soubbotina, "An Introduction to Sustainable Development", Washington, 2nd Edition, 2004.*

REFERENCE BOOKS

1. *Jeffrey D. Sachs, "The Age of Sustainable Development", Columbia University Press, 4th Edition, 2015.*
2. *K.A.Rasure, "Globalization And Sustainable Development", Oxford book company, 2nd Edition, 2010.*
3. *Barry Dalal Clayton and Stephen Bass., "Sustainable Development Strategies- a resource book", Earthscan Publications Ltd, London, 2002.*
4. *Karel Mulder, "Sustainable Development for Engineers"- A Handbook and Resource Guide, Green Leaf Publishing, 2006.*

15MEOE08 - PROCESSING AND APPLICATIONS OF BIOMATERIALS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of the course, the students will be able to

CO1 : Identify the suitable material for human implants and perform mechanical and tribological characterization. (Tensile, compression, hardness, wear, corrosion and water absorption).

CO2 : Choose a bio compact material (calcium phosphate, ceramic, glass, bioinert ceramics, polymeric, HDPE, hybrid, metals and alloys, Ti Alloys - Co-Cr-Mo, Ni or Ta-Based Alloys - Other Non-Ferrous alloys) for a orthopedic joints.

CO3 : Develop successful implants (biological, mechanical, morphological Compatibility) for dental and bone applications.

CO4 : Evaluate biomaterials, metals, ceramics, polymers, micro/nano for Surface modification, micro/nano fabrication to find the tensile strength and micro structure.

CO5 : Estimate the percentage of reinforcement (particle, fiber, laminates) to increasing the strength (tensile, flexural, bending, fatigue, wear, and corrosion) under specified constraints (density) for human implants.

CO6 : Design a suitable shape of the implants for orthopedic joint applications.

FUNDAMENTALS OF BIOMATERIALS AND BIOCOMPATIBILITY

Introduction - definitions and their Implications - Biomaterial - Biocompatibility -Host response - Cell-Material Interactions - Experimental Evaluation of Biocompatibility - In vitro Tests - In vivo Tests - Steps for characterizations of biomaterials - Broad overview of Fundamentals. **(7)**

MATERIALS FOR ORTHOPEDIC APPLICATIONS

Introduction - Structure and Properties of Hard Tissues - Processing and Properties of Bioceramics and Bioceramic Composites - Calcium Phosphate Based Biomaterials - Hydroxyapatite-Ceramic Composites - Glass-Ceramics Based Biomaterials - Mica Based Glass Ceramics - Other Bioglass-Ceramics - Bioinert Ceramics - Polymeric Biomaterials - Polymer-Polymer Composites - Polymer-Ceramic Composites - HDPE-Hap-Al2O3 Hybrid Composites - Metals and Alloys in Biomedical Applications - Issues Limiting Performance of Metallic Biomaterials - Wear of Implants - Corrosion of Metallic Implants - Ti-Based Alloys - Co-Cr-Mo, Ni or Ta-Based Alloys - Other Non-Ferrous Metals and Their Alloys - Coating on Metals. **(12)**

TITANIUM DENTAL IMPLANT SYSTEMS

Introduction - Requirements for Successful Implant Systems - Biological Compatibility - Mechanical Compatibility - Morphological Compatibility - Osseo integration and Bone/Implant Interface - Integrated Implant System. **(7)**

PROCESSING OF BIOMATERIALS

Introduction - Processing of Biomaterials - Metals - Ceramics - Polymers - Biocomposites - Sterilization - Processing for Scale - Micro/Nano Surface Modification - Micro/Nano Fabrication-Tensile testing, microscopy (SEM,AFM)evaluation. **(7)**

BIOMATERIAL APPLICATIONS

Introduction - Applications in Medicine, Biology, and Artificial Organs - Cardiovascular Medical Devices - Extracorporeal Artificial Organs - Orthopedic Implants - Dental Implantation - Bioadhesive - Opthalmologic Applications - Cochlear Prosthesis - Drug Delivery - Tissue Engineering - 2-D and 3-D tissue engineering applications and their mechanical characterization -Array Technologies and Specific Medical Applications. **(12)**

TOTAL : 45

TEXT BOOK

1. BikramjitBasu, Ashok Kumar and Katti S., 'Advanced Biomaterials - Fundamentals, Processing and Applications', John Wiley & Sons, INC, Publication, 2015.

REFERENCE BOOKS

1. Joon. B. Park and Joseph D. Bronzino 'Bio Materials - Principles and Applications', CRC press, 2010.

2. Park J. B. and Lakes R.S., 'Bio Materials - An Introduction', Plenum Press, New York, 2009

3. Dee KC, Puleo and DA, Bizios R, 'An introduction to tissue-biomaterial interactions', John Wiley & Sons, 2007.

15MEOE09 - NUMERICAL SIMULATION OF FLUID FLOW

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of the course, the students will be able to

CO1 : *Demonstrate ability to use the Finite-Volume Method to analyze one and two-dimensional problems of heat transfer and irrotational fluid flow*

CO2 : *Apply numerical techniques to solve systems of algebraic equations and integrate ordinary differential equations*

CO3 : *Evaluate heat transfer rates, fluid flow rates, etc.*

CO4 : *Judge the correctness of the numerical solutions;*

CO5 : *Recognize the need for turbulence models*

CONSERVATION LAWS OF FLUID MOTION AND HEAT TRANSFER

Introduction - Governing equations of fluid flow and heat transfer - Navier-Stokes (N-S) equations for a Newtonian fluid **(9)**

IRROTATIONAL FLOWS AND LAMINAR BOUNDARY LAYERS

Introduction - Potential functions and stream functions - Numerical treatment of steady irrotational flows in two dimensions - Simple two-dimensional laminar flows - Boundary layer over a flat plate - Blasius solution - Numerical treatment of ordinary differential equations related to Blasius solution. **(9)**

NUMERICAL HEAT TRANSFER - FINITE VOLUME METHOD

Introduction - Discretization of governing partial differential equations of heat transfer- Applications to steady and unsteady heat conduction in one and two dimensions - Treatment of heat sources - Explicit and implicit solution schemes for steady and unsteady heat conduction. **(9)**

NUMERICAL TREATMENT OF FLUID FLOW - FINITE VOLUME METHOD

Discretization of governing partial differential equations of fluid flow - Differencing schemes for convective-diffusive flows - Treatment of flow boundary conditions - Introduction to the SIMPLE Algorithm. **(9)**

TURBULENT FLOWS

Introduction - Reynolds Averaged N-S equations for turbulent flows - Eddy viscosity concept - Mixing length models - Brief overview of turbulence kinetic energy and dissipation (k-e) models - Brief overview of advanced turbulent flow models. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Ghoshdastidar.P.S, "Computer Simulation of Flow and Heat Transfer", Tata McGrawHill, New Delhi, 1999.*

2. *Versteeg. H.K. and Malalasekara.W, "An Introduction to Computational Fluid Dynamics - The Finite Volume Method", Pearson Education, 2nd Edition, England, 2007.*

REFERENCE BOOKS

1. *Muralidhar. K., Sundararajan. T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 2003.*

2. *Niyogi P., Chakrabarthy. S.K., Laha. M.K., "Introduction to Computational Fluid Dynamics", Pearson Education, 2005.*

3. *Chung T.J., "Computational Fluid Dynamics", Cambridge Univ. Press, New York, 2002.*

4. *Anil W. Date, "Introduction to Computational Fluid Dynamics", Cambridge Press, UK, 2005.*

5. *Titus Petrila and Damian Trif, "Basics of Fluid Mechanics and Introduction to Computational Fluid Dynamics", Springer, Boston, 2005.*

15MEOE10 - SOLAR ENERGY UTILISATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

At the end of the course student will be able to

CO1 : *Calculate solar time, local time, earth-sun angles, direct and indirect solar radiation for the given location using earth-sun geometry.*

CO2 : *Categorize solar cell materials with its properties and calculate energy conversion efficiency of solar cells using I-V characteristic curves.*

CO3 : *Derive the expression for overall heat transfer coefficient using network resistance method, relations for collector efficiency factor and collector heat removal factor of non- concentrating solar collectors.*

CO4 : *Calculate heating loads using F-chart method for air and liquid based solar heating systems.*

CO5 : *Analyze the Performance of the following thermo-electric devices: generators, refrigerators and heat pumps.*

INTRODUCTION TO SOLAR ENERGY

Introduction, overview of applications - calculation of solar constant, terminology related to solar radiation, definition and calculation of solar times, definition and calculation of all solar angles and related earth angles. **(4)**

PHOTOVOLTAICS

Fundamentals of solar cells: types of solar cells, semiconducting materials, band gap theory, absorption of photons, excitons and photoemission of electrons, band engineering; Solar cell properties and design; p-n junction photodiodes, depletion region, electrostatic field across the depletion layer, electron and holes transports, device physics, charge carrier generation, recombination and other losses, I-V characteristics, output power. **(9)**

SOLAR CELL

Solar Cell Applications - Solar cell manufacturing processes: material resources, chemistry, and environmental impacts; low cost manufacturing processes - Thin film solar cells - Single crystal, polycrystalline and amorphous silicon solar cells, cadmium telluride thin-film solar cells, conversion efficiency. **(6)**

SOLAR CALCULATION AND SOLAR COLLECTORS

Calculation of extra-terrestrial irradiation on a horizontal surface on a hourly and daily basis, relationship between radiation on titled and horizontal surfaces, effect of atmosphere on solar radiation, Hottel's estimation of clear sky radiation, types and classification of solar collectors, terminology related to non-concentrating collectors, efficiency of a solar collector. **(4)**

THERMAL MODELLING OF NON- CONCENTRATING COLLECTORS

Modeling of heat transfer processes in flat plate collector, formula for effective transmittance-absorptance product, estimation of top, bottom and overall heat loss coefficient using resistance network method, collector stagnation temperature, temperature distribution between tubes and along tubes, collector efficiency factor F, collector heat removal factor FR, collector heat exchanger modeling and combined efficiency factor FR. **(10)**

SOLAR THERMAL CONVERSION

Overview of active and passive heating - Calculation of space and water heating loads, degree-days, F-chart method for air and liquid based system. Low, medium and high temperature collectors, Heat storage, storage media, steam accumulator, other storage systems, heat exchangers and applications of stored energy. **(6)**

THERMO- ELECTRIC SYSTEMS

Thermoelectricity, Peltier effect, Seebeck effect; thermoelectric materials, Bismuth telluride, automotive thermoelectric generators, radioisotope thermoelectric generator; thermoelectric power generators, thermoelectric refrigerators and heat pumps. **(6)**

TOTAL : 45

TEXT BOOKS

1. *Principles of Solar Engineering, D. Yogi Goswami, Taylor and Francis, 2000, ISBN 10: 1-56032- 714-6*

2. *Garg H.P., Prakash J., "Solar Energy: Fundamentals & Applications", Tata McGraw Hill, New Delhi, 1997.*

REFERENCE BOOKS

1. *Applied Photovoltaics, Stuart Wenham, Martin Green, and Muriel Watt, Earthscan, 2007, ISBN 1-84407-407-3*

2. *Photovoltaic Engineering Handbook, F. Lasnier and T. G. Ang, IOP Publishing UK (Adam Hilger USA) 1990, ISBN 0-85274-311-4*

3. *Semiconductor Devices, Physics, and Technology, Second Edition, S. M., Sze, New York, NY: Wiley, 2001. ISBN: 0471874248*

4. *Solar Cells: Operating Principles, Technology and system Applications, Martin A. Green, Published by the University of New South Wales, 1998, ISBN 0 85823 580 3*

5. *S. P. Sukhatme, "Solar Energy", Tata McGraw Hill, New Delhi, 1999.*

6. *J. A. Duffie and W.A.Beekman, " Solar Engineering of Thermal Processes", Jhon Wiley and Sons, New York, 2005.*

7. *Tiwari G.N.,Suneja S., "Solar Thermal Engineering System", Narosa Publishing House, New Delhi, 1997.*

8. *T.Bhattachariya, "Terrestial solar Photovoltaic", Narosa Publishers, New Delhi, 2008.*

9. *H.S.Rauschenbach, "Solar Cell Array Design Hand Book", Van NostrandReinfold Company, New York, 1980.*

15EEOE01- ENERGY AUDITING

L	T	P	C
3	0	0	3

COURSE OUTCOME

After successful completion of this course, the students will be able to

CO1 : *Understand the current energy scenario and the need for energy auditing.*

CO2 : *Describe the energy conservation schemes in steam systems.*

CO3 : *Identify the design considerations for minimizing energy consumption in compressors, fans and blowers.*

CO4 : *Understand the concepts of energy efficient electrical systems.*

CO5 : *List the techno commercial statement for the investment for energy saving.*

POWER AND ENERGY MANAGEMENT

Energy Scenario -Role of Energy Managers in Industries - Energy Monitoring, Auditing and Targeting - Economics of various energy conservation schemes -Total Energy Systems.   **(9)**

ENERGY CONSERVATION IN MECHANICAL PROCESSES

Energy Audit -Various Energy Conservation Measures in Steam - Losses in Boiler - Energy Conservation in Steam Systems - Case studies.   **(9)**

ENERGY CONSERVATION IN PRODUCTIVE PROCESSES

Energy Conservation in Centrifugal pumps, Fans, Blowers and Air compressor - Energy Consumption - Energy saving potentials - Design Consideration.   **(9)**

ENERGY CONSERVATION IN NON-PRODUCTIVE PROCESSES

Refrigeration and Air conditioning - Heat load estimation - Energy conservation in cooling towers and Spray ponds - Energy Efficiency in Lighting - Case studies.   **(9)**

ENERGY CONSERVATION CONTROL STRATEGIES AND IMPLEMENTATION

Control : Thermostats - Boiler controls - Proportional, Integral and Derivative control - Adaptive control - Compensators. Implementation: Investment and Pay back calculations for energy conservation measures - Organizational support for energy management motivation.   **(9)**

TOTAL : 45

TEXT BOOKS

1. *Eastop T.D and Croft D.R, "Energy Efficiency for Engineers and Technologists", Logman Scientific & Technical publications, 1990.*

2. *Reay D.A, "Industrial Energy Conservation", Pergamon Press, 1st Edition, 1977.*

3. *Larry C Witte et. al, "Industrial Energy Management & Utilization". Springer Publication, 1st Edition, 1990.*

REFERENCES

1. *D P Kothari and I J Nagrath, "Power System Engineering", Tata McGraw-Hill Co, 2nd Edition, 2008.*

2. *https://www.beeindia.gov.in/content/energy-auditors (Guide Book link)*

GUIDE BOOKS

2.1. *General Aspects of Energy Management & Energy Audit*

2.2. *Energy Efficiency in Thermal Utilities*

2.3. *Energy Performance Assistance for Equipment And Utility Systems*

2.4. *Energy Efficiency in Electrical Utilities*

15EEOE02 - SOLAR AND WIND ENERGY SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of this course, the students will be able to

CO1 : *Describe the solar radiation, measurements and characteristics of solar PV cell.*

CO2 : *Develop the model of a PV system and its applications.*

CO3 : *Describe the basic types and mechanical characteristics and model of wind turbine.*

CO4 : *Analyze the electrical characteristics and operation of various wind-driven electrical generators.*

CO5 : *Understand various power electronic converters used for hybrid system.*

SOLAR RADIATION AND SOLAR CELL FUNDAMENTALS

Basic Characteristics of Sunlight - Solar Spectrum - Insolation specifics - Irradiance and Irradiation Pyrometer - Solar Energy statistics - Solar PV cell - I-V Characteristics - P-V Characteristics- Fill Factor . Modeling of solar cell - Maximum Power Point Tracking. **(9)**

SPV SYSTEM PERFORMANCE AND APPLICATIONS

PV module - Blocking diode and Bypass diodes - Composite characteristics of PV module - PV array - Solar Cell Array Design concepts - Peak power operation - System components. PV-powered fan- PV fan with Battery Backup - PV Powered pumping system -PV Powered lighting systems - Grid connected PV systems. **(9)**

WIND ENERGY FUNDAMENTALS AND COMPONENTS

Wind source - Wind statistics - Energy in the wind - Basic principle of wind energy conversion - Nature of wind power - Wind turbine power characteristics - Parts of wind turbines - Braking systems - Tower-Maximum power operation. **(9)**

WIND TURBINE TYPES AND CONTROL

Classification of WECS - Generating Systems - DC Generator - Synchronous Generator - Induction Generator - Doubly fed Induction Generator - Direct Driven generator - Generator Control - Load Control. **(9)**

SYSETM INTEGRATION

Energy Storage - Power Electronic Converters for interfacing wind electric generators - Power Quality issues - Hybrid system: Wind-Diesel systems - Wind-Solar systems. **(9)**

TOTAL : 45

TEXT BOOKS

1. S N Bhadra, S Banerjee and D Kastha, "Wind Electrical Systems", Oxford University Press, 1st Edition, 2005.

2. Chetan Singh Solanki, "Solar Photovoltaic's: Fundamentals, Technologies and Applications", PHI Learning Publications, 2nd Edition, 2011.

REFERENCES

1. Roger A. Messenger and Jerry Ventre, "Photovoltaic Systems Engineering", Taylor and Francis Group Publications, 2nd Edition, 2003.

2. M.Godoy Simoes and Felix A. Farret, "Alternative Energy Systems: Design and Analysis with Induction Generators", CRC press, 2nd Edition, 2008.

3. Ion Boldea, "The Electric Generators Hand Book - Variable speed generators", CRC press,2010.

15EEOE03 - HYBRID SMART VEHICLES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of this course, the students will be able to

CO1 : *Explain the dynamics of vehicle motion and propulsion systems.*

CO2 : *Identify various energy storage devices used in hybrid vehicles.*

CO3 : *Understand the application of electric machines in electric vehicles.*

CO4 : *Describe the working of hybrid electric drive train*

CO5 : *Describe the control and energy management strategies in hybrid vehicles.*

INTRODUCTION

Introduction to Hybrid Electric Vehicles - Social and Environmental importance of Hybrid and Electric vehicles - Components - Vehicle mechanics - Roadway fundamentals - Vehicle kinetics - Dynamics of vehicle motion - Propulsion system.   **(9)**

ENERGY STORAGE

Energy Storage Requirements in Hybrid and Electric Vehicles - Battery - Fuel Cell - Super Capacitor - Flywheel based energy storage and its analysis - Hybridization of different energy storage devices.   **(9)**

DC AND AC ELECTRICAL MACHINES

Motor and Engine rating - Requirements - DC machines -Three phase AC machines - Induction machines - Permanent Magnet machines - Switched Reluctance machines.Matching the Electric Machine and Internal Combustion Engine (ICE) - Sizing the motor - Sizing the power electronics - Selecting the Energy Storage Technology - Communications - Supporting subsystems.
           (9)

HYBRID ELECTRIC DRIVE-TRAIN

Basic Concept of Electric traction, Transmission configuration - Components - Gears - Differential - Clutch - Brakes: Regenerative braking - Motor sizing. Hybrid traction - Various hybrid drive-train topologies - Power flow control in hybrid drive-train topologies - Fuel Efficiency Analysis.   **(9)**

ENERGY MANAGEMENT STRATEGIES

Energy Management strategies used in Hybrid and Electric vehicles - Component level control and Supervisory control - Comparison and its Implementation issues of different energy management strategies.

Case study: Volvo XC90 T8 Plug-In Hybrid, Nissan X-Trial hybrid.   **(9)**

TOTAL : 45

REFERENCES

1.   *Iqbal Hussain, "Electric & Hybrid Vehicles - Design Fundamentals", CRC Press, 2nd Edition, New York, 2010,*

2.   *Mehrdad Ehsani, Yi MiGao, Sebastian E. Gay and Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.*

3.   *James Larminie and John Lowry, "Electric Vehicle Technology Explained", Wiley Publishers,2003.*

15EEE07 - ELECTRICAL SAFETY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of this course, the students will be able to

CO1 : *Expand skills in identifying the presence of electrical hazards, implementing measures to minimize risks.*

CO2 : *Develop skills in investigative techniques for determining the cause of electrical accidents, fires and explosions.*

CO3 : *Analyze and apply various grounding and bonding techniques.*

CO4 : *Select appropriate safety method for low, medium and high voltage equipment.*

CO5 : *Assess and provide solutions to a practical case study.*

INTRODUCTION AND HAZARDS OF ELECTRICITY

Introduction - Hazard Analysis: Primary and Secondary hazards- Arc, Blast, Shocks - Causes and Effects - Summary of Causes - Protection and Precaution - Injury and Death protective strategies - IE Rules 1956 - Basic rules for new installations: Power system, Domestic and Industry.(Qualitative treatment only)   **(9)**

ELECTRICAL SAFETY EQUIPMENT

General inspection and Testing procedure for electrical safety equipment - Electrical safety equipment for external protection: Flash and Thermal protection - Head and Eye protection - Insulation protection. Electrical safety equipment for internal protection: Over voltage, Short circuit, Earth Fault, Leakage current, High/Low frequency - Single Line diagram of industrial power system with safety control - Electrician's Safety Kit and Materials.   **(9)**

SAFETY PROCEDURES

Introduction - Six-Step Safety Method - Job briefings - Energized or De-energized - Safe switching of power systems - General Energy Control Programs - Lockout - Tag out - Voltage measurement techniques- Placement of safety grounds - Flash hazard calculations and approach distances - Calculating the required level of arc protection (Flash hazard calculations) - Barriers and Warning signs - Tools and Test equipment - Field marking of potential hazards - Shock avoidance techniques- One-minute safety audit.   **(9)**

GROUNDING AND ELECTRICAL MAINTENANCE

Need for Electrical Equipment grounding - System grounding - Equipment grounding- Types of Earthing - Earth Testing for electrical equipment's in Power house and Industry - Eight Step Maintenance program - Maintenance requirements for specific equipment and location - IEC and UL standard.   **(9)**

VOLTAGE SAFETY SYNOPSIS AND MEDICAL SAFETY MANAGEMENT

Safety equipment's and safety procedures for low voltage and high voltage system - Electrical safety around electronic circuits - Electrical safety for medical equipment like Over current safety, Isolation, EMI and Harmonics - Battery Maintenance Procedure - Stationary Battery Safety - Accident Prevention- Accident Investigation - First Aid Rescue Techniques - Electrical safety program structure and development - Safety Meetings - Safety Audits.   **(9)**

TOTAL : 45

TEXT BOOKS

1. *John Cadick, Mary Capelli-Schellpfeffer and Dennisneitzel, "Electrical Safety Handbook",Mcgraw Hill Publishing Company Ltd., 3ʳᵈ Edition, 1994.*

2. *Dennis Neitzel and Al Winfield, "Electrical Safety Handbook", McGraw-Hill Education, 4ᵗʰ Edition, 2012.*

REFERENCES

1. *Mohamed A El-Sharkawi, "Electric Safety: Practice and Standards", CRC press, New York, 2013.*

2. *Martha J. Boss and Gayle Nicoll, "Electrical Safety: Systems, Sustainability, and Stewardship", CRC press, New York, 2014.*

3. *Ray A. Jones and Jane g. Jones, "The Electrical Safety Program Guide", National Fire Protection Association, Quincy, 2011.*

4. *James H. Wiggins JR., "Managing Electrical Safety", Abs Consulting, Maryland, 2011.*

5. *Maxwell Adams. J, "Electrical Safety- A Guide to the Causes and Prevention of Electric Hazards", The Institution of Electric Engineers, 1994.*

6. *Ray A. Jones and Jane G. Jones, "Electrical Safety in the Workplace", Jones & Bartlett Learning, Technology and Engineering, 2000.*

7. *Video Link: Electrical Safety in the Workplace Seminar DVD - NFPA National Fire Protection Association.*

    http://www.nfpa.org/training-and-events/archived/training-videos/electrical-safety-videos

8. *E-Book: Johncadick, Marycapelli-schellpfeffer, Dennisneitzel, "Electrical Safety Handbook", McGraw Hill publishing company Ltd., 3rd Edition, 1994.*

    https://installist.files.wordpress.com/2009/12/electrical-safety-handbook.pdf

15EEE14 - ENERGY EFFICIENT LIGHTING SYSTEM

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

After successful completion of this course, the students will be able to

COURSE OUTCOME

CO1   :   Understand the properties of light, importance of lighting in various fields and types of lighting.

CO2   :   Understand the properties and laws of illumination, working of discharge lamps, fluorescent lamps, tungsten filament lamps and light control.

CO3   :   Compare the various lighting techniques and employ lighting control methods.

CO4   :   Choose the building materials and construction techniques for energy efficient lighting.

CO5   :   The students should be able to employ renewable energy methods for energy efficient lighting.

LIGHTING

Lighting - importance of lighting in buildings, Interior designing, Photography, Architecture - Difference between good and bad lighting - Challenges in lighting - Types of lighting.   **(9)**

ILLUMINATION FUNDAMENTALS AND VARIOUS ILLUMINATION METHODS

Introduction - Terms used in illumination - Laws of illumination - Polar curves - Photometry - Integrating sphere - Sources of light - Discharge lamps, Incandescent lamps - MV and SV lamps.   **(9)**

ENERGY EFFICIENT LIGHTING

Smart lighting - Fluorescent lamps - Comparison between tungsten filament lamps and fluorescent tubes - Basic principles of light control - Types and design of lighting and flood lighting.- CFL - LED - High Intensity Discharge lamps.   **(9)**

BUILDING MANGEMENT SYSTEM

Energy efficient landscape design - Natural lighting - Choice of building materials for energy efficient lighting - Light pipes - Light fixtures - Green buildings - Construction techniques   **(9)**

CASE STUDY

Solar lighting techniques - Lighting using wind power - Energy conservation building code - Energy efficient buildings in the country.   **(9)**

TOTAL : 45

TEXT BOOKS

1.   *Philip Gordon, 'Principles and Practices of Lighting Design: The Art of Lighting Composition' , Blue Matrix Publications, 2011.*

2.   *Jerry Yudelson 'Green Building Through Integrated Design', The McGraw Hill Publishers, 2009.*

REFERENCE BOOKS

1.   *Derek Phillips, "Daylighting: Natural Light in Architecture", Elsevier, 2004.*

2.   *Jerry Yudelson, "Greening Existing Buildings", The McGraw Hill Publisher, 1st Edition, 2009.*

3.   *Sam Kubba, "Handbook of Green Building Design and Construction", Elsevier, 2012.*

4.   *Solanki.C.S, 'Solar Photovoltaic Technology and Systems', PHI, 2013.*

5.   *J.F. Manwell, J.G. Mcgowan and A.L. Rogers, "Wind Energy Explained : Theory, Design and Applications", Wiley Publications, 2nd Edition, 2009.*

15ECOE01 - CONSUMER ELECTRONICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : *Describe the fundamental concepts, construction and working of Audio systems*

CO2 : *Analyze the recording and reproduction techniques of Audio Systems*

CO3 : *Differentiate between the types of electronic music synthesizers*

CO4 : *Describe the fundamental concepts, construction and working of Video systems*

CO5 : *Identify the problem and troubleshoot the consumer electronic products like TV, Washing Machines, Air Conditioners*

AUDIO SYSTEM

Microphone - Characteristics of Microphones - Gun Microphones - Wireless Microphones - Headphones and Headsets - Electrostatic Phones - Electret Electrostatic Headphones - Hearing Impairments - Hearing Aids - Ideal Loudspeaker - Basic Loudspeaker - Loudspeaker Construction - Woofers - Mid range, Extended range and High frequency Loudspeakers - Multispeaker systems - Baffles - Horns - Stereo Systems. **(10)**

RECORDING AND REPRODUCTION

Making the Record - Stereo Pickup Techniques - Stereo Recording Systems - Disc Equipment: Recording and Playback Characteristics - Stereo Pickup heads - Magnetic recording and Playback - Magnetic Erasing - Optical Recording and Reproduction - Mono, Stereo and Quad - Stereo Multiplexing - Equalisers and Mixers. **(9)**

ELECTRONIC MUSIC SYNTHESIZERS

Typical Generator - Basic Modifiers - Voltage Control - Envelope Generator - Electric Guitar - Electric Wind Instrument -Recording - Digital Computer - Public Address System - Speaker Matching Systems - Theater Sound System: Sound track, Types of sound film, Theater Sound Reproduction system, Working of a Projector. **(9)**

VIDEO SYSTEMS AND DISPLAYS

Monochrome - Color TV standards - TFT, Plasma, HDTV, LCD,LED TV, Video Telephone and Video Conferencing. **(9)**

DOMESTIC AND CONSUMER APPLIANCES

In Car Computers - Washing machines - Microwave ovens - Air-conditioners and Refrigerators - Airline Reservations - Remote controls Automated Teller Machines - Set top Boxes - Bar Codes - RFID. **(8)**

TOTAL : 45

TEXT BOOKS

1. *Bali, Consumer Electronics, Pearson Education,1st Edition, 2005.*

2. *Philip Hoff, Consumer electronics for Engineers, Cambridge University Press,1st Edition, 1998.*

REFERENCES

1. *Sridhar Canumalla, Puligandla ViswanadhamP.S.Bimbra, Portable Consumer Electronics: Packaging, Materials, and Reliability, Pennwell Books, 1st Edition, 2010.*

2. *Douglas Kinney, A Beginners Guide to Consumer Electronics Repair: Hand Book and Tutorial, iUniverse, Inc, 1st Edition, 2006.*

3. *Thomas M. Coughlin, Digital Storage in Consumer Electronics: The Essential Guide, Elsevier Inc., 1st Edition, 2008.*

4. *U.S. Consumer Electronics Industry in Review, Electronic Industries Association, Consumer Electronics Group, 1993.*

5. *https://www.pssurvival.com/ps/electronic*

15ECOE02 - ARM SYSTEM ARCHITECTURE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : *Distinguish between the feature of ARM7 and cortex microcontroller and infer the architecture, instruction set and programming model of ARM Cortex.*

CO2 : *Interpret interrupt service handler & exception types of ARM processor to develop ALP programs.*

CO3 : *Exemplify memory mapping technique in ARM embedded system.*

CO4 : *Illustrate the programming concepts in real time embedded application.*

CO5 : *Examine debugging technique to develop application software for real time system.*

EMBEDDED HARDWARE

ARM Embedded system-CISC and RISC philosophy-Embedded system Hardware-ARM and Cortex architecture- Programming model- Date flow- Operating modes - Instruction sets. **(9)**

INTERRUPT AND EXCEPTIONS

Interrupts in ARM and cortex- Exception Types- Fault Exceptions- The NVIC and Interrupt Control - Interrupt Behavior. **(9)**

MEMORY SYSTEMS

Memory System Features Overview- Memory Maps- Memory Access Attributes- Default Memory Access Permissions- Bit-Band Operations- Unaligned Transfers- Exclusive Accesses and Endian Mode. **(9)**

PROGRAMMING

Exceptions Programming- Advanced Programming Features and System Behavior- Efficient C Programming- FIR and IIR filter implementation-Introduction to RTOS. **(9)**

SYSTEM DEBUGGING

Debugging Features- CoreSight- Debug Modes- Debugging Events- Breakpoint- Accessing Register - Debugging Components-Case study: Embedded system (using ARM/cortex) for monitoring- controlling and industrial automation. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Andrew N. Sloss Dominic Symes Chris Wright, "ARM System Developer's Guide Designing and Optimizing System Software", Elsevier Inc 2010.*
2. *Joseph Yiu, "The Definitive Guide to the ARM Cortex-M", Elsevier- Newness, 2014.*

REFERENCES

1. *Peter Barry Patrick Crowley "Modern Embedded Computing Designing Connected, Pervasive, Media- Rich Systems", Elsevier, 2012.*
2. *Steve Furber, "ARM system on Chip Archiecture", Addison Wesley professional, 2ⁿᵈ Edition, 2000.*
3. *Jonathan N Valveno, "Embedded Systems : Introduction to ARM @ Cortex TM-Microcontrollers" 5ᵗʰ Edition, 2015.*
4. *Rajkamal, "Embedded system Architecture Programming and Design," Tata McGraw Hill, 2ⁿᵈ Edition, 2009.*
5. *Shibu K.V., "Introduction to Embedded Systems", Tata McGraw Hill, 1ˢᵗ Edition, 2009.*

15ECOE03 - BROADBAND COMMUNICATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : Describe the concepts and applications of Microwave and Millimeter wave communication

CO2 : Comprehend and explain the operation of Satellite communication and navigation systems

CO3 : Illustrate the operation of optical communication systems and high speed networks

CO4 : Exemplify the features and functionalities of cellular communication from 2G to 4G and beyond

CO5 : Distinguish and describe different wireless technologies based on its features and applications

MICROWAVE AND MILLIMETER WAVE COMMUNICATION

Microwave concepts - devices and lines - waveguides and cavity resonators -Microwave semiconductor diodes-Microwave tubes - antennas - Microwave and millimeter applications.   **(9)**

SATELLITE COMMUNICATION

Satellite orbits - Satellite Communication Systems - Satellite subsystems - Ground stations - Applications - Global Navigation satellite systems.   **(9)**

OPTICAL COMMUNICATION

Optical principles - optical communication systems - fiber optics cables - optical transmitters and receivers - wavelength division multiplexing - passive optical networks -40/100Gbps networks and beyond.   **(9)**

CELLPHONE TECHNOLOGIES

Cellular telephone systems - Cellular industry overview - 2G and 3G digital cell phone systems -Long term evolution and 4G cellular systems - Base stations and small cells.   **(9)**

WIRELESS TECHNOLOGIES

Wireless LAN - PANs and Bluetooth - Zigbee and mesh wireless networks - Wi-Max and wireless Meteroploitan area networks - Infrared wireless - Radio frequency identification - Ultra wideband wireless-wireless applications.   **(9)**

TOTAL : 45

TEXT BOOK

Louis E.Frenzel,"Principles of Electronic Communication Systems", Mc-Graw Hill Education,4th edition,2016

REFERENCES

1.   Kennedy G, "Electronic Communication Systems", Tata McGraw Hill, 4th Edition, 1999.

2.   Rappaport,T.S, "Wireless communications", Pearson Education, 2nd Edition, 2010

3.   William Stallings, "Wireless Communications and networks", Pearson Prentice Hall of India, 2nd Edition, 2009.

4.   David Tse, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 1st Edition, 2005.

5.   Aditya K.Jagannathan, "Principles of Modern Wireless Communication Systems: Theory and Practice", Mc-Graw Hill Education, 2016.

15ECOE04 - ROBOTICS FOR INDUSTRIAL APPLICATIONS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of this course the students will be able to demonstrate an ability to

CO1   :   Comprehend and appreciate the significance and role of industrial robot in the present contemporary world

CO2   :   Exemplify the features and functionalities of the sensors in Robot

CO3   :   Develop different language programs to design and develop robotic based systems

CO4   :   Develop system for industrial automation and medical application

CO5   :   Illustrate the methodologies to provide automatic solution for replacing humans in life threatening area

SCOPE OF ROBOTS

The scope of industrial Robots - Definition of an industrial robot - Need for industrial robots -Economic and Social Issues-applications.   **(4)**

ROBOT COMPONENTS

Fundamentals of Robot Technology - Automation and Robotics - Robot anatomy - Work volume -Precision of movement - End effectors - Sensors.   **(9)**

ROBOT PROGRAMMING

Robot Programming - Methods - Interlocks textual languages, Characteristics of Robot level languages, characteristic of task level languages.   **(9)**

ROBOT WORK CELL

Robot Cell Design and Control - Remote Center compliance - Safety in Robotics.   **(9)**

FUTURE TRENDS

Telepresence robot, Autonomous mobile robots, Walker Robots, Solar-ball Robot, Underwater bots, Aerobots - Advanced robotics in Space - Specific features of space robotics systems - longterm technical developments, Next generation robots.   **(14)**

TOTAL : 45

TEXT BOOKS

1.   *Robert J. Schilling, "Fundamentals of Robotics- Analysis and Control", Pearson Education, 2006.*

2.   *John M. Holland, "Designing Autonomous Mobile Robots-Inside the mind of an Intelligent Machine", Newnes Publication, 2004.*

REFERENCES

1.   *Mikell P.Groover, Mitchell Weiss, Roger N.Nagel Nicholas G.Odrey, "Industrial Robotics Technology, Programming and Applications", McGraw Hill Book Company 1986.*

2.   *John Iovine, "Robots, Android and Animatronics", Second Edition, McGraw-Hill, 2012.*

3.   *Fu K.S. Gonzaleaz R.C. and Lee C.S.G.,"Robotics Control Sensing, Vision and Intelligence",McGraw Hill, International Editions, 1987.*

4.   *Bernard Hodges and Paul Hallam, "Industrial Robotics", British Library Cataloging in Publication 1990.*

5.   *Deb, S.R., "Robotics Technology and flexible automation", Tata McGraw Hill, 1994.*

15ECOE05 - SIGNAL PROCESSING AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : *Compute the Discrete Fourier Transform (DFT) of a given discrete time sequence using Radix-2 Fast Fourier Transform algorithms and design FIR/IIR Filters*

CO2 : *Apply source coding procedure to calculate coding efficiency based on entropy & mutual information and outline different pulse analog modulation techniques*

CO3 : *Analyze various equalization techniques and compare its performance*

CO4 : *Calculate channel capacity using Shannon's channel capacity theorem and develop channel error control codes*

CO5 : *Analyze speech processing methods in time and frequency domain and design codec methods for speech compression techniques*

ORTHOGONAL TRANSFORMS AND DIGITAL FILTER STRUCTURES

DFT-DCT-Properties of DFT- Computation of DFT, FFT and structures-Decimation in time-Decimation in frequency - Linear convolution using DFT

Basic FIR/IIR filter structures-FIR/IIR Cascaded lattice structures-Parallel allpass realization of IIR transfer functions- Sine cosine generator - Computational complexity of filter structures **(10)**

DATA COMPRESSION

Information entropy-Source coding-Huffman algorithm-Delta Modulation-Adaptive Delta Modulation- Continuously Variable Slope Delta Modulation-Differential Pulse Code Modulation - Adaptive Differential Pulse Code Modulation. **(8)**

SIGNAL PROCESSING IN COMMUNICATION RECEIVER

Temporal Equalization-Space Time Equalization-Frequency Domain Equalization-Symbol Timing Recovery- Channel Quality Estimation- Automatic Frequency Control-Overall Receiver Block. **(9)**

ERROR CORRECTING CODES & CHANNEL CODING

Error Correcting codes-Error Correction-Linear Block Codes-Cyclic Codes- Bose, Chaudhari and Hocquenghem Codes-Convolution Codes-Viterbi Decoding-Interleaving Codes-Concatenated Codes- Turbo Codes. **(9)**

SPEECH CODING

Speech Coding-Adaptive Predictive Coding-Sub Band Coding,-Vocoders-Liner Predictive Coding- Image Coding-Joint Photo Graphic Expert Group(JPEG)-Moving Pictures Expert Group(MPEG), the layer-3 of MPEG-1 Algorithms(MP3),Lempel- ZIV Algorithms - Recognition techniques:Speech Recognition and Image recognition **(9)**

TOTAL : 45

TEXT BOOKS

1. V. Oppenheim, R. W. Shafer and J.R.Buck, "Discrete-Time Signal Processing", Pearson Education, 4th Edition,2011

2. Simon Haykins, "Digital Communications Systems", 1st Edition, Wiley, 2013.

REFERENCES

1. Sanjit. K. Mitra and Sanjit Kumar Mitra, "Digital Signal Processing - A computer based approach", Tata McGraw Hill, 4th Edition, 2011.

2. Todd K Moon, "Error Correction Coding - Mathematical methods and Algorithms", John Wiley & Sons, 2005.

3. Roberto Togneri, Christopher J.S DeSilva, "Fundamentals of Information Theory and Coding Design", CRC press, 2003

4. L.R.Rabiner and R.W.Schaffer "Digital Processing of Speech signals" Prentice Hall, 1978.

5. Nirmal K. Bose, Calyampudi Radhakrishna Rao, "Signal Processing and Its Applications" North-Holland, 1993

15CSOE01 - FUNDAMENTALS OF SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Describe the various software life cycle models and choose an appropriate model for a given application.*

CO2 : *Identify the functional requirements, prepare data flow, ER diagrams and Software Requirement Specifications.*

CO3 : *Employ suitable architectural styles, software design methodologies, coding standards and practices in developing practical applications*

CO4 : *Discuss various testing techniques and their application in defect removal.*

INTRODUCTION

The Software Engineering Discipline - Software Development Projects - Software Life Cycle Models: Use of Life Cycle Models - Classical Waterfall Model-Iterative Waterfall Model-Prototype model-Evolutionary Model-Spiral Model **(9)**

SOFTWARE REQUIREMENTS AND ANALYSIS

Requirements Analysis and Specification - Requirements Gathering and Analysis- Value of good SRS - Requirement process-Requirement Specification - desirable characteristics, components and Structure of requirements document - Functional Specification with use cases - basics - developing Use Cases -DFDs - Data Dictionary - ER Diagrams. **(8)**

SOFTWARE DESIGN

Design concepts - Cohesion and Coupling- The Open-Closed Principle - Function Oriented Software Design: Structured charts - Structured design methodology - Detailed Design: Logic / Algorithm design - State Modeling of Classes. **(10)**

CODING

Programming principles and guidelines - Structured programming - Information hiding - some programming practices - Coding standards - Code inspection - Planning- Self review - Group review meeting. **(7)**

TESTING

Testing Fundamentals -Black Box Testing: Equivalence Class Partitioning - Boundary Value Analysis - White box Testing: Control Flow based criteria - Data Flow based Testing - Levels of Testing: Unit Testing - Integration Testing - System Testing - Acceptance Testing. **(11)**

TOTAL : 45

TEXT BOOK

1. *Pankaj Jalote, "Software Engineering A precise Approach", Wiley India, Third edition 2012.*

2. *Rajib Mall, "Fundamentals of Software Engineering", PHI Learning Private Limited, Third Edition 2013.(Introduction only)*

REFERENCE BOOKS

1. *Roger.S.Pressman "Software Engineering A Practitioner's Approach", McGraw Hill International Edition, Seventh Edition, 2014.*

2. *Ian Sommerville, "Software Engineering", Dorling Kindersley (India) Private Ltd., Eighth Edition, 2008.*

15CSOE02 - INTRODUCTION TO DATA WAREHOUSING AND DATA MINING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Describe the basic concepts, architecture, data models of database management systems and data warehouse.*

CO2 : *Demonstrate the multidisciplinary fields of data mining and illustrate the techniques for data preprocessing.*

CO3 : *Find frequent item set and generate association rules for the given transactions.*

CO4 : *Analyze different types of data using classification and clustering techniques.*

BASIC CONCEPTS OF DATABASE SYSTEM

Purpose of DBMS - Applications - Views of data - Data Abstraction - Instances and Schemas - Data Models - Database Languages - Relational Databases - Database Architecture - Database users and administrators - History of Database systems

(8)

DATA MINING

Data Mining - On What Kind of Data-Data Mining Functionalities - Classification of Data Mining Systems - Data Mining Task Primitives - Integration of a Data Mining System with a Database or Data Warehouse System-Major Issues in Data Mining. **(9)**

DATA WAREHOUSING

Data Warehouse - Introduction-Multidimensional Data Model-Data Warehouse Architecture -Data Warehouse Implementation - From Data Warehousing to Data Mining. **(8)**

DATA PREPROCESSING AND ASSOCIATION RULES

Data Preprocessing: Needs Preprocessing the Data - Data Cleaning- Data Integration and Transformation-Data Reduction-Discretization and Concept Hierarchy Generation. Association Rules: Basic concepts - Apriori Algorithm - Generation of association rules from frequent item sets - FP Tree Algorithm - Pattern evaluation methods **(10)**

CLUSTERING AND CLASSIFICATION

Cluster analysis - Partitioning Methods - K-Means and K-Medoid algorithm - CLARA - CLARANS - Hierarchical clustering - BIRCH - Density based clustering - DBSCAN - Decision tree induction. **(10)**

TOTAL : 45

TEXT BOOKS

1. *Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Tata McGraw Hill, Sixth Edition, 2013. (Basic Concepts of Database System only)*

2. *Jiawei Han & Micheline kamber, "Data Mining-Concepts and Techniques" Morgan Kaufmann Publishers, Third Edition, 2012.*

REFERENCE BOOKS

1. *Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson Education, Sixth Edition, 2013.*

2. *Arun K Pujari, "Data Mining Techniques" Universities Press India Ltd., Third Edition, 2012.*

3. *Dunham, "Data Mining- Introductory and Advanced Topics", Pearson Education, New Delhi, First Edition, 2006.*

4. *Pieter Adriaans, Dolf Zantinge, "Data Mining ", Pearson Education, Third Edition 2009,Delhi.*

5. *Sam Anahory, Dennis Murray, "Data Warehousing in the Real World ", Pearson Education, Seventh indian Reprint New Delhi,2003.*

6. *George M. Marakas, " Modern Data Warehousing, Mining, & Visualization Core concepts", Pearson Education, First Edition, 2003*

7. *Paulraj Ponnaiah, "Data Warehousing Fundamentals", Wiley Publishers, Singapore, First Edition, 2001.*

15CSOE03 - INTRODUCTION TO EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Examine the characteristics and challenges in embedded system development*

CO2 : *Identify the parameters affecting CPU performance and develop optimized code*

CO3 : *Demonstrate the scheduling of given set of real-time tasks using the appropriate scheduling algorithm*

CO4 : *Design embedded system for simple applications*

INTRODUCTION

Characteristics of embedded computing applications- Challenges in embedded computing design - Performance in embedded computing.Embedded System Design Process - Computer Architecture Taxonomy - ARM Processor -Assembly Language Programming. **(10)**

CPU PERFORMANCE

I/O Primitives - Busy -Wait I/O - Interrupts - Memory System Mechanisms: Cache, Memory Management Unit and Address Translation - Pipelining - CPU Power Consumption **(8)**

DEVELOPMENT AND DEBUGGING

Development environments - Debugging Techniques - Debugging challenges - System Level Performance analysis - Program Level Performance analysis - Program Optimization **(9)**

SCHEDULING

Scheduling states of a Process-Running Periodic Processes - Preemption - Priorities- Rate Monotonic Scheduling - Earliest Deadline First Scheduling - Priority Inversion - Data dependency. **(10)**

NETWORKS

Bus Standards: I2C, CAN Bus, Field Bus. CASE STUDY: Alarm Clock, Elevator Controller. **(8)**

TOTAL : 45

TEXT BOOK

1. *Marilyn Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufman, Third Edition, 2012*

REFERENCE BOOKS

1. *Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education, First Edition, 2009. (For Scheduling)*

2. *David. E. Simon, "An Embedded Software Primer", Pearson Education, First Edition, 2012*

3. *Rajkamal, "Embedded Systems: Architecture, Programming and Design", McGraw Hill, Third Edition, 2014.*

15CSOE04 - INTERNET PROGRAMMING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Gain knowledge in overview of www and web based application.*

CO2 : *Design and develop dynamic and interactive web pages using DHTML.*

CO3 : *Design and develop web applications using servlets.*

CO4 : *Gain knowledge on E-business Models and E-marketing.*

BASIC WEB CONCEPTS

Basic Web Concepts - Web based Client/Server model -Web Protocols- Working of web browser - Browser & Server Communication - Review of HTML: Markup Languages, Introduction to HTML- forms - frames - tables. **(9)**

CLIENT SIDE PROGRAMMING

Client-side Programming (Review of JavaScript): Introduction, Writing Comments, Variables, Operators, Statements, Alert, Confirm, and Prompt Boxes, Functions, Event and Error Handling, Introduction to Built-in Classes, Form Validation, Cookies. **(9)**

DYNAMIC HTML

Dynamic HTML :Introduction - cascading style sheets-object model and collections - event model - filters and transition - data binding - data control - ActiveX control - handling of multimedia data. **(9)**

SERVER SIDE PROGRAMMING

Servlets - Deployment of simple servlets - web server (Java web server / Tomcat / Web logic) - HTTP GET and POST requests - session tracking - cookies - JDBC - simple web applications - Multi-tier applications. **(9)**

WEB BASED APPLICATIONS AND ITS TECHNOLOGIES

Rails:Overview of Rails-Ajax:Overview of Ajax Rails with Ajax- e-Business Models-e-Marketing-online payments-Security. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Deital & Deital, "Internet and World Wide Web-How to Program", Pearson Education Fifth Edition, 2011.*
2. *Robert W.Sebesta, "Programming with World Wide Web", Pearson Education, Eighth Edition, 2015.*

REFERENCE BOOKS

1. *Scot Johnson, Keith Ballinger,Davis Howard Chapman, "Special Edition Using Active Server Pages", Prentice Hall of India,paperback 1999.*
2. *Ravi Kalakota and Andrew B Whinston, "Frontiers of e-commerce", Addison Wesley, paperback 1999.*
3. *Jeffrey C. Jackson," Web Technologies: A Computer Science Perspective", Pearson Education, Reprint 2011.*
4. *Elliotte Rusty Harold, "Java Network Programming", O'Reilly Publishers, Fourth Edition 2013.*

15CSOE05 - CUSTOMER RELATIONSHIP MANAGEMENT ESSENTIALS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *State the evolution of marketing and define CRM architecture explaining customer acquisition, retention and segmentation.*

CO2 : *Describe the business value, its costs and deploying data mining for CRM with proper guidelines for privacy.*

CO3 : *Demonstrate the scoring process and apply the various CRM optimization techniques to optimize CRM process in order to improve customer profitability.*

CO4 : *Evaluate CRM tools using tool assessment and methodology to choose the appropriate tool for real time applications.*

INTRODUCTION

Most profitable Customer - CRM: Custom centered database, Managing campaigns, Evolution of marketing, Closed loop marketing, CRM architecture - Customer profitability - Customer acquisition - Cross selling - Customer retention - Customer segmentation. **(9)**

BUILDING THE BUSINESS CASE

Introduction - Uncovering the needs for data mining - Defining the business value - The costs - Deploying Data mining for CRM: Introduction - Define the problem - Define the user - Define the data - Scope the project - Trial - Quality assurance - Education - Launch - Continuation. **(10)**

COLLECTING CUSTOMER DATA

Introduction - Three types of customer data - Collecting customer data - Connecting customer - Customer data and privacy - Privacy and data mining - Guidelines for privacy - Legal issues associated with data mining. **(8)**

SCORING YOUR CUSTOMER

Introduction - Process - Scoring architectures and configurations - Preparing the data - Integrating scoring with other applications - Optimizing the CRM process: Introduction - Improved customer profitability through optimization - Optimized CRM - Complete loop - Optimal CRM process - Optimization techniques. **(8)**

OVERVIEW OF DATA MINING AND CRM TOOL MARKETS

Introduction - Data mining market place - Taxonomy of data mining tools - Tool assessment attributes and methodology - Tool evaluation - Other data mining tools -CRM tools - Next generation for CRM. **(10)**

TOTAL : 45

TEXT BOOK

1. *Alex Berson, Stephen Smith, Kurt Thearling, "Building Data mining Applications for CRM", Tata McGraw Hill, Fifteenth Reprint, 2008.*

REFERENCE BOOKS

1. *Francis Buttle, Stan Maklan "Customer Relationship Management: Concepts and Technologies", Routledge, Third Edition, 2015.*

2. *Roger J. Baran, Robert J. Galka, "CRM: The Foundation of Contemporary Marketing Strategy", S.Chand (G/L) & Company Ltd, Second Edition, 2017.*

15CSOE06 - E-COMMERCE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Describe the features of e-commerce, various business models and marketing strategies used in e-commerce.*

CO2 : *Use the knowledge on the mechanics of building a secure e-commerce website and payment systems.*

CO3 : *Comprehensive online retailing, marketing and impact of social media.*

CO4 : *Illustrate the procurement process and supply chain management in B2B e-commerce.*

INTRODUCTION

E-commerce: E-commerce and E-business - Features of E-commerce Technology - Types of E-commerce. Understanding E-commerce: Technology - Business and Society. E-commerce Business Models and Concepts: Eight Key Elements - Strategy, Structure and Process: Industry Structure - Industry Value Chains - Firm Value Chains - Firm Value Webs - Business Strategy.
(7)

BUILDING E-COMMERCE WEBSITE

Building an Ecommerce Presence: Systematic Approach - Choosing Software and Hardware: Web Server Software - Application Servers - Merchant Server Software Functionality and Packages - Web Services and Open Source Options - Other E-commerce Site Tools - Developing Mobile Website and Building Mobile Applications.
(8)

E-COMMERCE SECURITY AND PAYMENT SYSTEMS

Ecommerce Security Environment - Security Threats - Management Policies, Business Procedures and Public Laws - Payment Systems - E-commerce Payment Systems.
(7)

SOCIAL, MOBILE AND LOCAL MARKETING

Introduction to Social, Mobile and Local Marketing - Social Marketing: Social Marketing Players - The Social Marketing Process - Face book Marketing - Twitter Marketing - Pinterest Marketing - The Downside of Social Marketing - Mobile Marketing: Basic Mobile Marketing Features - Mobile Marketing Tools - Mobile Marketing Campaign - Local and Location Based Marketing: Location Based Marketing Platforms - The Technologies - Marketing Tools - Marketing Campaign - Marketing Results.
(8)

ONLINE RETAIL SERVICES, AUCTIONS AND PORTALS

E-commerce in Action: E-tailing Business Models: Virtual Merchants - Multi-channel Merchants - Catalog Merchants - Manufacturer Direct - Online Financial Services - Online Travel Services - Online Career Services. Online Auctions: Measuring Growth of Auctions and Dynamic Pricing - Benefits of Auctions - Risks and Costs of Auctions for Consumers and Businesses. E Commerce Portals: Types of Portals - Portal Business Models.
(9)

E-COMMERCE, SUPPLY CHAIN AND COLLABORATIVE MANAGEMENT

Defining and Measuring the Growth of B2B Commerce - Benefits and Challenges of B2B E-commerce - The Procurement Process and Supply Chain - Types of Procurement. Trends in Supply Chain Management and Collaborative Commerce: Just-in-Time and Lean Production - Supply Chain Simplification - Adaptive Supply Chains - Accountable Supply Chains - Sustainable Supply Chains - Electronic Data Interchange - Supply Chain Management Systems - Collaborative Commerce.
(6)

TOTAL : 45

TEXT BOOK

1. *Kenneth C. Laudon,Carol Guercio Traver, "E-Commerce-Business,Technology, Society", Pearson India, Tenth edition, 2016.*

REFERENCES

1. *Ravi Kalakota, Andrew Whinston, "Frontiers of Electronic Commerce", Pearson India, fourteenth Reprint 2007.*

2. *Dave Chaffey, "E - Business and E - Commerce Management: Strategy, Implementation, and Practice:" Pearson India, Sixth Edition, 2013.*

3. *Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, "E-Commerce, Fundamentals and Applications", Wiley India Private Ltd Reprint 2008.*

15ITOE01 - DIGITAL COMPUTER BASICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Explain various schemes of number system representations, code conversions and perform arithmetic operations.*

CO2 : *Describe Boolean Algebra, formulate and simplify Boolean expressions using K-Maps and illustrate the logic gates realization..*

CO3 : *Describe the working of basic combinational circuits and sequential circuits.*

CO4 : *Describe the structure and functioning of various memory schemes.*

NUMBER SYSTEMS

Binary Numbers, Number Base Conversions, Octal and Hexadecimal Numbers. Complements of Numbers - Signed Binary Numbers. Binary Codes : Binary-Coded Decimal(BCD) Code, Gray Code, ASCII Character Code, Error Detecting Code. BCD Addition - Decimal Arithmetic. Binary Storage and Registers. **(9)**

BINARY LOGIC AND BOOLEAN ALGEBRA

Definition of Binary logic. Boolean Algebra - Basic Definitions - Theorems and Properties of Boolean Algebra - Canonical and Standard Forms. Digital Logic Gates : Integrated Circuits. Gate-Level Minimization: Map Method - Four?Variable K-Map - Product?of?Sums Simplification. Realization of Boolean functions using Gates. **(10)**

COMBINATIONAL CIRCUITS

Adder : Half Adder - Full Adder - Binary Parallel Adder - BCD Adder. Subtractor : Half Subtractor - Full Subtractor. Code Conversion. Decoders - De-Multiplexer - Encoders - Multiplexers. **(9)**

SEQUENTIAL CIRCUITS

Storage Elements- Latches, Flip?Flops-RS,D,JK and T flip-flops-Triggering of flip-flops- Characteristic Tables- Characteristic Equations. Registers -Shift Registers. Counters: Binary ripple counter - Updown binary counter. **(9)**

MEMORY AND PROGRAMMABLE LOGIC

Random Access Memory - Memory Decoding - Read?Only Memory - Types of ROMs, Programmable Logic Array, Programmable Array Logic. **(8)**

TOTAL : 45

TEXT BOOK

1. *M. Morris Mano and Michael D. Ciletti,"Digital Design with an Introduction to the Verilog HDL, Pearson Education, Fifth edition, 2013.*

REFERENCE BOOKS

1. *M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, First edition, 2008.*
2. *Thomas L.Floyd, "Digital Fundamentals", Pearson Education, Tenth edition, 2011.*

15ITOE02 - PROGRAMMING IN JAVA

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Describe the fundamental aspects of object oriented programming paradigm.*

CO2 : *Develop java programs using features like methods, classes, constructors, overloading and string handling.*

CO3 : *Write exception handling routines for practical applications.*

CO4 : *Describe multithreading, synchronization and networking features of Java.*

CO5 : *Demonstrate use of applets and database connectivity in developing practical Applications.*

OBJECT ORIENTED PROGRAMMING

Introduction to object oriented languages - Evolution of object oriented languages - Object oriented programming paradigm - Basic concepts of object oriented programming - Procedural Vs object oriented programming.   **(6)**

INTRODUCTION TO JAVA

Java and Internet - Byte Code - Features of Java - Java Development Environment- Java Programming: Methods and Classes - Constructor - Garbage Collection - Overloading - Inheritance - Overriding - Packages and Interfaces - Java IO systems - String Handling : String and String Buffer.   **(12)**

EXCEPTION HANDLING

Exception Handling: Fundamentals of Exception handling and types - Built in Exceptions - user defined Exceptions.   **(5)**

MULTI THREADS

Multithreaded Programming : Thread Model - Thread properties - Thread priorities -Synchronization- Inter thread communication- Networking : Inet address - Datagrams - Sockets - URL connections.   **(11)**

APPLET AND DATABASE CONNECTIVITY

Introduction to Abstract Window Tool kit - Applet class - HTML applet tags - Parameter passing - Audio clip interface - Event class: Keyboard and Mouse events handling.   **(11)**

TOTAL : 45

TEXT BOOK

1.   *Herbert Schilt :" Java 2 - Complete Reference ", Tata McGraw Hill, Ninth Edition, McGraw Hill Education, 2014.*

REFERENCE BOOK

1.   *Deitel H.M and Deitel P.J, "Java - How to Program", Prentice Hall of India, Ninth Edition, 2012.*

15ITOE03 - FUNDAMENTALS OF DATABASE SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Describe the database system concepts and explain the key features of Relational data models.*

CO2 : *Describe the features of Entity Relationship diagram and draw Entity Relationship diagram for the given real world application*

CO3 : *Design a normalized database system and carry out data retrieval using SQL.*

CO4 : *Demonstrate various transaction concepts and various concurrency control mechanisms*

DATABASE SYSTEMS

Data Vs Information-Introducing the database and DBMS- Importance of Database Design- Files and File systems-Problems with File System Data Management, Database Systems.

Relational Database Model: Logical view of Data- Keys- Integrity Rules- Relational Set Operators- Data Dictionary and the system catalog -Codd's relational database rules. **(10)**

RELATIONAL MODEL

Entity Relationship Model: Entities-Attributes-Relationship-Connectivity and cardinality-Existence Dependence-Relationship Strength-Weak Entities-Relationship participation-Relationship Degree-Recursive Relationship-Developing an ER Diagram. **(8)**

STRUCTURED QUERY LANGUAGE

Introduction to SQL- Data Definition Commands- Data Manipulation Commands-Advanced Data Definition and SELECT Commands - Virtual Tables -Creating Views- Joining Database Tables. **(8)**

DATABASE DESIGN

Database Tables and Normalization- Need for Normalization- Normalization Process-Improving the Design-Surrogate Key Considerations, High level Normal Forms, Normalization and Database Design-Denormalization. **(10)**

TRANSACTION MANAGEMENT

Transaction Concepts: Transaction Properties- Transaction Concurrent Executions. Concurrency control with Locking Methods: Lock Granularity-Lock Types-Two-Phase Locking to Ensure Serializablity-Deadlocks-Database Recovery Management-RAID. **(9)**

TOTAL : 45

TEXT BOOK

1. *Peter Rob, Corlos M.Coronel, "Database Systems: Design, Implementation and Management", Thompson Learning Course Technology, Tenth edition, 2012.*

REFERENCE BOOKS

1. *Abraham Silberschatz, Henry F.Korth,S.Sudharshan,"Database System Concepts", McGraw-Hill, Sixth Edition, 2013.*

2. *Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson Education, Sixth Edition, 2013.*

3. *Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill Education, Third Edition, 2014.*

4. *Thomas M.Connolly and Carolyn E.Begg, " A Practical Approach to Design, Implementation and Management", Pearson, 6th Edition, 2014.*

15ITOE04 - CLOUD COMPUTING FUNDAMENTALS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Understanding the client- server, distributed collaborative and cloud computing architecture along with cloud storage and services.*

CO2 : *Classify the different virtualization environments and techniques.*

CO3 : *Illustrate various services deployed from a cloud architecture supported by different providers.*

CO4 : *Analyze the major security challenges and privacy problems in the cloud and virtual environment.*

INTRODUCTION

Understanding Cloud Computing- history of cloud computing: Client/Server computing, Peer to peer computing, Distributed computing and Collaborative computing.- Understanding cloud architecture, cloud storage and services-Pros and cons of cloud computing. **(9)**

VIRTUALIZATION

Introduction-Characteristics of Virtualized Environments - Taxonomy of Virtualization Techniques - Virtualization and Cloud Computing - Pros and Cons of Virtualization - Technology Examples **(9)**

CLOUD COMPUTING ARCHITECTURE

Cloud reference model: Architecture, Infrastructure - and Hardware as a service, Platform as a service-Software as a service, Types of cloud: Public clouds, Private clouds, Hybrid Cloud, Community Clouds. **(9)**

CLOUD SERVICES

Discovering Cloud services Development services and tools: Amazon, Google App Engine, IBM, Salesforce.com, Other Cloud Services development tools. **(9)**

CLOUD SECURITY

Security Overview - Cloud Security Challenges - Software as a Service Security - Security Governance - Risk Management - Security Monitoring - Security Architecture Design - Data Security - Application Security - Virtual Machine Security. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online",1st Edition, Pearson Education, New Delhi, 2009.*

2. *Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013.(Virtualization, Cloud Computing Architecture)*

3. *John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management,* and Security", CRC Press, 2010. (Cloud Security)

REFERENCES BOOKS

1. *Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.*

2. *Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.*

3. *Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.*

15ITOE05 - INFORMATION SECURITY FUNDAMENTALS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Identify and analyze the security threats and attacks and apply device suitable security policies and standards.*

CO2 : *Assess the risks and apply suitable risk control strategies.*

CO3 : *Employ appropriate intrusion detection and prevention systems to ensure information security.*

CO4 : *Discuss various national and international laws of information security and its framework.*

INTRODUCTION, NEED FOR SECURITY

Introduction to Information Security - The History of Information Security- Critical Characteristics of Information - NSTISSC Security Model - Components of an Information System - Securing Components - Balancing Information Security and Access - The Systems Development Life Cycle - The Security Systems Development Life Cycle. The Need for Security: Introduction - Business Needs First -Threats -Attacks. **(5)**

RISK MANAGEMENT AND INFORMATION SECURITY

Introduction - An Overview of Risk Management - Risk Identification -Risk Assessment - Risk Control Strategies - Selecting a Risk Control Strategy - Risk Management Discussion Points - Recommended Practices in Controlling Risk. **(6)**

POLICIES, STANDARDS, PRACTICES AND BUSINESS CONTINUITY

Introduction - Information Security Policy, Standards and Practices -The Information Security Blueprint: ISO 17799/BS 7799, ISO 27001and its controls, NIST Security Models, Design of Security Architecture - Security Education, Training and Awareness Program - Continuity Strategies. **(6)**

SECURITY TECHNOLOGY

Introduction - Intrusion Detection and Prevention Systems: IDPS Terminology, Use of IDPS, Strengths and Limitations of IDPS - Honey Pots, Honey Nets, and Padded Cell Systems - Scanning and Analysis Tools, Access Control Devices - **(8)**

BIOMETRIC CONTROLS

Biometrics - Nature of Biometrics Identification/Authentication Techniques - Biometric Techniques - Matching and Enrollment Process in Biometrics - Benefits Over Traditional Authentication Methods. **(6)**

SECURITY OF WIRELESS NETWORKS

Attacks on Wireless Networks: Other Security Risks in Wireless Networks, Management and Mitigations for Wireless Networks Attacks. **(7)**

LAWS AND LEGAL FRAMEWORK

Introduction - Information Security and the Law: The Rising Need -Understanding the Laws for Information Security: A Conceptual Framework - The Indian IT Act - Laws for Intellectual Property Rights (IPR) -Health Insurance Portability and Accountability Act (HIPAA) - Building Security into Software/System Development Life Cycle. **(7)**

TOTAL : 45

TEXT BOOKS

1. *Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Course Technology, New Delhi, Fourth Edition, 2012 Reprint.*

2. *Nina Godbole, "Information Systems Security-Security Management, Metrics, Frameworks and Best Practices", Wiley India Pvt. Ltd., New Delhi, First Edition, 2009.(Biometric Controls, Security of Wireless Networks, Laws and Legal Framework)*

REFERENCE BOOKS

1. Thomas R.Peltier, "Information Security Fundamentals", Auerbach Publications, Second Edition, 2013.
2. Micki Krause and Harold F.Tipton, "Information Security Management Handbook", Auerbach Publications, Sixth Edition,2008.
3. Mark Merkow and Jim Breithaupt," Information Security - Principles & Practices", Second Edition, Pearson Education, 2014.

15ITOE06 - INTRODUCTION TO HUMAN COMPUTER INTERACTION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Describe the importance and need for effective user friendly Graphical User Interfaces(GUI).*

CO2 : *Choose suitable interactions devices/tools to meet application specific requirements.*

CO3 : *Design Graphical User Interfaces(GUI) using apt components and apply the design guidelines for user-friendly navigation and presentation.*

CO4 : *Asses graphical user interfaces for compliance against the screen design guidelines.*

INTRODUCTION

Importance of User Interface: Definition-Importance of good design-Benefits of good design-Human-centered development and Evaluation-Human Performance models-A Brief history of screen design. **(9)**

THE GRAPHICAL USER INTERFACE & DESIGN PROCESS

GUI: Popularity of graphics - The concept of direct manipulation - Graphical system -Characteristics - Web user - Interface Popularity - Characteristics and Principles of User Interface.

Design process: Human Interaction with computers - Importance of Human Characteristics - Human Consideration - Human Interaction Speeds and Understanding Business Junctions. **(9)**

SCREEN DESIGNING

Design Goals - Screen Planning and Purpose - Organizing Screen Elements - Ordering of Screen Data and Content - Screen Navigation and Flow - Visually Pleasing Composition - Amount of Information - Focus and Emphasis - Presenting Information Simply and Meaningfully - Information retrieval on web - Statistical Analysis - Technological considerations in Interface Design. **(11)**

WINDOWS & COMPONENTS

Windows: New Navigation Schemes - Selection of Window - Selection of Devices Based on Screen Based Controls.

Components: Text and Messages - Icons and Increases - Multimedia - Colors - Uses -Problems - Choosing colors. **(9)**

SOFTWARE TOOLS AND INTERACTION DEVICES

Specification Methods - Interface Building Tools - Keyboard and Function Keys - Pointing Devices Speech Recognition. **(7)**

TOTAL : 45

TEXT BOOKS

1. *Wilbert O Galitz, "The Essential Guide to User Interface Design", Third Edition, Wiley India Pvt., Ltd., 2007.*

2. *Ben Shneidermann, "Designing the User Interface", Fifth edition, Pearson Education Asia, 2013. (Software Tools and Interaction Devices)*

REFERENCE BOOK

1. *Alan Dix, Janet Finlay, G D Abowd and Russel Beale, "Human Computer Interaction", Pearson Education, Third Edition, 2004.*

15ITOE07 - ENTERPRISE RESOURCE PLANNING CONCEPTS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Describe the operational aspects of ERP system and its related technologies.*

CO2 : *Demonstrate the steps required for ERP Project management and implementation process by choosing the right vendors/consultants, employee training and monitoring.*

CO3 : *Categorize the business modules of an ERP package inorder to define the functionality of various departments in a company.*

CO4 : *Analyze the ERP marketplace and its vendors, and assess how Enterprise Application Integration (EAI), e-business help the company use ERP to its utmost benefit.*

INTRODUCTION

Enterprise - An Overview - Introduction to ERP - Benefits Of ERP - ERP and Related Technologies - Business Process Reengineering (BPR) - Data Warehousing - Data Mining -OLAP - SCM. **(9)**

ERP IMPLEMENTATION

ERP Implementation Lifecycle - Implementation Methodologies - ERP deployment methods - Package Selection - Process Definition - Vendors and Consultants - Contract with Vendors, Consultants and Employees - Training and education- Project Management and Monitoring. **(10)**

THE ERP BUSINESS MODULES

Business modules of an ERP Package - Finance - Manufacturing - Human Resources - Plant Maintenance - Materials Management - Quality Management - Sales and Distribution. **(9)**

THE ERP MARKET & ERP - Present and Future

ERP Marketplace and Marketplace Dynamics - ERP Vendors - SAP AG, Oracle Corporation, Microsoft Dynamics, EPICOR, QAD, RAMCO Systems - Enterprise Application Integration (EAI)- ERP and E-Business- Future Directions and Trends in ERP.
(9)

SAP

Gateway to SAP: Architecture of SAP R/3 -SAP Integrated-Three Tier Architecture - SAP Easy Access - Understanding ABAP Workbench **(8)**

TOTAL : 45

TEXT BOOKS

1. *Alexis Leon," ERP Demystified", Tata McGraw Hill, New Delhi, Third Edition, 2014.*

2. *Dreamtech Press, "SAP R/3, Black Book", Dreamtech Software Team, 2006. (SAP)*

REFERENCE BOOKS

1. *Ellen F.Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Course Technology Ptr, Fourth Edition, 2013.*

2. *Vinod Kumar Garg and Venkitakrishnan N.K., "Enterprise Resource Planning - Concepts and Practice", Prentice Hall of India, New Delhi, Second Edition, 2012.*

15CHOE01- INDUSTRIAL SAFETY ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After completion of the course, students are able to

CO1 : *Practice the safety norms and inspect turning machines, boring machines, milling machine, planning machine, grinding machines, CNC machines and wood working machinery to create risk free working environment.*

CO2 : *Assess the adequacy of machinery guarding to eliminate or reduce the hazards from the point operation, flying chips and sparks and moving parts.*

CO3 : *Apply t the safety concepts in welding, gas cutting,storage and handling of gas cylinders, metal forming processes, etc.,*

CO4 : *Predict, identify and evaluate, hazardous conditions and practices safety rules in in cold forming and hot working of metals*

CO5 : *Employ the safety rules in inspection and testing process and take plan the preventive measures in health and welfare of workers'aspects in engineering industry.*

SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES

General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types,safety principles, electrical guards, work area, material handling,inspection, standards and codes- saws, types, hazards. **(9)**

PRINCIPLES OF MACHINE GUARDING

Guarding during maintenance, Zero Mechanical State (ZMS), Definition,Policy for ZMS - guarding of hazards - point of operation protectivedevices, machine guarding, types, fixed guard, interlock guard,automatic guard, trip guard, electron eye, positional control guard, fixedguard fencing- guard construction- guard opening. Selection andsuitability: lathe - drilling - boring - milling - grinding - shaping - sawing- shearing presses - forge hammer - flywheels - shafts - couplings -gears - sprockets wheels and chains pulleys and belts - authorized entryto hazardous installations-benefits of good guarding systems **(9)**

SAFETY IN WELDING AND GAS CUTTING

Gas welding and oxygen cutting, resistance welding, arc welding and cutting, common hazards, personal protective equipment, training,safety precautions in brazing, soldering and metalizing - explosive welding, selection, care and maintenance of the associated equipmentand instruments - safety in generation, distribution and handling ofindustrial gases-colour coding - flashback arrestor - leak detection-pipeline safety-storage and handling of gas cylinders. **(9)**

SAFETY IN COLD FORMING AND HOT WORKING OF METALS

Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operatedpresses, power press electric controls, power press set up and dieremoval, inspection and maintenance-metal sheers-press brakes. Hotworking safety in forging, hot rolling mill operation, safe guards in hotrolling mills - hot bending of pipes, hazards and control measures.Safety in gas furnace operation, cupola, crucibles, ovens, foundry healthhazards, work environment, material handling in foundries, foundryproduction cleaning and finishing foundry processes. **(9)**

SAFETY IN FINISHING, INSPECTION AND TESTING

Heat treatment operations, electro plating, paint shops, sand and shotblasting, safety in inspection and testing, dynamic balancing, hydrotesting, valves, boiler drums and headers, pressure vessels, air leaktest, steam testing, safety in radiography, personal monitoring devices,radiation hazards, engineering and administrative controls, Indian Boilers Regulation. Health and welfare measures in engineering industry-pollution control in engineering industry-industrial waste disposal **(9)**

TOTAL : 45

TEXT BOOKS

1. *Wells G.L.,R.M.C. Seagrave-Flow sheeting for safety, Indian Institute of Chemical Engineering, London U.K,1977.*

2. *TrevurKletz Butterworth, Learning from accidents, - London, 1988.*

3. *John Barton and Richard Rogers, Chemical reaction Hazards - A guide to safety, Institution of Chemical Engineering London, 1997.*

4. *Philip Hagan "Accident Prevention Manual for Business and Industry", N.S.C.Chicago, 13th edition 2009.*

REFERENCES

1. *Rohatgi A.K, Safety handling of Hazardous Chemicals Enterprises, Bombay, 1986.*

2. *Shukla S.K., Envirohazards and Techno Legal aspects, Shashi Publications, Jaipur India, 1993.*

3. *John V.Grimaldi and Rollin H.Simonds," Safety Management", Richard D Irwin, 1994.*

4. *Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.*

5. *"The Indian boilers act 1923 with amendments", Law Publishers (India) Pvt. Ltd., Allahabad.*

6. *"Health and Safety in welding and Allied processes", Welding Institute, UK, High Tech. Publishing Ltd., London, 1989.*

7. *"Safe use of wood working machinery", HSE,UK,2005.*

15CHOE02 - RISK ANALYSIS AND HAZOP

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After completion of the course, students are able to

CO1 : *Identify individual hazards in a process and deduce the associated risks.*

CO2 : *Identify radiation intensity and effects of explosion*

CO3 : *Perform risk analysis of various types of problems*

CO4 : *Evaluate effect about key hazard identification techniques*

CO5 : *Apply risk analysis techniques and Hazop study*

INTRODUCTION AND DISPERSION MODELS

Risk analysis introduction, quantitative risk assessment, rapid risk analysis - Comprehensive risk analysis - Emission and dispersion - Leak rate calculation. Single and two-phase flow - Dispersion model for dense gas - Flash fire - Plume dispersion - Toxic dispersion model - Ealuation of risk. **(9)**

RADIATION INTENSITY

Radiation - Tank on fire - Flame length - Radiation intensity calculation and its effect on plant, people and property radiation VCVCE - Explosion due to over pressure - Effects of explosion, risk contour -Effects, explosion, BLEVE - Jet fire - Fire ball. **(9)**

RISK ANALYSIS

Overall risk analysis - Generation of meteorological data - Ignition data - Population data - Consequences analysis and total risk analysis - Overall risk contours for different failure scenarios - Disaster management plan - Emergency planning - On site and off site emergency planning, risk management ISO 14000, EMS models case studies - Marketing terminal, gas processing complex, refinery. **(9)**

HAZARD ANALYSIS

Hazard identification safety audits, checklist, what if analysis, vulnerability models event tree analysis fault tree analysis, Hazan past accident analysis Fixborough - Mexico - Madras - Vizag - Bopal analysis **(9)**

CASE STUDIES

Hazop - Guide words, parameters, derivation - Causes - Consequences - Recommendation - Coarse Hazop study - Case studies - Pumping system - Reactor - Mass transfer system. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Ragavan K.V., Khan A.A., Methodologies in Hazard identification and assessment -Manual, CLRI publication, 1990.*

2. *Marcel.V.C., Major Chemical Hazard, Ellis Hawood Ltd., Chi Chester, UK, 1987.*

3. *Skeleton B., Process Safety Analysis, Institution of chemical Engineers, U.K., 1997.*

REFERENCE

1. *Daniel A Crowl., Louvar J.F., Chemical Process Safety: Fundamentals with Applications, Prentice Hall, New Jersey, 2002.*

15CHOE03 - GREEN TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After completion of the course, students are able to

CO1 : *Outline the green technology concepts and relevance in twenty first century requirements.*

CO2 : *Defend the environmental and sustainability issues, role of CSR and CER and Indian corporate structure and environment.*

CO3 : *Recall the indicators of sustainability and their use and can also find the alternate theories.*

CO4 : *Criticize the environmental reporting, ISO 14001, ISO 14064, financial initative by UNEP, etc.*

CO5 : *Analyze the green tax incentives and rebates, business redesign and its models.*

INTRODUCTION

The concept of green technology; evolution; nature, scope, importance and types; developing a theory; green technology in India; relevance in twenty first century. **(9)**

SUSTAINABILITY & ENVIRONMENT

Organizational environment; internal and external environment; Indian corporate structure and environment; how to go green; spreading the concept in organization; environmental and sustainability issues for the production of high-tech components and materials, life cycle analysis of materials, sustainable production and its role in corporate social responsibility (CSR) and corporate environmental responsibility (CER).

(9)

ECOSYSTEM APPROACHES

Approaches from ecological economics; indicators of sustainability; ecosystem services and their sustainable use; bio-diversity; Indian perspective; alternate theories **(9)**

ACTS OF GREEN TECHNOLOGY

Environmental reporting and ISO 14001; climate change business and ISO 14064; green financing; financial initiative by UNEP; green energy technology; green product technology. **(9)**

GREEN ECONOMICS

Definition; green techniques and methods; green tax incentives and rebates (to green projects and companies); green project technology in action; business redesign; eco-commerce models. **(9)**

TOTAL : 45

REFERENCES

1. *Green Technology and Green Technologies: Exploring the Causal Relationship by Jazmin Seijas Nogarida, 2008.*

2. *Green Marketing and Technology: A global Perspective by John F. Whaik, 2005.*

3. *The Green Energy Technology Book by Leo A. Meyer.*

4. *Green Project Technology by Richard Maltzman and David Shiden.*

5. *Green Marketing by JacquelinOttman.*

6. *Green and World by Andrew S. Winston.*

15CHOE04 - CORROSION SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of this course, the students will be able to

CO1 : Classify the types of corrosion and theories and also relate the various controlled corrosion process.

CO2 : Examine the factors involved in the corrosion and control methods of various corrosion.

CO3 : Analyze the mechanism of corrosion and evaluate the effects like pH, temperature, flow rate on corrosion.

CO4 : Design and develop the corrosion control methods like cathodic protection, sacrificial anode and impressed current anodes and anodic protection.

CO5 : Predict the different corrosion testing, monitoring and inspection tests by surface analytical studies.

INTRODUCTION

Introduction, classification, economics and cost of corrosion.emf series, galvanic series, corrosion theories derivation of potential - Current relations of activities controlled and diffusion controlled corrosion process. Potential - pH diagram, Fe-H_2O system, application and limitation. Passivation - Definition, anodic passivation theory of passivation, oxidation laws, effects of oxygen and alloying on oxidation rates. **(9)**

CORROSION CONTROL METHODS

Forms of corrosion - Definition, factors and control methods of various forms of corrosion such as pitting, inter granular, crevice, dezincification, stress corrosion, corrosion fatigue, fretting corrosion, hydrogen embitterment, corrosion processes and control methods in fertilizers, petrochemical, chemical building industries **(9)**

MECHANISM OF CORROSION

Environmental aspects, atmospheric corrosion - Classification, factors influencing atmospheric corrosion, temporary corrosion preventive methods, corrosion in immersed condition, effect of dissolved gases, salts, pH, temperature, and flows rates on corrosion, marine corrosion, underground corrosion. Biological corrosion, definition, mechanism of corrosion, control of bio-corrosion. **(9)**

CORROSION PREVENTION

Corrosion control aspects, electrochemical methods of protection-theory of cathodic protection design of cathodic protection, sacrificial anodes, impressed current anodes, anodic protection. Corrosion inhibitors for acidic, neutral and alkaline media, cooling water system - Boiler water system.Organic coating, surface preparation, natural, synthetic resin, paint, formulation and application. Design aspects in corrosion prevention, corrosion resistant materials. **(9)**

CORROSION TEST

Corrosion testing, monitoring and inspection, laboratory corrosion tests, accelerated chemical tests for studying different forms of corrosion. Electrochemical methods of corrosion rate measurements by DC and AC methods, corrosion monitoring methods, chemical and electrochemical removal of corrosion products, newer techniques to study corrosion processes, inspection methods by NDT. Surface analytical techniques such as AES, ESCA, SEM. Evaluation of paints by conventional and electrochemical methods. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Roberge P. R., Corrosion Engineering, McGraw Hill, New York, 2008.*

2. *Fontana M.G., Greene N.D., Corrosion Engineering, Third Edition, McGraw Hill, NewYork, 2005.*

3. *Uhling H. H., Revie R.W., Corrosion and Corrosion Control, John Wiley and Sons, Inc, 1985.*

REFERENCES

1. *Banarjee.S.N., An introduction to corrosion and corrosion inhibitors, Oxonian Press Ltd., New Delhi, 1985.*

15CHOE05 - INTRODUCTION TO CHEMICAL ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

After successful completion of this course, the students will be able to

CO1   : Express the fundamentals of chemical engineering and to solve problems.

CO2   : Ability to develop basic fluid concepts, transfer and separation operations.

CO3   : Design equipments for transport and separation processes.

CO4   : Apply material and Energy balance to precisely calculate material requirement of a process.

CO5   : Apply steady state balances to develop process flow sheet.

OVERVIEW OF CHEMICAL ENGINEERING

Concepts of unit operations and unit processes, and more recent developments, The Chemical Industry-scope, features & characteristics. Flow sheets, and symbols for various operations.   **(9)**

MATERIAL AND ENERGY BALANCE CALCULATIONS

Material balances in simple systems involving physical changes and chemical reactions; systems involving recycle, purge, and bypass, combustion reactions, Forms of energy, optimum utilization of energy, Energy balance calculations in simple systems. Introduction to Computer aided calculations-steady state material and energy balances, combustion reactions.   **(9)**

BASIC FLUID CONCEPTS

Dimensions and Units, Velocity and Stress Fields, Viscosity and surface tension, Non Newtonian viscosity, Dimensional Analysis (Buckingham PI theorem), Types of flows, Methods of Analysis, Fluid Statics. pipe flow, Pumps, Agitation and Mixing, Compressors.

(9)

HEAT TRANSFER OPERATIONS

Review of conduction, resistance concept, extended surfaces, lumped capacitance; Introduction to Convection, natural and forced convection, correlations; Radiation; Heat exchangers- Fundamental principles and classification of heat exchangers, Evaporators.   **(9)**

MASS TRANSFER OPERATIONS

Fundamental principles and classification of Distillations, Adsorption, Absorption, Drying, Extraction, Membrane Process.Energy and Mass Conservation in process systems and industries.Introduction to chemical reactors.   **(9)**

TOTAL : 45

REFERENCES

1.   *G.T. Austin, R.N. Shreve, Chemical Process Industries, 5th ed., McGraw Hill, 1984.*

2.   *W.L. McCabe, J.C. Smith and P. Harriott, Unit Operations of Chemical Engineering, 6th Edition, McGraw Hill, 2001.*

3.   *R. M. Felder and R.W. Rousseau, Elementary Principles of Chemical Processes, 3rd ed., John Wiley, New York,2004.*

4.   *L.B. Anderson and L.A. Wenzel, Introduction to Chemical Engineering, McGraw Hill, 1961.*

5.   *H.S. Fogler, Elements of Chemical Reaction Engineering, 4th Ed., Prentice-Hall, 2006.*

15MOE01 - GRAPH THEORY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

OBJECTIVE

To provide fundamental concepts on Graph Theory and its application for the study of Engineering.

OUTCOME

CO1 : *The students will be able to understand the idea of graph theory and to solve the real time problem.*

CO2 : *To relate the Graph theory Algorithms' in their field of engineering and apply the same in their respective main stream.*

CO3 : *To become familiar with Special graphs for modeling the networks.*

CO4 : *Able to design and solve Coloring concepts for defined problems.*

CO5 : *Model the networks using graph theory.*

GRAPHS AND SUBGRAPHS

Graph --Standard Concepts in Graphs - Subgraphs -Complete Graph - Bipartite Graph - Isomorphism - Adjacency Matrix and Incidence Matrix - Walk, Trail and Path -Bipartite Graph -Connectedness- The Shortest Path Problem- Disjkstra's Algorithm

(9)

TREES

Trees- Characterization- Blocks - Block Graphs - Cayley's Formula - Spanning Trees- Spanning Tree Algorithms - Kruskal's and Prim's Algorithm **(9)**

EULERIAN AND HAMILTONIAN GRAPHS

Eulerian graphs - Euler's theorem -Hamiltonian graphs - Dirac's and Ore's theorems - Closure of a graph - Bondy-Chvatal theorem - Traveling salesman problem -The Chinese Postman Problem- Fleury's Algorithm. **(9)**

COVERING AND COLORING

Covering - Independent Sets - Matching - Perfect Matching-Applications- The Personal Assignment Problem- Coloring - Chromatic Number - Four Color Problem - Chromatic Polynomials - Application. **(9)**

DIRECTED GRAPHS

Digraph - Orientation - Strongly, Weakly and Unilaterally Connected Digraphs - Directed acyclic graph - Adjacency matrix and Incidence Matrix of graph - Network Flows- Transport Networks- Max-Flow Min- Cut Theorem- Activity Network **(9)**

THEORY : 45

TEXT BOOK

1. *Gary Chatrand and Ping Zhang, Introduction to Graph Theory, McGraw Hill Education (India), 2006.*

2. *Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall of India Private Limited, 2004.*

REFERENCES

1. *Douglas B.West, "Introduction to Graph Theory" II Edition, Prentice Hall of India Private Limited, 2000.*

2. *Reinhard Diestel, "Graph Theory", II Edition, Springer Publications, 2006.*

3. *Clark J. and Holton D.A, "A First Look at Graph Theory", Allied Publishers, 1995.*

4. *Frank Harary, Graph Theory, 10th Edition, Narosa Publishing House, 2001.*

15MOE02 - METHODS OF APPLIED MATHEMATICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

OBJECTIVE

To provide fundamental concepts on Method of Applied Mathematics and its application for the study of Engineering.

OUTCOME

CO1 : The students will be able to understand the idea of integral equations and to solve the real time problems.

CO2 : To familiarize the students with basic concept of ordinary differential equations, special functions and solve problems associated with engineering applications.

CO3 : To achieve an understanding of the basic concepts of boundary value problems and characteristic function representations and method of solving them.

CO4 : Able to construct and solve a mathematical model for heat flow problems in real life situation

CO5 : Able to use the concepts of Calculus of variations and basic concepts for solving equations involving functional.

INTEGRAL EQUATIONS

Relation between integral and differential equations - Green's function. Fredholum's equation with separable Kernals Hilbert Schmidt theory, interactive methods for solving equations of second kind **(9)**

SECOND ORDER ORDINARY DIFFERENTITAL EQUATIONS AND SPECIAL FUNCTIONS

Singular points, Series solutions and the methods of Frobenius, Bessel Equation,Bessel Functions, modified Bessel functions and their properties, Ber and BeifunctionsLegendre equation. Legendre functions,associatedLegendre functions and their properties, Series solutions Valid for large arguments. **(9)**

BOUNDARY PROBLEMS AND CHARACTERISTIC FUNCTION REPRESENTATIONS

Sturm -Liouviller problems. Orthogonal functions and expansions in series of Orthogonal functions.Stodola and Vianello method for Sturm - Liouviller problems Fourier, Fourier - Bessel and Legedre Series. Fourier Integral. Applications to Rotating shafts and buckling columns. **(9)**

PARTIAL DIFFERENTITAL EQUATIONS

Linerar and quasi - linear equations of the first and second order. Characterstics of first and second order linear equations. Heat flowequations.Problems in one, two and three dimensions. Fourier method.

Wave equation. Vibrating string andMembrance Fourier Method. Non -homogeneous problems and the method of variation of parameters. **(9)**

INTEGRAL TRANSFORM METHODS

Applications of Laplace transform and Fourier Transforms to PDE - Calculus of Variations :

Variational notation, Constraints and Lagarangian multipliers, variable and points, Rayleigh - Ritz method. **(9)**

TOTAL : 45

TEXT BOOK

1. M.K.Venkatraman, Higher Mathematics for Engineering and Science, third Edition , The National Publishing Company,(2014)

2. F.B. Hildebrand : Advanced Calculus for applications second Edn. (EEE). Prentice Hall of India P.Ltd., (2014)

REFERENCES

1. *F.B. Hildebrand - Methods of Applied Mathematics , second Edn. Prentice Hall of India P.Ltd., (2012)*

2. *C.Stephenson : An introduction to partial differential equation for Science students , ELBS.*

3. *E. D. Rainville : Special Functions.*

4. *Dettman : Mathematical methods in physics and Engineering.*

15MOE03 - LINEAR AND NON - LINEAR PROGRAMMING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

OBJECTIVE

To provide fundamental concepts on Linear & Non- Linear Programming and its application for the study of Engineering.

OUTCOME

CO1 : *The students will be able to understand the idea of linear Programming problems and to solve the real time problems.*

CO2 : *To familiarize the students with basic concept of Transportation models and solve problems associated with engineering applications.*

CO3 : *To achieve an understanding of the basic concepts of Assignment problems and method of solving them.*

CO4 : *Able to construct and solve a Game theory models in real life situation*

CO5 : *Able to use the concepts of Non-linear Programming problems for solving Constrained and unconstrained equations.*

LINEAR PROGRAMMING

Formulation of LPP - Graphical methods for two variables - The Simplex method - Artificial Variables Techniques - Big M - method -The Two Phase method - Dual Simplex Method **(9)**

TRANSPORTATION MODEL

Mathematical formulation of a Transportation problem -Methods for finding initial basic feasible solution - North West corner rule -Least cost method - Vogle's Approximation method -Modified distribution method - Degeneracy in Transportation problems **(9)**

ASSIGNMENT PROBLEM

Mathematical formulation of an Assignment problem - Hungarian Method - Unbalanced Assignment Models - Maximization case in Assignment Problems - Restrictions in Assignments -Travelling Salesman Problem **(9)**

GAME THEORY

Two person zero- sum Games -The Maxmini - Minimax Principle -Saddle Point and value of the game - Games without saddle points, Mixed Strategies-Matrix Oddment method for n×n games -Dominance Property-Graphical Method of 2× n or m×2 games. **(9)**

NON-LINEAR PROGRAMMING

Non-linear Programming Algorithm - Unconstrained Non-linear Algorithms - Constrained Non-linear Lagrange multipliers, Kuhn-Tucker optimality conditions. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Operations Research An Introduction, Eight Edition, Hamdy A.TAHA , Pearson Prentice Hall 2007, New Delhi*
2. *Resource management techniques by V.Sundaresan, Tenth Edition, 2016 A.R Publications, Chennai*

REFERENCES

1. *Andrews L.C. and Phillips R.L., "Mathematical Techniques for Engineers and Scientists", Prentice Hall of India Pvt.Ltd., New Delhi, 2005.*
2. *O'Neil, P.V., "Advanced Engineering Mathematics", Thomson Asia Pvt. Ltd., Singapore, 2003.*

15MOE04 - PROBABILITY AND RANDOM PROCESSES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

OBJECTIVE

To provide fundamental concepts on probability and Random process and its application for the study of Engineering.

OUTCOME

CO1 : *The students will be able to understand the idea probability problems and to solve the real time problems.*

CO2 : *To familiarize the students with basic concept of probability distributions and solve problems associated with engineering applications.*

CO3 : *To achieve an understanding of the basic concepts of Correlation and regression and method of solving them.*

CO4 : *Able to solve a signal processing problems by using random process concepts.*

CO5 : *Able to use the concepts of Correlation functions and Power spectral densities for solving Electrical and Electronics problem.*

THEORY OF PROBABILITY

Sample Space, Events, Axioms of probability, Conditional probability, Independent events, Theorem of total probability, Baye's Theorem.   **(9)**

PROBABILITY DISTRIBUTIONS

Definition of Discrete and Continuous random Variables   **(9)**

Discrete distributions : Binomial, Poisson and Geometric - Properties and Simple problems

Continuous distributions : Normal, Uniform Exponential - Properties and Simple problems.

CORRELATION AND REGRESSION

Correlation - Meaning and scope of Correlation - Scatter diagram, Karl Pearson's co-efficient of Correlation, Spearman's Rank Correlation, Multiple Correlation and partial correlation - simple problems.

Regression Analysis - Meaning and Scope of regression- Regression in two variables - Uses of Regression.   **(9)**

RANDOM PROCESSES

Classification - Stationary process - Markov process - Poisson process - Random telegraph process.   **(9)**

CORRELATION AND SPECTRAL DENSITIES

Auto Correlation functions -Cross Correlation functions -Properties -Power spectral density - Cross spectral density -Properties.   **(9)**

TOTAL : 45

TEXT BOOKS

1. *S.C.Gupta and V.K. Kapoor , Fundamental of Mathematical Statistics , Tenth revised edition ,2002.*

2. *T.Veerarajan , Probability ,Statistics and Random Processes ,Second Edition ,TataMcGraw-Hill 2007*

REFERENCES

1. *Rohatgi V.K. (2002) : Introduction to Mathematical Statistics, Wiley. 2. Bhat, B. R. (2005) : Modern Probability Theory - An Introductory Text Book, Third Edition, New Age International.*

2. *Cochran, W.G.(2007): Sampling Techniques, Wiley Eastern Private Limited*

3. *Sukhatme, P.V. and Sukhatme, B.V.(1977): Sampling Theory of Survey with Applications, Asia publishing House.*

4. *Venkataraman M .K , "Higher mathematics for Engineering and Science" National Publishing Company ,2000*

5. *Ibe, O.C., "Fundamentals of Applied Probability and Random processes", 1st Indian Reprint , Elsevier , 2007.*

6. *Peebles, P.Z., " Probability, Random Variables and Random Signal Principles" , Tata McGraw Hill , 4th Edition , New Delhi, 2002.*

15POE01 - INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Demonstrate the understanding of length scales concepts, nanostructures and nanotechnology.*

CO2 : *Understand the different classes of nanomaterials.*

CO3 : *Identify the principles of processing, manufacturing and characterization of nanomaterials and nanostructures.*

CO4 : *Outline the applications of nanotechnology and develop an ability to critically evaluate the promise of a nanotechnology device.*

BASICS OF NANOTECHNOLOGY

Introduction - Time and length scale in structures -Definition of a nanosystem -Dimensionality and size dependent phenomena -Surface to volume ratio -Fraction of surface atoms - Surface energy and surface stress- surface defects-Effect of nanoscale on various properties - Structural,thermal, mechanical,magnetic, optical and electronic properties. **(9)**

DIFFERENT CLASSES OF NANOMATERIALS

Classification based on dimensionality-Quantum Dots,Wells and Wires- Carbon based nano materials (bucky balls, nanotubes, graphene)- Metal based nanomaterials (nanogold, nanosilver and metal oxides) - Nanocomposites-Nanopolymers - Nano ceramics -Biological nanomaterials. **(9)**

SYNTHESIS OF NANOMATERIALS

Chemical Methods:Metal Nanocrystals by Reduction -Sol - gel processing -Solvothermal Synthesis-Photochemical Synthesis - Chemical Vapor Deposition(CVD) - Metal Oxide - Chemical Vapor Deposition (MOCVD).Physical Methods : Ball Milling - Electrodeposition - Spray Pyrolysis - DC/RF Magnetron Sputtering - Molecular Beam Epitaxy (MBE). **(9)**

CHARACTERIZATION OF NANOSTRUCTURES

Introduction, structural characterization, X-ray diffraction (XRD-Powder/Single crystal), Small angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM) - Energy Dispersive X-ray analysis (EDAX)- Transmission Electron Microscope (TEM) - Scanning Tunneling Microscope (STM)-Atomic Force Microscopy (AFM), UV-vis spectroscopy (liquid and solid state) - Raman spectroscopy -X-ray Photoelectron Spectroscopy (XPS) - Auger Electron Spectroscopy (AES). **(9)**

APPLICATIONS

Solar energy conversion and catalysis - Molecular electronics and printed electronics -Nanoelectronics -Polymers with a special architecture - Liquid crystalline systems - Applications in displays and other devices -Nanomaterials for data storage -Photonics, Plasmonics- Chemical and biosensors -Nanomedicine and Nanobiotechnology. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Nanotechnology: Basic Science and Emerging Technologies, Mick Wilson, Kamali Kannargare., Geoff Smith Overseas Press (2005)*

2. *A Textbook of Nanoscience and Nanotechnology,Pradeep T., Tata McGrawHill Education Pvt. Ltd., 2012.*

3. *Nanostructured Materials and Nanotechnology,Hari Singh Nalwa,Academic Press, 2002.*

4. *Introduction to Nanotechnology, Charles P.Poole,FrankJ.Owens,Wiley Interscience (2003)*

5. *Textbook of Nanoscience and Nanotechnology, B.S. Murty, P. Shankar, Baldev Raj, B BRath, James Murday, Springer Science & Business Media, 2013.*

REFERENCES

1. *Nanotechnology: A gentle introduction to the next Big idea, Mark A.Ratner, Daniel Ratner, Mark Ratne, Prentice Hall P7R:1st Edition (2002)*

2. *Fundamental properties of nanostructed materials Ed D. Fioran, G.Sberveglier, World Scientific 1994*

3. *Dupas C., Houdy P., Lahmani M.,Nanoscience: Nanotechnologies and Nanophysics, Springer-Verlag Berlin Heidelberg, 2007*

15POE02 - PHYSICS AND TECHNOLOGY OF THIN FILMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Recognize the fundamental growth and material parameters of thin films.*

CO2 : *Evaluate and use models for nucleation and growth of thin films.*

CO3 : *Asses the relation between deposition technique, film structure, and film properties.*

CO4 : *Identify modern techniques for the characterization of thin films*

CO5 : *Demonstrate the applications of thin films*

PREPARATION OF THIN FILMS

Preparation methods: electrolytic deposition, cathodic and anodic films, thermal evaporation, cathodic sputtering, chemical vapour deposition. Molecular beam epitaxy and laser ablation methods. Thickness measurement and monitoring: electrical, mechanical, optical interference, microbalance, quartz crystal methods. **(9)**

GROWTH KINETICS OF THIN FILMS

General features.- nucleation theories - energy formation of a nucleus - critical nucleation parameters; spherical and non spherical (cap, disc and cubic shaped) - Effect of electron bombardment on film structure. Post- nucleation growth, epitaxial films and growth. **(9)**

ANALYTICAL TECHNIQUES OF CHARACTERIZATION

X-ray diffraction - photoluminescence - UV-Vis-IR spectrophotometer - Atomic Force Microscope - Scanning Electron Microscope - Hall effect - Vibrational Sample Magnetometer - Secondary Ion Mass Spectrometry - X-ray Photoemission Spectroscopy - Auger emission spectroscopy. **(9)**

PROPERTIES OF THIN FILMS

Dielectric properties - experimental technique for the determination of dielectric properties - optical properties - experimental technique for the determination of optical constants - mechanical properties - experimental technique for the determination of mechanical properties of thin films - magnetic and superconducting properties. **(9)**

APPLICATIONS

Optoelectronic devices : LED, LASER and Solar cell - Micro Electromechanical Systems (MEMS) - Fabrication of thin film capacitor - application of ferromagnetic thin films; data storage, Giant Magnetoresistance (GMR) - sensors - fabrication and characterization of thin film transistor and FET. **(9)**

TOTAL : 45

TEXT BOOKS

1.   *A. Goswami, Thin Film Fundamentals, New Age international (P) Ltd. Publishers, New Delhi, 2006.*

2.   *L.I. Maissel and Glang (Eds.), Handbook of Thin film Technology, McGraw- Hill, 1970.*

3.   *K.L. Chopra, Thin Film Phenomena, McGraw-Hill (1983)*

REFERENCES

1.   *Thin-Film Deposition : Principles and Practice, Smith Donald Donald L Smith Smith, McGraw-Hill Professional Pub, 1995*

2.   *J.C. Anderson, The Use of Thin Films in Physical Investigation, Academic Press 1966.*

3.   *J.J. Coutts, Active and Passive Thin Film Devices, Academic Press 1978.*

4.   *George Hass, Physics of Thin Films: Volumes 1.:12, Academic Press 1963.*

5.   *KiyotakaWasa, Makoto Kitabatake, Hideaki Adachi, Thin Films Material Technology, Springer-Verlag Berlin Heidelberg, 2004.*

15POE03 - SOLAR CELL FUNDAMENTALS AND MATERIALS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Demonstrate the knowledge about photovoltaics.*

CO2 : *Gain knowledge about principle of operation of solar cells*

CO3 : *Realization about semiconducting materials used in the manufacture of PV cells*

CO4 : *Outline the various advanced solar cell technologies, their current status and future technological challenges*

EVULAUTION OF SOLAR CELLS

Historical development; present and future global issues- commercialization/economic factors- basic components of PV systems- The solar spectrum - terrestrial and space spectra; air mass (AM0, AM1.5) -Introduction to 1st, 2nd and 3rd generation photovoltaics. **(9)**

SOLAR CELL FUNDAMENTALS

Photovoltaic effect - Principle of direct solar energy conversion into electricity in a solar cell - light absorption- creating charge carriers forming the electric field - driving the charge carriers - solar cell parameters- electrical characteristics - the ideal solar cell, solar cell in practice, the quantum efficiency and spectral response, optical properties - basics of solar cell device design. **(9)**

SEMICONDUCTOR PROPERTIES

Overview of semiconductor properties relevant to solar cell operations- semiconductor band structure, carrier statistics in semiconductors, the transport equations, carrier mobility, carrier generation by optical absorption-band to band transitions, free-carrier absorption, recombination- bulk recombination processes, surface recombination, minority carrier life time. **(9)**

SILICON AND THIN FILM SOLAR CELLS

Si photovoltaics-single crystal silicon cells - semicrystalline and polycrystalline silicon cells - overview of various thin film solar cells:gallium arsenide solar cells - fabrication techniques, InP & cadmium telluride based solar cells - copper indium diselenide solar cells - multijunction cells -environmental and health aspects. **(9)**

ADVANCED SOLAR CELLS

Advanced solar cell concepts -organic (polymer) photovoltaics -new concepts - quantum dots, wires, intermediate band, multiple exciton generation - Dye sensitized solar cells - perovskite solar cells - challenges in materials and device design -current and future research trends in PV. **(9)**

TOTAL : 45

TEXT BOOKS

1. Fonash S. J., Solar Cell Device Physics, Academic, 2010.
2. Goetzberger, J. Knobloch, and B. Voss Crystalline Silicon Solar Cells, Wiley,1998.
3. Green M. A. Third Generation Photovoltaics: Advanced Solar Energy Conversion" Springer, 2006.

REFERENCES

1. *Chetan Singh Solanki., Solar Photovoltaic: Fundamentals,Technologies and Application, PHI Learning Pvt., Ltd., 2009.*
2. *Jha A.R., Solar Cell Technology and Applications, CRC Press,2010.*

15POE04 - ADVANCED MATERIAL PROCESSING TECHNOLOGIES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Recognize the criteria for material selection based on properties of materials and to choose the required material for a specified application.*

CO2 : *Understand various metallurgical forming processes such as casting, rolling extrusion, drawing, development of grain structure and processing of different composite types.*

CO3 : *Demonstrate knowledge about powder metallurgy, ceramic and polymer processing methods.*

CO4 : *Identify and choose the required surface treatment technique for coating formation on account of enhancing the surface properties of the mechanical components for engineering applications.*

CO5 : *Understand the applicable joining and machining techniques and their limitations*

SELECTION OF MATERIALS.

Motivation for selection - Selection for mechanical properties, strength, toughness, fatigue and creep - Selection for surface durability, corrosion and wear resistance - Relationship between materials selection and processing - Case studies - aero, auto, marine, machinery and nuclear applications.High and low temperature materials, superconductors, supramagnetic materials, high entropy alloys,nanomaterials and biomaterials. **(9)**

METALLURGICAL FORMING AND PROCESSING OF COMPOSITES

Metallurgical forming: Casting, rolling extrusion, drawing, development of grain structure for specific properties. Processing of composites: lay up methods, press/ autoclave / resin transfer moulding, Reinforced reaction injection molding (RRIM), obtrusion and filament winding. **(9)**

POWDER METALLURGY, CERAMIC AND POLYMER PROCESSING

Powder metallurgy and ceramic processing: green fabrication methods, sintering, hot pressing, Hot isostatic pressing (HIP), spark plasma sintering, development of microstructure in powder processed materials.Polymer processing: extrusion, injection moulding, blow moulding, rotational moulding, vacuum forming and related processes processing of cellular polymers. **(9)**

COATING METHODS

Introduction to surface Engineering, Differences between surface and bulk, Properties of surfaces-wear, wettability. Chemical vapour deposition, physical vapour deposition, electro deposition, electroless deposition, thermal spray processes. Principle of various coating processes, process parameters, controlling the yield of coating and various surface properties of the coating. Criteria for selection of a surface coating technology. Product oriented surface coating technology. **(9)**

JOINING AND MACHINING

Joining: fusion welding, solid state welding, adhesive bonding, mechanical joining and recent advancements in welding. machining: Electromachining (electrochemical and electro-discharge), mechanical machining and recent advancements. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Charles J.A., Crane, F.A.A and Furness, J.A.G., Selection and use of Engineering Materials, 3rd Edition, Butterworth-Heinemann, 1977.*

2. *BetzalelAvitzu, Metal Forming- Processes and Analysis, Tata McGraw Hill, 1977.*

3. *William F Hasford, Robert M Caddell, Metal Forming: Mechanics and Metallurgy, Cambridge University Press P.ltd,2007.*

4. *Angelo P C and Subramanian R, Powder Metallurgy Science, Technology and Applications, Prentice Hall of India, New Delhi, 2012.*

REFERENCES

1. *Michael Barsoum, Fundamentals of Ceramics, McGraw Hill Publishing Co., INC, 1997*

2. *Gowariker V R, Viswanathan N V, JayadevSreedhar, Polymer Science, New Age International P Ltd., 2005.*

3. *David S. Rickerby, Allan Matthews,Advanced surface coatings: a handbook of surface engineering, Blackie, 1991.*

4. *Parmar, R.S, Welding Engineering and Technology, Khanna Publishers, 2003.*

15COE01 - MEDICAL NANO TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

The students will be able to

CO1 : *Understand the essential features of nanomedicine*

CO2 : *Identify the medical based nanotools*

CO3 : *Assess health effects due to nanoparticle exposure*

ASSESSING NANOTECHNOLOGY HEALTH

Nanomaterials : The Current State of Nanotechnology Application - Nanotechnology Risks - Risk Analysis - Hazard Identification - Exposure Assessment for Nanomaterials - Risk Characterization - Risk Management - Best Practices for Nanomaterials in the Workplace - Safety Research - Needs for Engineered Nanoscale Materials **(9)**

RISK ASSESSMENT AND ENVIRONMENTAL PROTECTION

Context for Technological Risk - Need for Risk Assessment for Nanotechnology - Adaptive Risk Assessment for Nanomaterials - Origins and Development of Risk Assessment - Risk Assessment Used in Environmental Decision Making - Issues in Applying the Four Steps of Risk Assessment to Nanotechnology - Hazard Assessment - Exposure Assessment - Dose - Response Evaluation **(9)**

SUSTAINABLE NANOTECHNOLOGY DEVELOPMENT

Necessity of Risk Assessment in Nanotechnology - The Pace of Nanotechnology Development and the Paucity of Information - Potential for Wide Dispersion in the Environment Amid Uncertainty - Few Standards or Guidelines - Environmental Risk Issues - Carbon Nanotubes - Defining the Toxic Dose - Environmentally Friendly Nanotechnology - Life Cycle Analysis for Sustainable Nanotechnology **(9)**

HUMAN HEALTH, TOXICOLOGY, AND NANOTECHNOLOGY RISK

Mechanisms of Toxicity - Types of Toxicological Studies - Pulmonary Toxicity Studies - Gastro intestinal Toxicity - In Vitro Studies - Dermal - In Vitro Toxicity Studies **(4)**

ENVIRONMENTAL RISKS

Antimicrobial Properties of Nanoscale Silver - Buckyballs, Titanium Dioxide - Short-term Toxicity Tests - Daphnia LC50 Assays - Studies of Nanomaterial Toxicity to Fish - Buckyballs and Bass-TiO_2 in Arsenic - Field Studies - Environmental Exposures - Nanoscale Zerovalent Iron **(9)**

NANOELECTRONIC DEVICES

Resonant tunneling diodes - Field effect transistors - Single electron transfer devices - Potential effect transistors - Light emitting diodes and lasers - Nanoelectromechanical system devices - Quantum dot cellular automata **(5)**

TOTAL : 45

TEXT BOOKS

1. *GerogeW.Hanson, "Fundamentals of Nanoelectronics", Prentice Hall, 2007*

2. *Vladimir V. Mithin et.al, "Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications" Cambridge University Press, 2012*

REFERNCES

1. *Mithin.V, Kochelap.V and Stroscio.M, "Introduction to Nanoelectronics", Cambridge University Press, 2008*

2. *Karl Gosar et.al, "Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum devices", Springer, 2005.*

15COE02 - ADVANCED DRUG DELIVERY SYSTEM

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *The students will be able to know the fundamentals of Nanoscience and their applications in pharamacological industries*

CO2 : *The students will able to describe polymeric drug delivery systems and their encapsulation methodology to study targeted drug delivery with different polymeric systems*

CO3 : *The students will able to identify lipids-nanocarriers and their application in biological system*

CO4 : *The students will able to study site specific drug delivery for gene therapy*

THEORY OF ADVANCED DRUG DELIVERY

POLYMERS Dendrimers- Synthesis -Nanoscale containers- Dendritic Nanoscafold systems Biocompatibility of Dendrimers, Gene transfection. pH based targeted delivery- chitosan and alginate. Copolymers in targeted drug delivery- PCL,PLA, PLGA.
(8)

Fundamentals of Nanocarriers - Size, Surface, Magnetic and Optical Properties, Pharmacokinetics and Pharmacodynamics of Nano drug carriers. Critical Factors in drug delivery. Transport of Nanoparticles - In Vitro and Ex Vivo Models. **(10)**

LIPID BASED NANOCARRIERS

Liposomes, niosomes and solid lipid nanoparticles. Ligand based delivery by liposomes. Cubosomes. **(9)**

MICROBES AND ANTIBODY BASED NANOCARRIERS

Bacterial dependent delivery of vaccines. Drug delivery and subcellular targeting by virus, Drug packaging and drug loading. Delivery of therapeutics by antibodies and antibody bioconjugates. **(9)**

SITE SPECIFIC DRUG DELIVERY

Concepts and mechanism of Site specific drug delivery- Microneedles, Micropumps, microvalves. Implantable microchips.
(9)

TOTAL : 45

REFERENCES

1. *Drug Delivery: Engineering Principles for Drug Therapy, M. Salzman, Oxford University Press, 2001.*
2. *Drug Delivery and Targeting, A.M. Hillery, CRC Press, 2002.*
3. *Drug Delivery: Principles and Applications, B. Wang, Wiley Intersceince, 2005.*
4. *Nanoparticle Technology for Drug Delivery, Ram B. Gupta, Uday B. Kompella Taylor & Francis, 2006.*

15COE03 - BIOSENSORS

ASSESSMENT : THEORY

L	T	P	C
3	0	0	3

COURSE OUTCOME

CO1 : *The students will able to understand protein based biosensors and their enzyme reactivity, stability and their application in protein based nano crystalline thin film processing*

CO2 : *The students will able to describe DNA based biosensors to study the presence of heavy metals in the food products*

CO3 : *The students will able to understand fluorescence, UV-Vis and electrochemical applications of biosensors*

CO4 : *The students will able to study about the fabrication of biosensors and its application as nanochip analyzer*

PROTEIN BASED BIOSENSORS

Nano structure for enzyme stabilization - Single enzyme nano particles - Nanotubes microporus silica - Protein based nano crystalline Diamond thin film for processing **(9)**

DNA BASED BIOSENSOR

Heavy metal complexing with DNA and its determination water and food samples - DNA zymo biosensors **(9)**

ELECTRO CHEMICAL APPLICATION

Detection in biosensors - Flurorescence - Absorption - Electrochemical. Integration of various techniques - Fibre optic biosensors **(9)**

FABRICATION OF BIOSENSORS

Techniques used for microfabrication - Microfabrication of electrodes - On chip analysis **(9)**

BIOSENSORS IN RESEARCH

Future direction in biosensor research - Designed protein pores-as components of biosensors - Molecular design - Bionanotechnology for cellular biosensing - Biosensors for drug discovery - Nanoscale biosensors **(9)**

TOTAL : 45

REFERENCES

1.   *Biosensors: A Practical Approach, J. Cooper & C. Tass, Oxford University Press, 2004*
2.   *Nanomaterials for Biosensors, Cs. Kumar, Willey - VCH, 2007*
3.   *Smart Biosensor Technology, G.K. Knoff, A.S. Bassi, CRC Press, 2006.*

15COE04 - NANOCOMPOSITES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

The students will be able to

CO1   : Study the different synthesis techniques of metal ceramic nanocomposites and their functionality

CO2   : Describe the processing techniques for heterometallic nanocomposites and to study their electromagnetical property

CO3   : Understand the design of super hard nanocomposites with improved mechanical properties

CO4   : Study the polymer based carbon nanotube composites, to study their mechanical properties and their industrial applications

NANO CERAMICS

Metal-Oxide or Metal-Ceramic composites, Different aspects of their preparation techniques and their final properties and functionality.   **(9)**

METAL BASED NANOCOMPOSITES

Metal-metal nanocomposites, some simple preparation techniques and their new electrical and magnetic properties.   **(9)**

DESIGN OF SUPER HARD MATERIALS

Super hard nanocomposites, its designing and improvements of mechanical properties.   **(9)**

NEW KIND OF NANOCOMPOSITES

Fractal based glass-metal nanocomposites, its designing and fractal dimension analysis. Electrical property of fractal based nanocomposites. Core-Shell structured nanocomposites.   **(9)**

POLYMER BASED NANOCOMPOSITES

Preparation and characterization of diblock Copolymer based nanocomposites; Polymercarbon nanotubes based composites, their mechanical properties, and industrial possibilities.   **(9)**

TOTAL : 45

REFERENCES

1.   *Nanocomposites Science and Technology - P. M. Ajayan, L.S. Schadler, P. V. Braun 2006.*

2.   *Physical Properties of Carbon Nanotubes- R. Saito 1998.*

3.   *Carbon Nanotubes (Carbon, Vol 33) - M. Endo, S. Iijima, M.S. Dresselhaus 1997.*

4.   *The search for novel, superhard materials- Stan Vepr¡ek (Review Article) JVST A, 1999*

5.   *Electromagnetic and magnetic properties of multi component metal oxides, hetero*

6.   *Nanometer versus micrometer-sized particles-Christian Brosseau,Jamal Ben, Youssef, Philippe Talbot, Anne-Marie Konn, (Review Article) J. Appl. Phys, Vol 93, 2003*

7.   *Diblock Copolymer, - Aviram (Review Article), Nature, 2002*

15COE05 - BIOREFINERY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

The students will be able to

CO1 : *Understand various renewable feedstocks for biofuels production*

CO2 : *Understand the broad concept of second and third generation biofuel products from biomass and other low-cost agri-residues and biowastes.*

CO3 : *Analyze the design processes for biofuel production*

CHEMISTRY & BIOCHEMISTRY OF BIOMASS

Types of biomass (e.g. wood waste, forestry residues, agricultural residues, perennial annual crops, organic municipal solid waste). Composition of lignocellulose (lignin, hemicellulose, cellulose); energy crops; chemical pretreatment; enzymatic pretreatment; degradation of cellulose; triichoderma cellulases; bacterial cellulases; and comparison with degradation of high starch. **(9)**

BIODIESEL

Sources and processing of biodiesel, nature of lipids, fatty acids and triglycerides.Sources and characteristics of lipids for use as biodiesel feedstock; and conversion of feedstock into biodiesel, (transesterification). Use of vegetable oil (SVO) and waste vegetable oil (WVO). Environmental issues of biodiesel; major policies and regulations pertaining to the production, distribution, and use of biodiesel. **(9)**

BIOMETHANE OR BIOGAS

Hydrolysis; anaerobic digestion; methanogenesis (acetoclastic, hydrogenotrophic), rates of methane formation; and one and two stage fermentation.Thermal depolymerization.Use of exhaust gases (e.g. CO_2, H_2S and H_2) from geothermal power plants and industrial operations (e.g. coal and oil refineries) as an energy sources (methane and hydrogen) **(9)**

GASIFICATION & PYROLYSIS TECHNOLOGIES

Gasification processes and the main types of gasifier designs; production of electricity by combining a gasifier with a gas turbine or fuel cell.Combined- cycle electricity generation with gas and steam turbines, and generation of heat and steam for district heating systems or CHP, including kalina Cycle. Production of synthesis gas (i.e. CO, H_2, H_2O, CO_2) tar vapor and ash particles) for subsequent conversion to hydrogen and transport fuels; advanced gas cleaning technologies for biomass. Biological conversion of syngas into liquid biofuels. Fast pyrolysis technology to produce a range of fuels, chemicals, and fertilizers; biorefineries, and new uses for glycerine in biorefineries. **(9)**

POLICIES AND FUTURE R&D OF BIOFUELS & BIOENERGY

Analysis of both current and future EU regulations and directives on biofuels and bioenergy.Tax regulations. Evaluation of different production alternatives to produce bioenergy; competitiveness of bioenergy alternatives in agriculture compared to other energy sources. Evaluation of current and future R&D needs; legal framework to support sustainable development and increased use of biofuels; government policies and programs with regard to biofuels and investment opportunities worldwide. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Robert C.Brown, "Biorenewable Resourses: Engineering", New Products from Agriculture, Wiley- Blackwell Publishing, 2003*

2. *Samir K.Khanal, "Anaerobic Biotechnology for Bioenergy Production: Principles and Application", Wiley- Blackwell Publishing 2008*

REFERENCE

1. *Martin Kaltschmitt; Hermann Hofbauer. " Biomass Conversion and Biorefinery", Springer Publishing, 2008*

15HOE01 - PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Design the Management function for a given organization*

CO2 : *Design and develop a strategic approach for the completion of the project*

CO3 : *Analyze the behavior of individuals and groups in organizations in terms of the key factors*

CO4 : *Formulate the procedure for recruitment, selection, training of staff to establish an organization*

INTRODUCTION TO MANAGEMENT

Meaning, Definition and Significance of Management-Basic functions of Management-Development of Management Thought

(9)

MANAGEMENT CONCEPTS

Planning, Organizing, Staffing, Directing and Controlling- MBO-Six sigma   **(9)**

ORGANIZATIONAL BEHAVIOR

Significance of OB, Role of Leadership, Personality and Motivation, Stress, Attitudes, Values and Perceptions at work   **(9)**

BUSINESS PROCESS REENGINEERING

Need for BPR, Various phases of BPR, Production and Productivity-Factors influencing Productivity.   **(8)**

HUMAN RESOURCE MANAGEMENT

Evolution of Management- Development of Managerial skills-Human Resource Management - Objectives -Job analysis - Recruitment -Selection and Placement and Training Development   **(10)**

TOTAL : 45

TEXT BOOK

1. *Harold Koontz, Heinz Weihrich and Ramachandra Aryasri, "Principles of Management" Tata Mcgraw Hill, New Delhi, 2013*

2. *Mamoria, CB, "Personnel Management", Sultan Chand and Sons, New Delhi 2013*

REFERENCE BOOKS

1. *Robbin Finchanm and Peter Rhodes, "Principles of Organizational Behavior" Oxford University Press, 2010*

2. *CB Gupta "Management Theory and Practice" Sultan Chand and Sons, New Delhi, 2009*

3. *VSP Rao " Management Text and Cases" Excel Books, New Delhi, 2009*

4. *Fred Luthans " Organizational Behavior" Mc-Graw hill, New York 2005*

5. *Knanna OP "Industrial Engineering and Management", Dhanpat Rai publications, New Delhi 2003*

15HOE02 - CURRENT TRENDS IN INDIAN ECONOMY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Outline the structure of our Indian Economic System*

CO2 : *Access the role of industrial sector in Indian economy*

CO3 : *Interpret the demographic trends for the current scenario*

CO4 : *Analyze the role of two tier for the achievement of common national goals*

NATIONAL INCOME AND AGRICULTURE SECTOR

Economics Development-Meaning-National Income and Per capita Income in India- Indian Planning-Agricultural Development of India: Major crops- Production-Productivity-Contribution to GDP and Exports **(8)**

INDUSTRIAL SECTOR

India's industrial development-Industrial policies of 1948, 1956 and 1991-Liberalisation-Public sector-Privatization-Disinvestment policy-Role and importance of large scale industries and small scale industries-Special economic zones-Contribution to GDP-Growth rate **(8)**

POPULATION

Growth and policy issues-Demographic trends-Vital statistics-India's population: size and growth rate-Demographic dividend-HDI-Population policy-Issues of Unemployment, Poverty and inequality in India **(10)**

SERVICE SECTOR

Service sector in India-Banking-Insurance-Telecommunication-IT sector-Sofware exports-BPO-Contribution to GDP **(9)**

FEDERAL SYSTEM AND FOREIGN TRADE

Federal setup in India-Taxes: Direct and Indirect Tax-Value added Tax-Foreign direct investment-Merits and Demerits-India's imports and exports: Composition and direction-Foreign exchange reserve position- MNC's in India **(10)**

TOTAL : 45

TEXT BOOK

Ruddar Datt and Sundaram, KPM, Indian Economy, S.Chand and company, New Delhi-2015 Ramesh Singh Indian Economy, McGraw hill Education 7th edition, 2015

REFERENCES

www.jagranjosh.com

15HOE03 - MONETARY ECONOMICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Evaluate the monetary measures formulated through static and dynamic role of money*

CO2 : *Design the driving force of circular flow of money*

CO3 : *Analyse how quantity theory of money fluctuate the price level*

CO4 : *Estimate the demand and supply of money based on the Interest rate*

NATURE AND SIGNIFICANCE OF MONEY

Definition of Money-Functions of Money-Static and Dynamic role of Money-Circular flow of Money-Monetary standards-Gold standard-Paper currency standard-Principles of Note issue-Measures of Money supply **(9)**

QUANTITY THEORY OF MONEY

Fisher's quantity theory of Money-Assumptions-Cash Balance Approach (Cambridge Equations)- Equation of Marshall, Pigou and Keynes-Similarities and dissimilarities of cash balance and cash transaction approaches-Income and expenditure theory-Superiority of Income and expenditure theory-Demand for Money: Classical and Keynesian liquidity preference theory approach **(9)**

INFLATION AND DEFLATION

Meaning-Types-Causes of Inflation-Demand Pull and Cost push inflation -Inflationary Gap-Phillips Curve-Effects of Inflation-Deflation-Causes-Measures to control Inflation and Deflation-Stagflation **(9)**

COMMERCIAL BANKING AND FINANCIAL MARKETS

Functions of Commercial Banks-Credit Creation-Meaning and constitute of Money Markets-Capital Market-Institutional structure of Capital Market-Primary Market-Secondary Market-Indian capital Market-Non-Banking financial intermediaries **(9)**

CENTRAL BANKING AND MONETARY POLICY

Central Banking-Functions-Organization-Instruments of Credit control-Monetary Policy: Meaning, Objectives, and Recent policy changes in RBI-Monetary Policy in a developing economy **(9)**

TOTAL : 45

TEXT BOOK

1. *Jhinghan ML "Monetary Economics:" Vrinda Publications, New Delhi 2013*

REFERENCE BOOKS

1. *Sethi TT, "Monetary Economic Theory", S Chand & Co, New Delhi 1996*
2. *Mithani DN, "Money Banking and International Trade", Himalaya, Mumbai 2013*

15HOE04 - ACCOUNTING FOR MANAGERIAL DECISIONS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Differentiate Financial and Management Accounting*

CO2 : *Analyze the profit and loss of the firm using the classifications of ratio analysis*

CO3 : *Prepare a fund flow statement*

CO4 : *Sketch the Break even chart and interpret the results for a given data*

MANAGEMENT ACCOUNTING

Introduction to Management Accounting - Nature and Scope of Management Accounting - Importance - Functions - Distinguish between Financial and Management Accounting - Tools in Management Accounting - Limitations - Disadvantages **(9)**

FINANCIAL STATEMENTS

Ratio Analysis - Meaning - Significance - Classifications - Liquidity Ratios - Turnover Ratios - Profitability Ratios - Solvency Ratios **(8)**

FUND FLOW AND CASH FLOW STATEMENT

Meaning and concept of flow of Funds-Meaning of fund Flow Statement - Difference between Fund flow statement and Income statement - Preparation and Interpretation of cash flow statement **(9)**

INVESTMENT DECISION

Budgeting - Objectives - Features - Advantages - Disadvantages - Cash Budget - Flexible Budget **(9)**

MARGINAL COSTING AND WORKING CAPITAL MEASUREMENT

Marginal Costing - Importance - Advantages - Breakeven Point - Breakeven Chart - Margin of Safety - Profit Volume Analysis - Working Capital - Importance - Factors Affecting Working Capital - Computation of Working Capital Requirements **(10)**

TOTAL : 45

TEXT BOOK

1. *R.K.Sharma and Sasi K.Gupta, "Management accounting", 2014*

15HOE05 - ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Develop an entrepreneurial mindset by learning key skills such as creative thinking, innovations and funding for business*

CO2 : *Formulate a business plan*

CO3 : *Assess the strengths and weaknesses of business plan*

CO4 : *Prepare a business plan for selecting a product*

LAUNCHING ENTREPRENEURIAL VENTURES

Creativity, Innovations, Methods to Initiate Ventures, Legal Challenges, Search for Entrepreneurial Capital **(8)**

BUSINESS PLAN FOR NEW VENTURES

Meaning and Objectives of a Business Plan, Advantages and cost of preparing a Business Plan, Elements, Critical Assessment **(9)**

STRATEGIC PERSPECTIVES

Strategic Growth, Need for Strategic Planning, Understanding the growth stage, Unique managerial Concerns of growing enterprise, Valuation Concerns **(10)**

ENTREPRENEURSHIP

Indian Perspective: Historical Perspective, Global Indian Entrepreneurs, Institutions, Modern Entrepreneurs **(9)**

PROJECT WORK

Students have to prepare a detailed business plan selecting a product(s), Presentation of such business plans and submission after necessary corrections suggested by subject faculty. **(9)**

TOTAL : 45

TEXT BOOK

1. *Robert D Hisrich, Michael P Peters & Dean Shepherd, "Entrepreneurship", Tata McGraw Hill, 2013*

REFERENCES

1. *Thomas W.Zimmerer, Norman M.Scarborough, "Essentials of Entrepreneurship and Small Business Management", Prentice Hall of India, 2009*
2. *G.S.Sudha, "Management and Entrepreneurship Development", Indus Valley Publication, 2009*

15HOE06 - EMPLOYABILITY SKILLS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

Set a goal and outline strategies to achieve it

CO1 : Prepare a job application letter with a resume for a position in a corporate sector.

CO2 : Analyse the listening comprehension and answer the questions

CO3 : Find a solution for a problem in the corporate sector applying problem solving skills

GOAL SETTING AND TIME MANAGEMENT

Goal Setting - Immediate, Short Term and Long Term Goals - Smart Goals - Strategies to Achieve Goals - Confidence Building, Self-esteem, Motivation - Time Management - Identifying Time Wasters - Time Management Skills.   **(9)**

SPEAKING

Ice-breakers - Self introduction - Role Play - Debate - Group Discussion: Purpose - Group Behavior - Analyzing Performance. Job Interviews: Identifying Job Openings - Interview Process - Types of Questions - Mock Interviews - Professional Grooming.
(11)

READING AND WRITING

Reading Comprehension - Speed Reading Necessary for Reading Letters and Files - Vocabulary Development - Preparing Job Applications - Writing Covering Letter and Résumé - Applying for Jobs Online - Creative Writing - Article Writing - Book Review
(9)

LISTENING

Listening to - Conversations, Long Speeches, Narrations, Descriptions, Famous Speeches.   **(8)**

LEADERSHIP AND TEAM MANAGEMENT

Qualities of a Good Leader - Leadership Styles - Decision Making - Problem Solving - Etiquettes - Email, Professional, Dining & Telephone - Team Building - Team Work - Delegation.   **(8)**

TOTAL : 45

TEXT BOOKS

1. *Aruna Koneru. "Professional Communication". Tata MacGraw Hill Publishing Company Limited. New Delhi, 2008.*

2. *Jones, Leo and Richard Alexander. "New International Business English" Cambridge University Press, 2003.*

REFERENCE BOOK

1. *Corneilssen, Joep. "How to Prepare for Group Discussion and Interview". New Delhi: Tata-McGraw-Hill, 2009.*

15HOE07 - ENGLISH FOR ACADEMIC PURPOSES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Write a description of a system.*

CO2 : *Formulate a research paper*

CO3 : *Listen to a lecture and prepare a summary.*

CO4 : *Construct dialogues using appropriate expressions.*

FOCUS ON LANGUAGE

Sentence construction- Types of clauses- Sequence- Co ordination- Subordination- Paragraphing Information - Describing a system & procedure **(8)**

READING

Understand a writer's purpose - Use strategies to ascertain meaning from unfamiliar vocabulary encountered in context - Recall and use vocabulary regarding urbanization and mega cities - To identify and outline main ideas in a passage - Skim a reading passage for main ideas - Summarize texts and images - Using a dictionary to obtain lexical, phonological and orthographical information - Identify and use target vocabulary words - Highlight important parts and texts. **(8)**

WRITING

Achieving appropriate tone and style in Academic Writing - Writing a Research Article - Types of Research Designs - Choosing a Research Problem- The Abstract - The Introduction - The Literature Review - The Methodology - The Results - The Discussion - The Conclusion - Citing Sources - Proof reading Your Paper **(10)**

LISTENING

Listening to conversation - Lectures - Topics - Discussions - Listening comprehension on specific topics - Listening to recognize formal and informal spoken English **(8)**

SPEAKING

Seminar skills - Engage in verbal role playing in formal and informal situations - Express advice and personal opinions with supporting information - Paraphrase stories and information - Expressing requests - Suggestions - Complaints - Apology - Giving and accepting compliments - Making invitations - Refusing invitations **(11)**

TOTAL : 45

TEXT BOOK

1. *MLA Hand book 8th Edition Published 2016, ISBN : 9781603292627*

REFERENCE BOOK

1. *English for writing research papers, Authors : Wall work, Adrian Published 2016. Spinger Publication.*

15HOE08 - ENGLISH FOR COMPETITIVE EXAMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Listen to TOEFL, GRE & IELTS exercises and formulate appropriate answers.*

CO2 : *Speak using right grammar and appropriate pronunciation on general and academic topics.*

CO3 : *Analyze the passage and answer the questions.*

CO4 : *Generate and organize ideas on a given topic*

LISTENING

Listening to conversation - Narration - Suggestion - Assumptions - Predictions - Implications - Problems - Academic conversations - discussions - Lectures **(11)**

SPEAKING

Independent speaking - Integrated speaking - Speaking about a personal experience - Preferences - Report the speakers opinion - Explain a problem and solution give a summary of an Academic lecture. **(13)**

READING

Read and understand short passages - Integrated reading tasks - Read the passage and choose the right summary of the passage - Reading for main ideas - Scanning the passage for synonyms - Making inferences - Identifying exceptions - Locating references **(12)**

WRITING

Independent writing - Integrated writing - Writing short essays - Writing dialogues - Articles - Sentence construction **(9)**

TOTAL : 45

TEXT BOOK

1. *Sharpe J.Pamela. Barron's How to prepare for the TOEFL Test of English as a foreign Language. 11th Edition, Galgotia publications Pvt.Ltd: New Delhi, 2004.*

REFERENCE BOOK

1. *Sharpe J.Pamela. Barron's TOEFL iBT Internet- Based Test. 12th Edition, Galgotia publications Pvt.Ltd: New Delhi, 2009.*

2. *Longman Introductory course for the TOEFL test.*

15HOE09 - LIFE AND LITERATURE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *Compose an essay on the prose piece*

CO2 : *Analyse the poem and write a critical appreciation of it*

CO3 : *Read the story and find the moral values implied in the stories*

CO4 : *Write a review of the fiction*

PROSE

The Postmaster by Rabindranath Tagore,

Snapshot of a Dog by J G Thurber

On the Rule of the Road by A.G. Gardiner

The Village Schoolmaster by Oliver Goldsmith

Incident of the French Camp by Robert Browning   **(13)**

POEMS

Stopping By Woods on a Snowy Evening by Robert Frost

The Ballad of Father Gilligan by W.B. Yeats   **(9)**

SHORT STORIES

The Model Millionaire by Oscar Wilde

The Ant and the Grasshopper by W. Somerset Maugham

The Doll's House by Katherine Mansfield, Biography   **(10)**

Albert Einstein and Steve Jobs

FICTION

The Old Man and the Sea by Ernest Hemmingway

The Scarlet Pimpernel by Baroness Emma Orczy

Practice in creative writing, review writing   **(13)**

TOTAL : 45

TEXT BOOK

1. *Kumara Pillai. ed. A Book of Modern Short Stories. Macmillan: New Delhi, 2009*

2. *Colleen and Darius Krishnaraj. ed. Convergence, A Book of Short Stories. Macmillan: New Delhi, 2009*

3. *Ernest Hemmingway. The Old Man and the Sea. Arrow: Warwickshire, 2000*

   Baroness Emma Orczy, The Scarlet Pimpernel. Hutchinson : 1995

REFERENCE BOOK

1. *Xavier. ed. An Anthology of Popular Essays and Poems. Macmillan: New Delhi, 2009.*