

COIMBATORE INSTITUTE OF TECHNOLOGY

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

VISION AND MISSION OF THE INSTITUTE

VISION

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

MISSION

The mission of 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

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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

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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 promote research culture and self-development with an aptitude for lifelong learning among graduates.
- PEO3** : To inculcate professional ethics with a commitment to the society and environment.

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DEPARTMENT OF CIVIL ENGINEERING

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to :

1. **Engineering knowledge** : Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis** : Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions** : Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage** : Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society** : Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability** : Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics** : Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work** : Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication** : Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance** : Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning** : Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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DEPARTMENT OF CIVIL ENGINEERING

PROGRAMME SPECIFIC OUTCOMES (PSOs)

- PSO1** : The graduates of this programme with proficiency in mathematics and physical science will excel in the core areas of civil engineering such as Structural, Environmental, Geotechnical, Water resources engineering and Construction Management.
- PSO2** : The graduates will plan, produce detailed drawings, write specifications, prepare cost estimates.
- PSO3** : The graduates will interact with stakeholders effectively and execute quality construction work.

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DEPARTMENT OF CIVIL ENGINEERING

B.E. CIVIL ENGINEERING-FULL TIME

(III TO VIII SEMESTER)

Curriculum from the Academic Year 2019 - 2020 and onwards

SUBJECTS OF STUDY

Semester III

Course Code	Course Name	L	T	P	C	Category
19CEM31	Differential Equations and Boundary Value Problems	3	1	0	4	BSC
19CE31	Mechanics of Solids	3	1	0	4	ES
19CE32	Engineering Geology	3	0	0	3	PC
19CE33	Mechanics of Fluids	3	0	0	3	PC
19CE34	Surveying	3	0	0	3	PC
19CE35	Water Supply Engineering	3	0	0	3	PC
19HSS01	Science of Creativity and Professional Ethics	1	0	0	1	HSC
19CEL36	Strength of Materials Laboratory	0	0	2	1	PC
19CEL37	Survey Laboratory	0	0	2	1	PC
	One Credit Course	1	0	0	1	EEC
19HOC31	Communication Skills for Engineers I*	0	0	2	1	EEC
	TOTAL CREDITS				25	

Semester IV

Course Code	Course Name	L	T	P	C	Category
19CE41	Construction Technology	3	0	0	3	PC
19CE42	Strength of Materials	3	1	0	4	PC
19CE43	Transportation Engineering	3	0	0	3	PC
19CE44	Applied Hydraulics and Hydraulic Machinery	3	0	0	3	PC
19CE45	Waste Water Engineering	3	0	0	3	PC
19CE46	Professional Practices and Ethics	3	0	0	3	BSC
19CEL47	Hydraulics Laboratory	0	0	2	1	PC
19CEL48	Environmental Engineering Laboratory	0	0	2	1	PC
	One Credit Course	1	0	0	1	EEC
19HOC41	Communication Skills for Engineers II*	0	0	2	1	EEC
	TOTAL CREDITS				23	
	* Not to be counted for GPA. Pass is required					

Semester V

Course Code	Course Name	L	T	P	C	Category
19CE51	Structural Analysis - I	3	0	0	3	PC
19CE52	Design of Reinforced Concrete Structural Elements	3	0	0	3	PC
19CE53	Mechanics of Soils	3	0	0	3	PC
19CE54	Concrete Technology	3	0	0	3	PC
	Elective- I	3	0	0	3	EC
	Elective - II	3	0	0	3	EC
19CEL55	Computer Aided Civil Engineering Drawing	0	0	2	1	ES
19CEL56	Highway Engineering Laboratory	0	0	2	1	PC
	One Credit Course	1	0	0	1	EEC
	Mini Project	-	-	-	-	EEC
19INT51	Internship*	0	0	2	1	EEC
19HOC51	Employability and Personality Development Skills I #	0	0	2	1	EEC
	TOTAL CREDITS				23	

***2 weeks of Internship to be completed during 4th semester vacation**

Semester VI

Course Code	Course Name	L	T	P	C	Category
19CE61	Structural Analysis - II	3	0	0	3	PC
19CE62	Design of Steel Structures	3	0	0	3	PC
19CE63	Foundation Engineering	3	0	0	3	PC
	Elective- III	3	0	0	3	EC
	Elective- IV	3	0	0	3	EC
19CEL64	Soil Mechanics Laboratory	0	0	2	1	PC
19CEL65	Quantity Surveying and Project Planning Laboratory	0	0	2	1	PC
	One Credit Course	1	0	0	1	EEC
19CE66	Mini Project	0	0	6	3	EEC
19INT61	Internship*	0	0	2	1	EEC
19HOC61	Employability and Personality Development Skills II #	0	0	2	1	EEC
	TOTAL CREDITS				23	

***2 weeks of Internship to be completed during 5th semester vacation**

Not to be counted for GPA. Pass is required

Semester VII

Course Code	Course Name	L	T	P	C	Category
19CE71	Irrigation Engineering	3	0	0	3	PC
19CE72	Earthquake Resistant Design of Structures	3	0	0	3	PC
19CE73	Construction Management	3	0	0	3	PC
	Elective- V	3	0	0	3	EC
	Elective- VI	3	0	0	3	EC
19CEL74	Computer Applications Laboratory	0	0	2	1	PC
19CEL75	Concrete Laboratory	0	0	2	1	PC
19CE76	Project Work Phase I	0	0	6	3	EEC
	TOTAL CREDITS				20	

Semester VIII

Course Code	Course Name	L	T	P	C	Category
	Elective- VII	3	0	0	3	EC
	Elective-VIII	3	0	0	3	EC
19CE81	Project Work Phase II	0	0	10	5	EEC
	TOTAL CREDITS				11	

* Including first year credits

TOTAL CREDITS = 164*

BSC - Basic Sciences

HSC - Humanities and Social Sciences

ES - Engineering Sciences

PC - Professional Core

PE - Professional Elective

OE - Open Elective

EEC - Employability Enhancement Course

EC - Elective Course - PE / OE

LIST OF ELECTIVES

PROFESSIONAL ELECTIVES

1. STRUCTURAL ENGINEERING

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19CEE01	Design of Concrete Structures	3	0	0	3	PE
2	19CEE02	Advanced Concrete Structures	3	0	0	3	PE
3	19CEE03	Prestressed Concrete Structures	3	0	0	3	PE
4	19CEE04	Design of Bridges	3	0	0	3	PE
5	19CEE05	Advanced Steel Structures	3	0	0	3	PE
6	19CEE06	Advanced Structural Analysis	3	0	0	3	PE
7	19CEE07	Prefabricated Structures	3	0	0	3	PE
8	19CEE08	Advanced Surveying	3	0	0	3	PE
9	19CEE09	Numerical Methods for Civil Engineering	3	0	0	3	PE
10	19CEE10	Finite Element Method	3	0	0	3	PE
11	19CEE11	Industrial Structures	3	0	0	3	PE
12	19CEE12	Smart Materials and Structures	3	0	0	3	PE
13	19CEE13	Safety in Civil Engineering Practice	3	0	0	3	PE
14	19CEE14	Remote Sensing and GIS	3	0	0	3	PE
15	19CEE15	Ground Improvement Techniques	3	0	0	3	PE
16	19CEE16	Design of Deep Foundation	3	0	0	3	PE
17	19CEE17	Earthquake Resistant Design of Masonry and Timber Structures	3	0	0	3	PE
18	19CEE18	Building Services and Maintenance Engineering	3	0	0	3	PE
19	19CEE19	Optimization Techniques in Civil Engineering	3	0	0	3	PE
20	19CEE20	Theory of Architecture	3	0	0	3	PE
21	19CEE21	Green Building Concepts and Practices	3	0	0	3	PE

2. ENVIRONMENTAL ENGINEERING

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19CEE22	Design of Environmental Structures and Drawing	3	0	0	3	PE
2	19CEE23	Air Pollution and Control	3	0	0	3	PE
3	19CEE24	Solid and Hazardous Waste Management	3	0	0	3	PE
4	19CEE25	Environmental Impact Assessment	3	0	0	3	PE
5	19CEE26	Industrial Waste Water Management	3	0	0	3	PE
6	19CEE27	Geo Environmental Engineering	3	0	0	3	PE

3. TRANSPORTATION ENGINEERING

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19CEE28	Pavement Engineering	3	0	0	3	PE
2	19CEE29	Airport and Harbour Engineering	3	0	0	3	PE
3	19CEE30	Traffic Engineering	3	0	0	3	PE
4	19CEE31	Urban Transportation Planning	3	0	0	3	PE
5	19CEE32	Intelligent Transport System	3	0	0	3	PE

4. HYDRAULICS

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19CEE33	Hydraulic Structures	3	0	0	3	PE
2	19CEE34	Engineering Hydrology	3	0	0	3	PE

5. CONSTRUCTION ENGINEERING AND MANAGEMENT

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19CEE35	Valuation of Immovable Properties	3	0	0	3	PE
2	19CEE36	Engineering Economics	3	0	0	3	PE
3	19CEE37	Maintenance and Rehabilitation of Structures	3	0	0	3	PE
4	19CEE38	Advanced Construction Technology	3	0	0	3	PE
5	19CEE39	Contract Management	3	0	0	3	PE
6	19CEE40	Construction Equipments and Techniques	3	0	0	3	PE
7	19CEE41	Formwork for Concrete Structures	3	0	0	3	PE
8	19CEE42	Entrepreneurship in Civil Engineering	3	0	0	3	PE

ONE CREDIT COURSES***A) INDUSTRY BASED ONE CREDIT COURSES**

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19CEOC01	Building Construction Process- An Overview	1	0	0	1	OC
2	19CEOC02	Applications of IOT in Civil Engineering	1	0	0	1	OC
3	19CEOC03	Certification and Career Roadmap in Civil Engineering	1	0	0	1	OC
4	19CEOC04	Environmental Monitoring	1	0	0	1	OC
5	19CEOC05	Python for Civil Engineers	1	0	0	1	OC
6	19CEOC06	3D Printing of Civil Engineering Structures	1	0	0	1	OC

B) DEPARTMENT BASED ONE CREDIT COURSES

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19CEOC07	Alternative Building Materials from Waste	1	0	0	1	OC
2	19CEOC08	Structural Drawing	0	0	2	1	OC
3	19CEOC09	Sustainability in Construction	1	0	0	1	OC
4	19CEOC10	Introduction to Image Processing and GIS	0	0	2	1	OC

C) NPTEL ONLINE COURSES

* One credit courses could be opted from Department / Industry / NPTEL

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LIST OF OPEN ELECTIVES

DEPARTMENT OF CIVIL ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
19CEOE01	Town Planning and Architecture	3	0	0	3	All Branches
19CEOE02	Climate Change and Adaptation	3	0	0	3	All Branches
19CEOE03	Metro Systems and Engineering	3	0	0	3	All Branches
19CEOE04	Renewable Energy Sources	3	0	0	3	All Branches
19CEOE05	Principles of Sustainable Development	3	0	0	3	All Branches
19CEOE06	Disaster Management	3	0	0	3	All Branches

DEPARTMENT OF MECHANICAL ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
19MEOE01	Design of Experiments	3	0	0	3	All branches
19MEOE02	Engineering Optimization	3	0	0	3	All branches
19MEOE03	Engineering Polymers, Composites and Allied Manufacturing Processes	3	0	0	3	Mechanical Chemical & Civil
19MEOE04	Industrial Robotics	3	0	0	3	Mechanical EEE and ECE
19MEOE05	Business Process Re-engineering	3	0	0	3	All branches
19MEOE06	Engineering Economics and Financial Management	3	0	0	3	All branches

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
19EEOE01	Energy Auditing	3	0	0	3	ECE, Mech, Chemical, Civil
19EEOE02	Solar and Wind Energy systems	3	0	0	3	ECE, Mech, Chemical
19EEOE03	Electrical Safety Procedures and Management	3	0	0	3	All Branches
19EEOE04	Energy Efficient Illumination Systems	3	0	0	3	All Branches
19EEOE05	Electric Vehicle Technology	3	0	0	3	All Branches except Civil & Chemical
19EEOE06	Energy Efficiency in Thermal and Electrical Utilities	3	0	0	3	EEE & Mechanical

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
19ECEOE01	Signal Processing and its Applications	3	0	0	3	Chemical, Mechanical & Civil
19ECEOE02	Smart Sensors and IoT	3	0	0	3	All Branches
19ECEOE03	Consumer Electronics	3	0	0	3	Mechanical & Civil
19ECEOE04	Robotics	3	0	0	3	Mechanical, CSE & IT
19ECEOE05	Information Theory and Coding Techniques	3	0	0	3	All Branches
19ECEOE06	Wireless Sensor Networks	3	0	0	3	All Branches
19ECEOE07	Automotive Embedded Systems	3	0	0	3	All Branches
19ECEOE08	5G Technologies and Applications	3	0	0	3	All Branches
19ECEOE09	Vehicular Communication	3	0	0	3	All Branches
19ECEOE010	Sensing for Automotive Systems	3	0	0	3	All Branches

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
19CSOE01	Customer Relationship Management	3	0	0	3	All Branches
19CSOE02	Fundamentals of Software Engineering	3	0	0	3	All Branches
19CSOE03	Internet Programming	3	0	0	3	All Branches
19CSOE04	Introduction to Data Warehousing and Data Mining	3	0	0	3	All Branches
19CSOE05	Introduction to Embedded Systems	3	0	0	3	All Branches

DEPARTMENT OF INFORMATION TECHNOLOGY

Course Code	Course Name	L	T	P	C	Eligible Branches
19ITOE01	Digital Computer Basics	3	0	0	3	Civil, Mech, Chem
19ITOE02	Programming in Java	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
19ITOE03	Fundamentals of Database Systems	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
19ITOE04	Cloud Computing Fundamentals	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
19ITOE05	Information Security Fundamentals	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
19ITOE06	Introduction to Human Computer Interaction	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
19ITOE07	Enterprise Resource planning Concepts	3	0	0	3	EEE, ECE, Mech, Civil & Chemical

DEPARTMENT OF CHEMICAL ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
19CHOE01	Industrial Safety Engineering	3	0	0	3	All Branches
19CHOE02	Risk Analysis and Hazop	3	0	0	3	All Branches
19CHOE03	Green Technology	3	0	0	3	All Branches
19CHOE04	Corrosion Science and Engineering	3	0	0	3	All Branches
19CHOE05	Introduction to Chemical Engineering	3	0	0	3	All Branches
19CHOE06	Nanomaterial Synthesis and Characterization Laboratory	0	0	6	3	All Branches
19CHOE07	Multivariate Statistics Laboratory	0	0	6	3	All Branches

DEPARTMENT OF MATHEMATICS

Course Code	Course Name	L	T	P	C	Eligible Branches
19MOE01	Graph Theory & its Applications	3	0	0	3	All Branches
19MOE02	Methods of Applied Mathematics	3	0	0	3	All Branches
19MOE03	Linear and Non - Linear Programming	3	0	0	3	All Branches
19MOE04	Probability and Random Processes	3	0	0	3	All Branches

DEPARTMENT OF PHYSICS

Course Code	Course Name	L	T	P	C	Eligible Branches
19POE01	Introduction to Nanoscience and Nanotechnology	3	0	0	3	All Branches except IT
19POE02	Physics and Technology of Thin Films	3	0	0	3	Mechanical, EEE, Chemical & ECE
19POE03	Solar Cell Fundamentals and Materials	3	0	0	3	EEE, ECE & Chemical
19POE04	Advanced Material Processing Technologies	3	0	0	3	Mechanical & Chemical

DEPARTMENT OF CHEMISTRY

Course Code	Course Name	L	T	P	C	Eligible Branches
19COE01	Medical Nanotechnology	3	0	0	3	Chemical
19COE02	Advanced Drug Delivery Systems	3	0	0	3	Chemical
19COE03	Biosensors	3	0	0	3	Chemical, ECE & EEE
19COE04	Nanocomposites	3	0	0	3	Mechanical, Chemical & Civil
19COE05	Biorefinery	3	0	0	3	Mechanical & Chemical

DEPARTMENT OF HUMANITIES

Course Code	Course Name	L	T	P	C	Eligible Branches
19HOE01	Principles of Management	3	0	0	3	Common to all branches
19HOE02	Current Trends in Indian Economy	3	0	0	3	Common to all branches
19HOE03	Monetary Economics	3	0	0	3	Common to all branches
19HOE04	English for Academic Purposes	3	0	0	3	Common to all branches
19HOE05	English for Competitive Exams	3	0	0	3	Common to all branches
19HOE06	Life and Literature	3	0	0	3	Common to all branches

19CEM31 - DIFFERENTIAL EQUATIONS AND BOUNDARY VALUE PROBLEMS

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Analyze the concepts of ordinary differential equations in modelling and solving physical problems

CO2 : Demonstrate accurate and efficient use of numerical solutions of ordinary differential equations and their role in modern mathematics and applied contexts

CO3 : Formulate concrete problems and finding the solutions of partial differential equations

CO4 : Solve the boundary value problems relevant to vibration of strings

CO5 : Familiarize finite difference approximation to get numerical solutions of partial differential equations

ORDINARY DIFFERENTIAL EQUATIONS

Second and higher order linear differential equations with constant coefficients - Cauchy-Euler equation, Cauchy-Legendre equation- Method of variation of parameters - System of simultaneous linear differential equations with constant coefficients (9)

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

Numerical solution of first order ordinary differential equation: Taylor Series Method -Picard's Method - Euler's method -Modified Euler's method- Fourth order Runge- Kutta method - Milne's predictor and corrector method (9)

PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations - Solutions of first order non-linear partial differential equations(standard types) - Lagrange's linear equations -Second and higher order homogeneous linear equations with constant coefficients (9)

BOUNDARY VALUE PROBLEMS

Method of separation of variables - Vibration of strings - One dimensional wave equation - One dimensional heat flow equations with steady state and unsteady state solutions (9)

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

Difference quotients - Graphical representation of partial quotients - Classification - One dimensional heat equation: Explicit formula - Bender Schmidt recurrence method - One dimensional wave equation: Explicit formula (9)

TOTAL: 45+15=60

TEXT BOOKS

1. B.S. Grewal, "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, 2012.
2. B.V.Ramana, "Higher Engineering Mathematics", Kindle Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018.

REFERENCES

1. *Srimanta Pal and Suboth. C. Bhunia, Engineering Mathematics, Oxford University Press, New Delhi, 2015.*
2. *Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.*
3. *S.S. Sastry, "Introductory Methods of Numerical Analysis", 5th Edition, Prentice Hall India Learning Private Limited, 2012.*

19CE31 - MECHANICS OF SOLIDS

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1** : Compute the centroid of given plane and composite sections and calculate the moment of inertia, principal moment of inertia for a given plane sections.
- CO2** : Compute simple stress and strain, thermal stresses for the given linear bars and compound bars with single axial load also calculate the change in volume of given three dimensional bars subjected to three mutually perpendicular forces.
- CO3** : Compute principal stresses for the given two dimensional stress systems and calculate stresses for the given material due to suddenly applied load and impact load.
- CO4** : Compute and construct shear force, bending moment diagrams for the given determinate beams subjected to Point loads, UDL and UVL.
- CO5** : Compute stresses related to bending and shear for the given determinate beams with different cross sections subjected to Point loads and UDL and also compute bending and shear stress of given hollow and solid circular shaft.

CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA

Centroid of areas, compound areas - Determination of moment of inertia of plane figures- principal moment of inertia - Radius of gyration **(12)**

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 - 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. **(12)**

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. **(12)**

BENDING OF BEAMS

Types of Beams - Types of loads - 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 bending moment and shear force - Design of beams - Beams of uniform strength - Flitched beams - Leaf springs. **(12)**

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. **(12)**

TOTAL: 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, 2018.*
3. *Punmia B.C, Ashok jain and Arun jain, "Mechanics of Materials", Lakshmi Publications, New Delhi, 2017.*

REFERENCES

1. *Beer F.P, Johnston E.R., DeWolf J.T. and Mazurek D., "Mechanics of Materials", McGraw-Hill Higher Education, 7th edition, 2014.*
2. *L.S.Negi, "Strength of Materials", Tata Mc Graw Hill Education Pvt. Ltd, 2017.*
3. *Sadhu Singh, "Strength of Materials", Khanna Publishers, New Delhi, 2016.*
4. *Prakash Rao D.S., "Strength of Materials" Volume I, Universities Press (India) Limited, Hyderabad, 2004.*
5. *Lehri, R.S., Lehri, A.S., "Strength of Materials", S K Kataria & Sons, New Delhi, 2012.*
6. *Timonshenko, S.P, Gere, J.M., "Mechanics of Materials", CBS Publishers, New Delhi, 2006.*
7. *Egor P. Popov, "Introduction to Mechanics of Solids", Prentice Hall of India, New Delhi, 2003.*

ONLINE RESOURCE

1. <https://nptel.ac.in>

19CE32 - ENGINEERING GEOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO 1 :** Describe the importance of geology in civil engineering, weathering, type of soils, geological work of various geological agents, earthquake, interior and age of the earth, landslide mitigation.
- CO 2 :** Explain geological surface and subsurface features
- CO 3 :** Identify the elements of crystallography to classify minerals based on their system
- CO 4 :** Identify minerals based on their physical properties and its distribution in India.
- CO 5 :** Identify rocks based on mineralogy, texture, structure and mode of occurrence with its application in civil engineering purposes.
- CO 6 :** Employ the geological knowledge for projects of dams & reservoirs, tunnels, coastal protection.
- CO 7 :** Interpret subsurface geological features and properties of rocks using fundamental principles of geophysical methods.

PHYSICAL GEOLOGY AND GEOMORPHOLOGY

Applications of earth science in civil engineering practices - understanding internal structure -composition and age of the earth. Rock weathering - types and effects in civil engineering- soil - soil profile - types - mode of formation -process of mass wasting- landslides and related phenomenon- causes and control - geomorphological features developed by river, ground water, wind. Earthquake-theory-terminology - causes-seismic waves-measurements, Richter scale - Tsunami - impacts on civil engineering works.(9)

STRUCTURAL GEOLOGY

Dip and strike-apparent dip and true dip- folds- parts of fold- types of fold- mechanism of fold-recognition of fold. Fault- fault terminology- classification of fault- effects of fault on out crop- significance of folds and fault- unconformities- types- recognition of unconformities- joints- classification of joints- structures due to denudation- outlier- Inlier- off lap- on lap. (9)

MINERALOGY & CRYSTALLOGRAPHY

Physical properties of mineral - its composition - system of crystallization - ore forming and rock forming minerals - origin - uses -distribution in India. Quartz group- Feldspar group - Feldspathoid group - Silica group - Pyroxene group - Mica group - Olivine group - Chlorite group - Serpentine group - Clay mineral group- Alumino silicate group- Calcic minerals-Carbonate group-Economic minerals deposits in India (9)

PETROLOGY & STRATIGRAPHY

Rock cycle - Igneous, sedimentary and metamorphic rocks- mineralogical composition, texture and structure, classification, engineering properties of Igneous rocks - granite, gabbro, dolerite and basalt. Sedimentary Sandstone, Shale, Limestone, Laterite. Metamorphic Rock - Gneiss, Quartzite, Slate, Charnokite, Decorative Stones-Porphyrries- Marble. Outline of stratigraphy-geologic time scale- stratigraphic units- origin and formation of coal-chemical and banded constituents of coal-ranks of coal- distribution of coal in India- petroleum formation-structural and stratigraphic controls-traps-distribution in India. (9)

APPLIED GEOLOGY

Rocks as building stones-properties of building stones-road metals-geology of dam sites-dams terminology-types-problems associated with dam sites- geology of reservoirs-tunnels-bridges- constructional features-stability of bridges- foundation of bridges and coastal protection -geophysical survey-magnetic survey-electrical survey-seismic survey and radiometric survey-principles and applications (9)

TOTAL : 45

TEXT BOOKS

1. Parbin Singh., "A textbook of Engineering and General Geology", kataria & sons, publishing house, Delhi, 2012.
2. K. M. Bangar., "Principles of Engineering Geology, Standard Publishers distributors. NAI SARAK Delhi-2013
3. W.D. Thornbury ., "Principles of Geomorphology" Second Edition,- CBS-Publications, New Delhi; December 2004

REFERENCES

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. Dr. Savindra Singh, "Physical Geography" Pravalika Publications, Allahabad, India; 2015
4. Tyrrell, "Principles of Petrology", B.I .Publications, Bombay, 1998.
5. Billings, "Structural Geology", Asia Publishing House, New Delhi, 1989.
6. Dexter Perkins, Mineralogy, 3rd Edition; University of North Dakota @ 2011.
7. William E. Ford; Dana's textbook of mineralogy; CBS publishers & distributors, New Delhi; 2006.
8. Rutley's Elements of Mineralogy 27th edition revised by CD Gribble- CBS-publications, New Delhi ; December 2005.
9. Umeshwar Prasad; Economic Geology Economic Mineral Deposits second edition CBS publishers & distributors, New Delhi, 2006.
10. Petar Milanovic" Engineering Karstology of Dams and Reservoirs", CRC Press; 2016.
11. William Lowrie "Fundamentals of Geophysics" Third edition; Cambridge university press, 1997.

19CE33 - MECHANICS OF FLUIDS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

On successful completion of this course, students will have the ability to

CO1 : Apply the storage and flow concepts of fluids and pressure acting on fluids

CO2 : Apply the principles of static conditions on fluids

CO3 : Analyse the principles of fluid flow using measuring devices

CO4 : Analyse simple pipe systems for transport of liquids under different flow conditions

CO5 : Apply the principles of dimensional analysis in solving fluid problems through model studies

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. **(9)**

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 **(9)**

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 **(9)**

FLOW THROUGH PIPES

Laminar flow in circular pipes - Hagen - Poiseuille'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 **(9)**

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 **(9)**

TOTAL : 45

TEXT BOOK

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 And Fluid Mechanics Including Hydraulic Machines", Standard Book House, 21st edition, New Delhi, 2017.
3. Rajput.R.K. "Fluid Mechanics and Hydraulic Machines", S.Chand and Co, New Delhi, 2015.

REFERENCES

1. *Streeter, V.L., & Wylie, E.B., "Fluid Mechanics", McGraw Hill, 2000.*
2. *Frank.M. White, "Fluid Mechanics", Tata McGraw Hill, 7th Edition, New Delhi, 2017.*
3. *Ramamrutham.S, "Hydraulics Fluid Mechanics and Fluid Machines", Dhanpat Rai Publishing Company (P) Ltd, 9th Edition, New Delhi, 2014.*
4. *Arora K.R., "Fluid Mechanics, Hydraulics and Hydraulic Machines", Standard Publishers & Distributors, 9th edition, 2005.*

ONLINE RESOURCE

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

19CE34 - SURVEYING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Assess the angles, distances and levels

CO2 : Identify the data collection methods and prepare field notes

CO3 : Demonstrate the application of survey instruments

CO4 : Interpret the survey data and compute areas and volumes

CO5 : Describe the principles of photogrammetry and hydrographic surveying

MEASUREMENT OF DISTANCES AND DIRECTIONS

Importance of surveying to engineers, plane and geodetic surveying, principles of surveying, classification of surveys, Linear Measurements using chain, measuring tape, hypotenuse allowance. Measurement of angles, bearings and included angles using Compass, Measurement of angles by Vernier theodolite, Application of Electronic Theodolites. (9)

LEVELLING AND COMPUTATION OF AREAS AND VOLUMES

Levelling- Basics definitions, types of levels and levelling staff, methods of levelling, Determination of levels- Height of Instrument Method - Rise and Fall method, Contouring- Characteristics and uses of Contours, Direct & Indirect methods of contour surveying, Areas - Determination of areas consisting of irregular boundary and regular boundary. Volumes - determination of volume of earth work in cutting and embankments, capacity of reservoirs. (9)

THEODOLITE TRAVERSING AND TRIANGULATION

Theodolite Surveying - Types of Theodolites, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Traversing -Methods of traversing, traverse computations and adjustments, Gale's traverse table, Omitted measurements. Tachometric Surveying - Principles of Tachometry, stadia and tangential methods of Tachometry. Triangulation - baseline - satellite stations - reduction to centre- trigonometrical levelling - single and reciprocal observations (9)

CURVES AND ADVANCED TOPICS IN SURVEYING

Curves: Types of curves and their necessity, elements of simple curve and setting out of simple curve, Introduction to compound, reverse, transition and vertical curves. Hydrographic Surveying-methods, applications and uses - Tides - MSL - Sounding methods - Three point problem - Strength of fix, Introduction to photogrammetry (9)

MODERN SURVEYING METHODS:

Total Station and Global Positioning System.- Basic principles, classifications, applications, comparison with conventional surveying. Electromagnetic distance measuring system - principle of working and EDM instruments, Components of GPS - space segment, control segment and user segment, reference systems, satellite orbits, GPS observations. Applications of GPS, GIS and remote sensing. (9)

TOTAL : 45

TEXT BOOKS

1. *Kanetkar.T.P and Kulkarni.S.V, 'Surveying and Levelling', Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2014*
2. *B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, 'Surveying' (Vol - 1, 2 & 3)', Laxmi Publications (P) Ltd., New Delhi. 2016*
3. *Chandra A M, 'Higher Surveying', New Age Publishers; New Delhi, 2015*

REFERENCES

1. *Hoffman. B, H. Lichtenegga and J. Collins, 'Global Positioning System - Theory and Practice', Springer -Verlag Publishers, 2001.*
2. *R. Subramanian, 'Surveying and Levelling', Oxford university press, New Delhi. 2013*
3. *Duggal S K, "Surveying (Vol - 1 & 2)", Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2016.*
4. *R. Agor, "Surveying and levelling", Khanna Publishers 2015.*

ONLINE RESOURCE

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

19CE35 - WATER SUPPLY ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1** : Identify various sources and characteristics of water and analyse the importance and demand for planned water supply system.
- CO2** : Analyse the need and economic feasibility in the conveyance of potable water from the source using pipes and pumps.
- CO3** : Design various conventional treatment system to achieve the potable water quality standards specified.
- CO4** : Interpret advanced water treatment system available in current scenario to provide high quality drinking water.
- CO5** : Describe the basic requirements of water distribution system and determine the pipe flow rates and pressure heads using pipe network analysis.

SOURCES OF WATER

Importance and need for planned water supply scheme -Design period- Population forecasting methods -Water demand-types and per capita demand, factors affecting per capita demand - Sources of water and their characteristics, Surface and Groundwater - Impounding Reservoir: Mass in-flow curve and analytical methods -Water characterization-physical, chemical and biological - Significance - Drinking Water quality standards (IS, CPHEEO and WHO) **(9)**

CONVEYANCE FROM THE SOURCE

Intake structures, need and its types -Pipe materials, pipe appurtenances and valves used in transmission of water- laying, jointing and testing of pipes - Hydraulics design of pressure pipes - Pumps, pumping station and capacity of pumps - Selection of pumps. **(9)**

WATER TREATMENT

Screening - Sedimentation - theory, types of settling, Stokes law - Coagulation - theory, chemicals used, flocculation - Jar test - design of sedimentation tank - Filtration - removal mechanisms, filter media, types, slow sand, rapid sand and pressure filters, filter design - Disinfection - methods. Chlorination - action, factors influencing, free chlorination, combined chlorination. **(9)**

TERTIARY WATER TREATMENT

Water softening - Desalination - demineralization - Adsorption - Ion exchange- Membrane Systems - Reverse osmosis - Iron and Manganese removal - Defluoridation - Construction and Operation & Maintenance aspects - Recent advances - MBR process. **(9)**

WATER DISTRIBUTION

Requirements of water distribution and its method - Components - Service reservoirs - Analysis and design of distribution network by equivalent pipe method and Hardy-Cross method of balancing- Leak detection - Corrosion and its control- Principles of design of water supply in buildings - House service connection - Fixtures and fittings, systems of plumbing and types of plumbing - Langelier saturation index (LSI). **(9)**

TOTAL : 45

TEXTBOOKS

1. Garg, S.K., "Water supply Engineering", Vol.I, Khanna Publishers, New Delhi, 2017.
2. Birdie G.S. and Birdie J.S. "Water Supply and Sanitary Engineering" Dhanpat Rai Publishing Company New Delhi, 8th edition 2017.
3. Duggal.K.N., "Elements of Environmental Engineering", S.Chand& Co., New Delhi ,2007.
4. Punmia.B.C., Ashok Jain and Arun Jain, "Water supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2016.
5. Modi, P.N., Water Supply Engineering, Vol.I, Standard Book House, New Delhi, 2010.

REFERENCES

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2. Peavy, Rowe, Tchobanoglous, "Environmental Engineering", McGraw Hill Publishers, New Delhi, 2017.
3. Syed R. Qasim and Edward M. Motley Guang Zhu, "Water Works Engineering Planning, Design and Operation", Prentice Hall of India Learning Private Limited, New Delhi, 2009.

ONLINE RESOURCES

1. <https://nptel.ac.in>

19HSS01 - SCIENCE OF CREATIVITY AND PROFESSIONAL ETHICS

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

After successful completion of course, students will be able to

CO1 : Understand the principles of karma yoga, duty consciousness and evolution of the universe.

CO2 : Analyze the benefits of yoga and meditation.

CO3 : Understand the benefits of harmony, introspection and examine human values for sustained growth in career and life

LIFE FORCE, CONCIOSNESS AND EVOLUTION OF UNIVERSE

Science of Creativity and Personality Development - Principles of Karma Yoga - Duty Consciousness - Law of Nature - Life Force -Potentiality of the Life Force - Consciousness - Pancha Thanmatras - Biomagnetism. Evolution of the Universe: Creation Theory - Evolution Theory - Evolution of Living Beings: Absolute Space and Force - Seven Constituent Layers in the Body. **(6)**

YOGA AND ITS BENEFITS

Simple and Safe yoga - Upa yoga Practices : Yoga for peace, health, joy, love, well-being and success. Physical exercise - Meditation - Seven centers of meditation - benefits - effect of good vibrations - cause and effect system. **(3)**

HARMONY IN LIFE, INTROSPECTION AND HUMAN VALUES

Harmony in Life : Self, family, society and nature - Introspection : Analysis of thought, Moralization of desire, Neutralization of anger, Eradication of worries and Self realization.

Morals, Values and Ethics - Integrity - Work ethics - Service learning - Virtues - Respect for others - Valuing time - Co-operation -Commitment - Empathy - Self confidence - Challenges in work place - impact of cyber space on individual. **(6)**

TOTAL: 15

TEXT BOOKS

1. Yogiraj Vethathri Maharishi, "Karma Yoga - The Holistic Unity", Vethathri Publications 4th Edition, 2009.
2. R.S.Naagarazan, "A Textbook on Professional Ethics and Human Values", New Age International Publishers, New Delhi, 2011.

REFERENCES

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", 2nd Edition, Ramakrishna Vivekananda Publications, 2008.

3. *Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", 4th Edition McGraw Hill, New York, 2005.*
4. *M. Govindarajan, S. Natarajan, V.S. Senthilkumar, "Engineering Ethics", 1st Edition, Prentice Hall of India, 2009.*

19CEL36 - STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

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

- CO1** : Assess the tensile and shear strength of mild steel rod and compressive strength, water absorption and efflorescence of given bricks.
- CO2** : Assess the hardness number of given metal pieces.
- CO3** : Assess the impact strength of given metal and stiffness of helical spring.
- CO4** : Assess the compressive strength and hardness properties of wooden specimens.
- CO5** : Assess the flexural rigidity and modulus of elasticity of simply supported beams with rectangular, semi circular and trapezoidal cross section, fixed beam and cantilever beam of square cross section.

LIST OF EXPERIMENTS

1. Tension test on steel bars
2. Shear test on steel bars
3. Tests on bricks
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. Bending test on beams (simply supported, cantilever, fixed)
10. Torsion test on mild steel.

REFERENCES

1. Rajput, R.K., "Essentials of Strength of Materials", S.Chand & Company Ltd., New Delhi, 2015.
2. IS 432 Part I- 1982, "Specification for Mild Steel and Medium Steel bars and hard-drawn steel wire for Concrete Reinforcement", Bureau of Indian Standards, New Delhi.
3. IS 3495 Part I to IV- 1992, "Methods of Tests of Burnt Clay Building Bricks", Bureau of Indian Standards, New Delhi.

19CEL37 - SURVEY LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

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

CO1 : *Examine the measurements of distance, area, angles, and levels*

CO2 : *Evaluate the cutting and filling quantities*

CO3 : *Determine the setting out works of buildings, bridges and other structures*

LIST OF EXPERIMENTS

Chain Survey

1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset
2. Setting out works - Foundation marking using tapes single Room and Double Room
3. Setting out works - Curve marking using tape - offset method Compass Survey
4. Compass Traversing - Measuring Bearings & arriving included angles Levelling - Study of levels and levelling staff
5. Fly levelling using Dumpy level & Auto level
6. Check leveling, Measurement of L/S and C/S of Road - Differential Levelling Theodolite - Study of Theodolite
7. Measurements of horizontal angles by reiteration and repetition and vertical angles
8. Determination of elevation of an object using single plane method when base is accessible/inaccessible.
9. Setting out works - Foundation marking using electronic theodolite, Tacheometry - Tangential system - Stadia system
10. Determination of Tacheometric Constants
11. Heights and distances by stadia Tacheometry Total Station - Study of Total Station, Measuring Horizontal and vertical angles
12. Traverse using Total station and Area of Traverse
13. Determination of distance and difference in elevation between two inaccessible points using Total station
14. Setting out works - Foundation marking using electronic total station

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, 10th Edition, Standard Book house, 2008*

19CE41 - CONSTRUCTION TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : *Understand building components and its construction process.*

CO2 : *Demonstrate the types of brick and stone masonry*

CO3 : *Describe types of roofs and floors*

CO4 : *Classify the different types of staircases based on geometrical configurations, doors and windows.*

CO5 : *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- Classification of stone masonry - Joints in stone masonry -Concrete block walls - Types of concrete blocks - Construction Joints -need and materials used. **(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 - Vertical movement - 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 - Different types of pointing - Paints -Types of paints - Paintings of Interior & Exterior walls, wooden and steel members-Fire protection - Fire resisting properties of common building materials - Fire safety equipment for buildings - Thermal Insulation and sound insulations. **(9)**

TOTAL : 45

TEXT BOOKS

1. Punmia. B.C., Ashok.K.Jain& Arun.K.Jain, "Building Construction", Laxmi Publications (P) Ltd, New Delhi, 2016.
2. S. C. Rangwala "Building Construction",Charotar Publishing House(P) Ltd, Gujarat, 2017.
3. P.C Varghese "Building Construction", Prentice-Hall of India, New Delhi, 2011.

REFERENCES

1. Sharma S.K. and Kaul B.K., "Building Construction", S.Chand & Company Ltd., New Delhi, 2013.
2. Sushil Kumar., "Building Construction", Standard Publishers distributors, New Delhi, 2016.
3. S.P.Arora and S.P.Bindra, " Building Construction" Dhanpat Rai publications,2010.

ONLINE COURSES

1. <https://nptel.ac.in>

19CE42 - STRENGTH OF MATERIALS

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1** : Determine slope and deflection of statically determinate beams subjected to Point load and UDL.
- CO2** : Sketch Shear force and bending moment diagram for the given statically indeterminate beams subjected to Point load and UDL.
- CO3** : Compute the stresses due to combined bending and axial load for short column and critical load calculation in long columns
- CO4** : Compute stresses in thin, thick cylinders subjected to fluid pressure and member forces in simple plane roof trusses.
- CO5** : Calculate the stresses due to unsymmetrical bending in the symmetrical and unsymmetrical sections and locate the shear centre for thin walled open sections with one axis of symmetry.

DEFLECTION OF DETERMINATE BEAMS

Governing differential equation - slope and deflection of beams - Double Integration method - Macaulay's method - Moment area method - Conjugate beam method **(12)**

STATICALLY INDETERMINATE BEAMS

Analysis of propped cantilevers and fixed beams - Analysis of Continuous beams using Theorem of Three moments. **(12)**

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. **(12)**

THICK CYLINDER AND MEMBER FORCES IN TRUSS

Stresses in thin walled cylindrical shells - Wire wound cylindrical Vessels - Thick cylinder - Lamé's equations. Plane roof trusses - Forces in the member - Method of Joints and method of sections **(12)**

UNSYMMETRICAL BENDING AND SHEAR CENTRE

Analysis of stresses and deflections due to unsymmetrical Bending - Significance of shear centre - Location of shear centre for Thin walled open sections with one axis of symmetry **(12)**

TOTAL: 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, 2018.
3. Punmia B.C, Ashok jain and Arun jain, "Mechanics of Materials", Lakshmi Publications, New Delhi, 2017.

REFERENCES

1. Beer F.P.,Johnston E.R.,DeWolf J.T. and Mazurek D.,*"Mechanics of Materials"*,McGraw-Hill Higher Education,6th edition,2011.
2. Negi L.S., *"Strength of Materials"*,Tata Mc Graw Hill Education Pvt. Ltd,2017.
3. Sadhu Singh,*"Strength of Materials"*,Khanna Publishers, NewDelhi,2016.
4. Prakash Rao D.S., *"Strength of Materials" Volume I*, Universities Press (India) Limited, Hyderabad, 2004.
5. Lehri R.S., Lehri A.S., *"Strength of Materials"*, S K Kotaria & Press, New Delhi, 2012.
6. Timoshenko,S.P, Gere,J.M.,*"Mechanics of Materials"*,CBS Publishers,New Delhi,2006.
7. Egor P .Popov, *"Introduction to Mechanics of Solids"*, Prentice Hall of India, New Delhi, 2003.

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CE43 - TRANSPORTATION ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Interpret the types of Indian roads, organizations and pavements

CO2 : Design the geometrical components for Indian roads

CO3 : Demonstrate the organizational set up and features of Indian Railways

CO4 : Design the components of permanent way in Indian Railway

HIGHWAY PLANNING

IRC, CRR and NHAI-Classification of roads-Road patterns-Planning Surveys-Master Plan and Phasing of master plan- New Highway alignment - Factors -Engineering surveys- Maximum dimension of road vehicles - Passenger Car Units - Pavements - flexible - rigid - comparison - soil subgrade, sub base and base course, wearing course - Highway drainage - significance - requirements (9)

HIGHWAY GEOMETRIC DESIGN

Various Cross section elements - Friction, roughness, light reflecting characteristics-camber - IRC standards- Right of way- Sight distance-Design of Horizontal Alignments- Super elevation- Widening of pavement on horizontal curves-Transition curves-Types- Length-Examples. Design of vertical alignment- Gradient-Types- Vertical curves -Summit curves, Valley curves- Examples. (9)

HIGHWAY CONSTRUCTION

Materials - Properties of road aggregates and tests - Bituminous materials - Types- Requirements - Tests to determine the properties of Bitumen - Various Bituminous mixes - Highway construction procedures (6)

ELEMENTS OF RAILWAY ENGINEERING

Comparison of railway and highway transport - organization of Indian railways - Railway board - Zonal railways, Permanent way - Gauges - Railway Track cross section - coning of wheels - Rails, Rail joints - Creep - effects- remedies - Sleepers - Ballast - Sub grade and Embankment -Track alignment- Surveys. Gradients - super elevation and cant deficiency - Negative super elevation- Curves - points and crossings -necessity -Turnouts - Switches - types of switches crossing-components, types (12)

RAILWAY STATIONS AND SIGNALS

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- Signalling -Object engineering principles - classification and types - Level crossings - Safety in Railways (9)

TOTAL : 45

TEXT BOOK

1. Khanna.S.K and Justo.C.E.G., "Highway Engineering", Khanna Publishers, Roorkee, 2001.
2. Saxena S.C and Arora S.P, "A Text book of Railway Engineering", Dhanpat Rai Publications, New Delhi, 2005.

REFERENCES

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. *J. S. Mundrey, "Railway Track Engineering", Tata McGraw-Hill Education, New Delhi, 2010.*
4. *Clifford F. Bonnett, "Practical Railway Engineering", Imperial College Press, London, 2005.*
5. *IRC Codes 15-2002, 37-2001, 38-1988, 52-1988, 62-1976, 66-1976, 73-1980, 58-2002 & IRC SP 23-1993.*

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CE44 - APPLIED HYDRAULICS AND HYDRAULIC MACHINERY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1** : Obtain hydraulically best section for uniform flow in open channel and find the flow parameters through notches, weirs and flumes.
- CO2** : Compute the flow characteristics of non-uniform flow in open channels based on geometrical and flow parameters.
- CO3** : Analyse relative and absolute velocity on flat and curved vanes in rest and motion.
- CO4** : Evaluate the performance tests on different types of hydraulic turbines.
- CO5** : Estimate the performance parameters of different pumps and its applications.

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. **(9)**

NON-UNIFORM FLOW IN OPEN CHANNELS

Non-uniform flow - critical depth - specific energy - flow characteristics - hydraulic jump - backwater curves - surges in channel. **(9)**

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. **(9)**

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. **(9)**

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 **(9)**

TOTAL : 45

TEXT BOOKS

1. Bansal.R.K., "A TextBook of Fluid Mechanics and Hydraulic Machines", M/s. Lakshmi Publications, Madras, 2017.
2. Modi.P.N, & Seth.S.M., " Hydraulics, Fluid Mechanics & Hydraulic Machinery", Metropolitan Book Company, New Delhi, 2017.
3. Arora K.R., "Fluid Mechanics, Hydraulics and Hydraulic Machines", Standard Publishers & Distributors, 2014.

REFERENCES

1. Kumar.K.L, "*Engineering Fluid Mechanics*," M/s. S. Chand Co., Madras.2006.
2. Ramamrutham.S, "*Fluid Mechanics, Hydraulics & Fluid Machinery*", M/s. Dhanpat Rai & Sons, New Delhi, 2018.
3. R.K.Rajput, "*A TextBook of Fluid Mechanics and Hydraulic Machines*", M/s. S. Chand Publications, New Delhi, 2016.
4. R.S. Khurmi, "*A TextBook of Hydraulics, Fluid Mechanics and Hydraulic Machines*", M/s. S. Chand Publications, New Delhi, 2014.

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CE45 - WASTE WATER ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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** : *Analyse the hydraulic components of sewage and design sewers including sewage pumping stations.*
- CO3** : *Summarize the perspectives of various house drainage systems.*
- CO4** : *Demonstrate the physico-chemical and bio-chemical characteristics of domestic Sewage and also deploy the appropriate conventional treatment schemes.*
- CO5** : *Design sludge digesters and also to justify the effluent disposal standards and sludge disposal.*

SEWERAGE SYSTEMS

Introduction - Necessity and objectives of sanitary engineering projects - Definitions - systems of Sanitation - Quantity of sanitary sewage - variation in quantity of sewage - quantity of storm sewage - Characteristics and composition of sewage - effluent standards - Sampling of sewage - Examination of sewage - DO, BOD, COD and their significance - Cycles of decomposition. **(9)**

DESIGN OF SEWERS

Components and design period - Hydraulics of sewers - Self cleansing velocity, non-scouring velocity - Design of sewers - Sewer appurtenances - Drains and sewer section - Sewer materials and sewer joints - Construction and maintenance of sewer - Pumping of sewage - House drainage - Sanitary fixtures / fittings - systems of plumbing - General layout of house drainage - street connections - Testing of house sewers - Septic tanks and effluent disposal system. **(9)**

PRIMARY TREATMENT OF SEWAGE

Objectives and basic principles of sewage treatment - Preliminary treatment - screens - Grit chamber - and Skimming tank - Design of Grit chamber - Primary treatment - Principles of sedimentations - Sedimentation tank types - surface overflow rate - detention time and Design of primary settling tanks. **(9)**

SECONDARY TREATMENT

Basic principles of biological treatment - types - suspended and attached growth process - Activated sludge process (ASP) - flow diagram - process modification of ASP - aeration - diffuser, mechanical aeration - Design of ASP - Trickling filters - types - comparison and construction - recirculation - Recirculation ratio, operational problems - design of high rate and standard rate filters - Process description of Sequential batch reactor (SBR), Upflow anaerobic sludge blanket reactor (UASBR), fluidized bed reactor (FBR), packed bed reactor (PBR) and extended bed reactor (EBR) - Waste stabilisation ponds - Oxidation ponds and Aeration lagoons. **(9)**

SLUDGE DIGESTION AND DISPOSAL

Sludge disposal - Sludge volume calculation - Sludge characteristics - sludge digestion - Digestion process - stages - Design of sludge digesters - Disposal of digested sludge - Use of lagoons for disposal of raw sludge - Advantages in sludge treatment and disposal - Effluent disposal - Standards for disposal - Disposal methods - Dilution - zones of pollution in lakes - Eutrophication - self-purification of streams - oxygen sag curve - Land disposal. **(9)**

TOTAL : 45

TEXT BOOKS

1. Garg S. K., "Environmental Engineering", Vol. I & Vol. II, Khanna Publishers, New Delhi, 1994.
2. Birdie G.S., and Birdie, "Water Supply And Sanitary Engineering", Dhanpat Rai Publishing Company (P) Ltd. New Delhi, 2011.
3. Metcalf and Eddy, "Wastewater Engineering Treatment, Disposal and Reuse", McGraw-Hill Publishing Co, Indian Edition, New Delhi, 2005.

REFERENCES

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.
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.

ONLINE COURSES

1. <https://nptel.ac.in>

19CE46 - PROFESSIONAL PRACTICE AND ETHICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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** : Perform and establish approval process for any type of buildings including electrical supply and water supply.
- CO3** : Able to execute the Fundamentals for establishment of individual firms, registration with government agencies and membership in professional bodies.
- CO4** : Able to perform documentation and preparation of bills from commencement till the closure of the project.
- CO5** : Perform ethics and fundamentals in establishing professional practice with social responsibility.

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. Land use Classification in urban & Mofussil Areas-Related Regulatory and approvals. Preparation and Submission of Drawings and Documents for Building Approval and Layout. (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 multi-storeyed 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)

ESTABLISHMENT FOR PROFESSIONAL PRACTICE

Establishment of firm - Consultancy, Construction - Registration of firms with GST, CST, Companies -IT - Licensing from local bodies - Metros - Municipalities, 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)

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)

ROLES AND RESPONSIBILITIES

Professional Ethics - Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Multinational Corporations - Business Ethics - Environmental Ethics -Role in Technological Development - Engineers as Managers - Consulting Engineers - Engineers as Expert Witnesses and Advisors - Honesty - Moral Leadership - Sample Code of Conduct. **(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.
3. W.M.Martin & R.Schinzinger., "*Ethics in Engineering*"-, McGraw-Hill, 2005

REFERENCES

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.*

ONLINE RESOURCES

1. *Manual of Professional practice for civil engineers - <https://pdfslide.net/documents/pice-manual-of-professional-practice-for-civil-engineers.html>*
2. *TNEB - <https://www.tangedco.gov.in/procedure.html>*
3. *Municipal Administration & Water Resources Department - https://cms.tn.gov.in/sites/default/files/go/maws_e_18_2019_0.pdf*

19CEL47 - HYDRAULICS LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

- CO1** : *Examine the flow meters through venturimeter and Orifice meter and the losses of flow of water through pipes.*
- CO2** : *Compute the rate of flow of water from a tank and in an open channel*
- CO3** : *Examine the Bernoulli's theorem for varying cross section of pipe flow.*
- CO4** : *Determine the metacentric height of the model of the ship in hydrostatic condition.*
- CO5** : *Find the performance of centrifugal, reciprocating pumps, Pelton and Francis turbines through characteristics 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

REFERENCES

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,2015.*
3. *Kumar.K.L, "Engineering Fluid Mechanics", M/s.S.Chand Co., Madras.2006.*

19CEL48 - ENVIRONMENTAL ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

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 and 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 Dissolved Oxygen Content in the given Water/ Wastewater Sample.
6. Assessment of Settleable, Total, Volatile, Fixed, Dissolved and Suspended Solids in Water/Wastewater Sample.
7. Determination of pH and Assessment of Optimum Coagulant Dose (OCD) to treat the given Water/ Wastewater sample.
8. Assessment of Available Chlorine in the given Bleaching powder sample and Estimation of Residual Chlorine of the given Polluted Water/Wastewater Sample.
9. Assessment of Biochemical Oxygen Demand (BOD) of the given Water/Wastewater Sample.
10. Assessment of Chemical Oxygen Demand (COD) of the given Water/Wastewater Sample.

REFERENCES

1. *"Environmental Engineering Laboratory manual", Published by the Department of Civil Engineering, Coimbatore Institute of Technology, Coimbatore, 2018.*
2. *IS 10500, Drinking water Specification, Bureau of Indian Standards, New Delhi, 2012.*
3. *IS 3025, Methods of sampling and test (physical and chemical) for water and wastewater. Bureau of Indian Standards, New Delhi, 1986.*

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CE51 - STRUCTURAL ANALYSIS I

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Compute static and kinematic indeterminacy of structures.

CO2 : Calculate the forces of pin jointed plane and space trusses by method of tension coefficient.

CO3 : Apply energy concepts and theorems to determine the deflection of statically determinate beams, frames and plane trusses

CO4 : Analyze statically indeterminate beams and trusses by consistent deformation method.

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

CO6 : Construct influence line diagrams for concentrated and distributed moving loads and analyze determinate and indeterminate beams.

FUNDAMENTALS OF STRUCTURAL ANALYSIS AND ANALYSIS OF PIN JOINTED SPACE TRUSSES

Determination of static and kinematic indeterminacy- Principle of superposition- Analysis of Pin-jointed plane and space trusses by Method of Tension coefficient. (9)

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 (9)

ANALYSIS OF STATICALLY INDETERMINATE BEAMS AND PLANE TRUSSES

Analysis of statically indeterminate beams - Consistent deformation method - Theorem of least work (beams upto 2 degrees of freedom only). Analysis of statically indeterminate plane trusses by Consistent deformation method - Lack of fit - settlement and temperature effects (9)

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. (9)

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 principle - Application of Muller Breslau principle to beams with degree of static indeterminacy not exceeding one. (9)

TOTAL : 45

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.

REFERENCES

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.*

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CE52 - DESIGN OF REINFORCED CONCRETE STRUCTURAL ELEMENTS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

On successful completion of this course, the student will be able to

- CO1** : Identify the relevant material properties of concrete and steel, evaluate the connected strength parameters as per (LSM) and codal provisions of IS 456, 2000. Distinguish between the WSM and LSM and infer the benefits of LSM.
- CO2** : Assess design loads, compute design strength required in flexure, shear, torsion and bond for Under-Reinforced, Doubly Reinforced and Flanged beams, apply design parameters as per LSM and IS 456 to satisfy both strength and serviceability criteria. Using LSM, analytically compute design strengths of existing beams. Complete structural detailing as per SP34.
- CO3** : Assess design loads, compute design strength required in flexure, shear and bond for one way, two way and staircase slabs to fulfill both strength and serviceability criteria as per IS 456 . Using LSM, analytically compute design strengths of existing slabs. Complete structural detailing as per SP34.
- CO4** : Using interaction charts; compute design strengths as per LSM for both short and long columns in axial compression uniaxial and biaxial bending as per codal provisions. Analytically be able to evaluate structural strengths of existing columns. Complete structural detailing as per SP34.
- CO5** : Design as per LSM for strength in flexure, shear and bond for concrete wall footings, isolated and combined column footings. Apply IS 456 provisions for serviceability criteria of LSM. Complete structural detailing as per SP34.

MATERIALS FOR CONCRETE AND CONCEPT OF LIMIT STATE DESIGN

IS code regulations - Materials for concrete - Stress - Strain curve for concrete in compression - Concrete Grades, Types, Mix proportioning - Types of reinforcement, Grades - 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. Design of singly reinforced rectangular beams for flexure, shear and torsion. (9)

LIMIT STATE DESIGN OF BEAMS

Design of doubly reinforced rectangular and flanged beams for flexure, shear and torsion. Design of continuous beams using B.M. and S.F. coefficients as per IS code - detailing. (9)

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. Staircase, Loads and types, Design of dog legged staircase slab and flat slab with drop only - Detailing. (9)

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 Interaction Charts- Detailing. (9)

DESIGN OF FOOTINGS

Design of wall footings - Design of isolated, square and rectangular footings - Combined rectangular footings and trapezoidal footings - Detailing. (9)

TOTAL : 45

TEXT BOOKS

1. *Unnikrishna Pillai and Devadas Menon, "Reinforced Concrete Design", Tata McGraw Hill Publishing Co, New Delhi, 2011.*
2. *Varghese PC., "Limit State Design of Reinforced Concrete", Prentice Hall of India Pvt. Ltd., 2004.*

REFERENCES

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 McGraw - 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 GoelA.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- 24 - 1983, Explanatory Handbook for IS Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.*
12. *SP - 34 - 1987, Hand Book on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi.*

19CE53 - MECHANICS OF SOILS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Determine the properties of soil and classify them.

CO2 : Apply the principles of water flow through soil medium and estimate permeability of soil.

CO3 : Estimate the vertical stresses acting on soil for the given load condition.

CO4 : Understand and determine the phenomenon of consolidation and compaction of soil.

CO5 : Estimate the shear parameters of soils and analyze the stability of slopes.

INTRODUCTION

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 stress at a point - Mechanism of shear resistance - Mohr- Coluomb 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. Gopal Ranjan and Rao, ASR, "Basic and Applied Soil Mechanics" New Age International (P) Limited Publication, New Delhi, Thrid Edition, 2016.
2. Venkataramaiah, "Geotechnical Engineering", New Age International Ltd., New Delhi, Sixth Edition, 2018.

3. Punmia, B.C, "Soil Mechanics and Foundation Engineering", Laxmi Publications, New Delhi, Seventeenth Edition, 2017.
4. Palanikumar. M, "Soil Mechanics", PHI Learning (P) Ltd., New Delhi, 2013.

REFERENCES

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. Das and Khaled Sobhan, "Principles of Geotechnical Engineering" Cengage learning, 2013.

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CE54 - CONCRETE TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Assess the properties and select the concrete ingredients.

CO2 : Design the concrete mix as per IS code and ACI specifications.

CO3 : Employ the different methods of manufacture of concrete.

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

CO5 : Identify the appropriate special concrete for a specific requirement.

CEMENT AND AGGREGATES

Types of cement - properties and specific uses of various cements - Tests on 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 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, 2018

REFERENCES

1. *Neville.A.M., "Properties of Concrete", Pearson Education Limited, 2012.*
2. *Santhakumar A.R., "Concrete Technology" Oxford University Press, New Delhi, 2018*
3. *Krishnasamy K.T., "Concrete Technology", Dhanpat Rai, New Delhi, 2014.*
4. *Gambhir M.L., "Concrete Technology", Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.*
5. *IS 456- 2000 : Indian Standard Code of Practice for Plain and Reinforced Concrete, BIS, New Delhi.*
6. *IS 10262-2019 : Guidelines for Concrete Mix Design proportioning.*

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEL55 - COMPUTER AIDED CIVIL ENGINEERING DRAWING

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

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

CO1 : *Create site plan, landscape design and arrange the components of building to satisfy the functional and orientation aspect as per National Building Code.*

CO2 : *Develop detailed drawings of plan, elevation and section of Buildings by manual and computer aided drawing*

CO3 : *Prepare drawings of types of doors, windows and staircases.*

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 Drawing for presentation and submission.

BASIC HOUSE DESIGN

Concept of one 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., 2007.

REFERENCES

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.
3. Sikka V.B., A Course in Civil Engineering Drawing, 4th Edition, S.K.Kataria and Sons, 2015.
4. Verma.B.P., Civil Engineering Drawing and House Planning, Khanna Publishers, 2010.

ONLINE RESOURCES

1. www.sketchup.com
2. www.autodesk.in/products/3ds-max/overview

19CEL56 - HIGHWAY ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

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
7. Moisture Content Test
8. Crushing Test

TESTS ON BITUMEN

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

REFERENCES

1. *Highway Material Testing* - S.K.Khanna & C.E.G. Justo, Nem Chand & Bros, Roorkee, 2013.
2. *Bureau of Indian Standard Code of Practice for*
 - *Particle Size and Shape IS 2386 - Part I , 2016*
 - *Specific gravity, Density, Voids, Adsorption and Bulking IS 2386 - Part III, 2016*
 - *Mechanical Properties IS 2386 - 1963 Part IV, 2016*

ONLINE RESOURCES

1. <https://ts-nitk.vlabs.ac.in/transportation-engineering/List%20of%20experiments.html>
2. http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/Transportation_Engineering_Lab/index.html

19CE61 - STRUCTURAL ANALYSIS II

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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 indeterminate structures.*
- CO4** : *Formulate stiffness matrix and apply to analyse indeterminate structures.*
- CO5** : *Outline the basic concepts, applications and limitations of Finite Element Method.*

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). **(9)**

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. **(9)**

MATRIX FLEXIBILITY METHOD

Element flexibility - Structure flexibility - Formulation of Structure flexibility matrix - Determination of forces - Application to simple indeterminate beams, frames and trusses. **(9)**

MATRIX STIFFNESS METHOD

Element stiffness - Structure stiffness - Formulation of Structure stiffness matrix - Application to simple indeterminate beams, frames and trusses. **(9)**

INTRODUCTION TO FINITE ELEMENT METHOD

Basic steps - Concept of an element - Various element shapes - Application of Finite Element Method - Limitations - Element stiffness matrix for one dimensional members - Procedure of assembly and solving equations (No problems). **(9)**

TOTAL : 45

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.

REFERENCES

1. Rajasekaran S. and Sankarasubramanian G., "Computational Structural Mechanics," Prentice Hall of India, New Delhi, 2012.
2. PrakashRao 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, 2008.
9. Reddy J.N., "An Introduction to the Finite Element Method", Tata McGraw Hill Company, NewDelhi, 2005.

19CE62 - DESIGN OF STEEL STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1** : Apply the Working Stress Method and Limit State Method design concepts
- CO2** : Analyze statically indeterminate beams and portal frames using plastic theory
- CO3** : Design the bolted and welded connections
- CO4** : Design the tension members as per IS code and concepts of shear lag
- CO5** : Design the compression members as per IS code
- CO6** : Design the laterally supported and unsupported beams as per IS code

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. **(9)**

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. **(9)**

TENSION MEMBERS

Design of tension members subjected to axial tension- tension member subjected to bending - lug angles. Design of Tension Splice - Concept of Shear lag **(9)**

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. **(9)**

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. **(9)**

TOTAL : 45

TEXT BOOKS

1. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2016.
2. Duggal.S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publication, 2019.
3. Jayagopal.L.S & Tensing.D, "Design of Steel Structures", Vikas Publication House Ltd, Noida, 2015.
4. Gambir M.L., "Fundamentals of Structural Steel Design", Tata McGraw Hill Publication, New Delhi, 2013

REFERENCES

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, 2017.
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 (6) ISI Hand Book for "*Structural Engineers, Application of Plastic Theory in Design of Steel Structures*", 1972.
6. SP6 (1) ISI Hand Book for "*Structural Engineers, Structural Steel Section*", 1964.

19CE63 - FOUNDATION ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Select and conduct suitable site investigation for the proposed civil engineering project.

CO2 : Estimate the bearing capacity of soil based on shear and settlement criteria.

CO3 : Understand the concepts of settlement and proportioning of footings.

CO4 : Determine the load carrying capacity and settlement of piles.

CO5 : Understand the Earth pressure theories and analyze the stability of retaining wall.

SOIL INVESTIGATION AND CHOICE OF FOUNDATION

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

BEARING CAPACITY

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 - Methods of improving bearing capacity. **(9)**

SETTLEMENT AND PROPORTIONING OF SHALLOW FOUNDATIONS

Types of Isolated footing, Combined footing, Mat foundation- Settlement of foundations - Components of settlement - Allowable and maximum differential settlement - Proportioning of footing (No structural design) - Methods of minimizing settlement. **(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 Load carrying capacity by field tests - Pile loadTest - Group Capacity - Settlement of Pile - Negative skin friction. **(9)**

EARTH PRESSURE AND RETAINING WALLS

Earth pressure theory - Plastic equilibrium in soil - 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)**

TOTAL : 45

TEXT BOOKS

1. Varghese P.C., "Foundation Engineering", Prentice Hall of India, 2012.
2. GopalRanjan and Rao A.S.R., "Basic and Applied Soil Mechanics", New age International (P) Ltd Publications, New Delhi, Third Edition, 2016.

REFERENCES

1. Venkataramaiah.C, "Geotechnical Engineering", New Age International Ltd., Sixth Edition, New Delhi, 2012.
2. Alam Singh., "Modern Geotechnical Engineering", IBS Publications, New Delhi, 2012.
3. Punmia.B.C., "Soil Mechanics and Foundation Engineering", Laxmi Publications, New Delhi, Seventeenth Edition, 2017.
4. Braja M. Dass, "Principles of Foundation Engineering", Thomson Brooks Gole, Singapore, 2010.

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEL64 - SOIL MECHANICS LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

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

CO1 : Classify the soil based on index properties.

CO2 : Estimate the density and consolidation parameters of soil.

CO3 : Assess the soil parameters for design of foundation and subgrade.

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)

REFERENCES

1. "Soil Engineering Laboratory Instruction Manual", Published by the Department of Civil Engineering, CIT, Coimbatore - 2016.
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. "I.S. Code of Practice 2720 (Part I to XLI) - 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 Publishers, New Delhi, 2002.

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEL65 - QUANTITY SURVEYING AND PROJECT PLANNING LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

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- Datasheets 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 PRIMAVERA AND MS PROJECT

Introduction to project planner and project management - defining Administrative categories- - 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. *DuttaB.N., "Estimating and Costing in Civil Engineering", UBS Publishers and Distributors(P)Ltd., NewDelhi, 2003.*
2. *RangwalaS.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.*

REFERENCES

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 & CompanyLtd.,2004.*

19CE71 - IRRIGATION ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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 for a given 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.

REFERENCES

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

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CE72 - EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : *Apply concepts of structural dynamics in determining response of free and forced vibration for a given SDOF and MDOF structural systems.*

CO2 : *Analyse the role of natural calamity in the damage of structures.*

CO3 : *Design and detail the RC structural elements and shear wall for seismic resistance as per Indian Standards.*

CO4 : *Develop the skill to analyse and to apply in the practical problems.*

STRUCTURAL DYNAMICS

Basic Concepts of vibration - Equation of motion- D'Alemberts Principle- Single Degree of Freedom system - Idealization of structure as SDOF 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 - Reid's Elastic rebound theory- Plate tectonics - Seismic waves - Behavior of RCC, steel and prestressed concrete structures under earthquake loading -Pinching Effect - Bouchinger Effect - Lessons learnt from past earthquakes - Seismograph and Accelerograph - Seismic Zoning map of India. **(9)**

SEISMIC ANALYSIS

Response Spectrum - Modal response contribution - Modal participation factor. Calculation of base shear as per IS 1893-2016 and IS 4326 provisions - Static and Dynamic method - Equivalent Static Lateral force method and Response spectrum method. **(9)**

EARTHQUAKE RESISTANT DESIGN

Design of Beams, Columns - Shear wall - Types of Shear wall - Design of Rectangular Shear wall with boundary elements (IS 13920 -2016) - Introduction to coupled shear wall system. **(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 of Masonry Structures as per IS 13827 and IS13828. Modern Concepts - Base isolation - Soil structure interaction. **(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.*
3. *Anil K. Chopra, "Dynamics of Structures - Theory and Applications to Earthquake Engineering", Prentice Hall of India Pvt. Ltd., New Delhi, 2007.*

REFERENCES

1. *Amr S. Elnashai and Luigi Di Sarno, "Fundamentals of Earthquake Engineering", John Wiley & Sons, Ltd., 2008.*
2. *Clough, R.W. and Penzien, J., "Dynamics of Structures", McGraw-Hill, Inc, 1995.*
3. *Pauley and Priestly, "Seismic Design of Reinforced Concrete and Masonry Buildings", John Wiley & Sons, 1992.*
4. *Moorthy C V R, "Earthquake Tips", NICEE, IIT Kanpur 2002.*
5. *IS 1893: 2016 Part I Criteria for earthquake resistant design of structures.*
6. *IS 1893: 2016 Part II Criteria for earthquake resistant design of structures: Liquid retaining tanks*
7. *IS 4326: 1993 Code of practice for earthquake resistant design and construction of buildings.*
8. *IS 13920 - 2016, Indian Standard Code of Practice for Ductile Detailing of RC Structures, Bureau of Indian Standards, New Delhi.*

ONLINE RESOURCE

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

19CE73 - CONSTRUCTION MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Describe construction management functions, various organization structures and duties of various construction team.

CO2 : Employ the procedure for contractor's selection through tendering process.

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

CO4 : Formulate construction resource planning and achieve project targets with managerial skills.

CO5 : Plan, control and monitor construction projects with respect to time and cost.

CONSTRUCTION PROJECT AND ORGANISATION MANAGEMENT

Basics of Construction - Unique features of construction - Construction projects- Types and features, Phases of a project - Construction Project management - Importance, Functions & Scope - Project Organization - Forms of business organization - Structure of construction organization -Management levels - Construction team- Roles, Responsibilities and Skills of construction team - Factors behind the success of a construction organization. **(9)**

TENDERING AND CONTRACTING

Tender - Types, Terms and Conditions, issue procedure, opening, Scrutiny, Acceptance, Rejecting - Prepare Tender Notice - Technical terms - Administrative approval, Technical Sanction, Issue rate, Competent Authority, Secured Advance, Mobilization Advance, Earnest money deposit (EMD) and Security deposit (SD) - Contract - Introduction, Requirement, Types - Contract documents and Conditions of Contract - Contract agreement - Prequalification of Contract - Importance - Methods of getting work done in government organization through contracts - Measurement book, Muster roll, types of bills and recording - Cash book -Work register - imprest account. **(9)**

CONSTRUCTION PLANNING, SCHEDULING AND TIME MANAGEMENT

Construction project planning - Stages of project planning: Pre-tender planning, Preconstruction planning, Detailed construction planning - Process of development of plans and schedules - work break-down structure- activity lists - assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data- Techniques of planning- Bar charts, Gantt Charts - Networks: basic terminology, types of precedence relationships, preparation of CPM networks - activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks - PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion. **(9)**

CONSTRUCTION RESOURCE MANAGEMENT

Planning and organizing construction site and resources - Site layout including enabling structures, developing site organization, Documentation at site - Manpower: planning, organizing, staffing, motivation - Materials: concepts of planning, procurement and inventory control - Equipment: basic concepts of planning and organizing - Funds: cash flow, sources of funds - Histograms and S-Curves - Earned Value - Resource Scheduling-resource aggregation, allocation, smoothening and leveling. **(9)**

PROJECT MONITORING AND CONTROL

Project Monitoring & Control - Supervision, record keeping, periodic progress reports, periodical progress meetings - Updating of plans: purpose, frequency and methods of updating - Common causes of time and cost overruns and corrective measures - Basics of Modern Project management systems such as Lean Construction - Use of Building Information Modelling (BIM) in project management - Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. **(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.*

REFERENCES

1. *Kumar NeerajJha, "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.*

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEL74 - COMPUTER APPLICATIONS LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

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.

REFERENCES

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*

19CEL75 - CONCRETE LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

On completion of the course the students will be able to

CO1 : *Identify Quality Control tests on cement, mortar and concrete as per Indian Standard*

CO2 : *Design a concrete mix and evaluate the strength of the concrete as per Indian Standard*

CO3 : *Evaluate the fresh properties of concrete by performing workability tests*

CO4 : *Evaluate the hardened properties of concrete under tension, compression and transverse loading.*

CO5 : *Assess the strength of existing concrete structures by performing NDT tests.*

LIST OF EXPERIMENTS

I. 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 - 2019

II. Tests on Cement & Cement Mortar

3. Normal Consistency and Setting Time of Cement
4. Soundness Test on Cement
5. Compressive Strength Test for Cement
6. Flow Test on Mortar
7. Setting Time of Cement Mortar

III. Tests on Fresh Concrete

8. Slump Test
9. Compacting Factor Test
10. Vee - Bee Consistometer test
11. Kelly Ball Test

IV. Tests on Hardened Concrete

12. Compressive Strength of Concrete on Cube and Cylinder
13. Split Tensile Strength of Concrete on Cylinder
14. Modulus of Rupture of concrete

V. Non - Destructive Testing

15. Ultrasonic Pulse Velocity Test
16. Rebound Hammer Test
17. Windsor Pin System
18. Demo of Core Cutting Machine

TEXT BOOKS

1. A. M. Neville, "Properties of Concrete" by Pearson 5th edition Education Ltd 2016.
2. M. S. Shetty, "Concrete Technology" by S. Chand & Co.2008

REFERENCES

1. *Santhakumar A.R., "Concrete Technology" by Oxford University Press, New Delhi, 2012*
2. *Krishnasamy K.T., "Concrete Technology" by Dhanpat Rai, New Delhi, 2012.*
3. *Gambhir M.L., "Concrete Technology" Tata McGraw Hill Publishing Company Limited, New Delhi, 2009.*
4. *Job Thomas, "Concrete Technology" by Cengage learning India Pvt Ltd 2015.*
5. *Indian Standards (IS 456-2000, IS 269-1989, IS 516-1959, IS 1786-1985, IS 1893-2002, IS 12269-1987, IS 9103-1999, IS 8112-1989)*

ONLINE RESOURCES

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

19CEE01 - DESIGN OF CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO5 : Design bridges

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 loads (by upper bound theorem) **(9)**

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) **(9)**

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. **(9)**

GROUND AND UNDER GROUND WATER TANK

Classifications- IS code provision - Design of ground level square, rectangular and circular tanks - Design of underground rectangular tank. **(9)**

OVERHEAD WATER TANK AND BRIDGES

Design of overhead rectangular (with problems). Design of staging for rectangular tank. Introduction to circular and Intz type tanks. Types of bridges - IRC loadings - Design of single span slab bridges for class A loadings only (Restricted to two lane) **(9)**

TOTAL : 45

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.

REFERENCES

1. Reynolds C.E., *"Reinforced Concrete Designer's Hand Book"*, Cement and Concrete Association, London, 2002.
2. Johnson Victor D., *"Essentials of Bridge Engineering"*, Oxford and IBH Publishing Company, New Delhi, 2003.
3. Krishna Raju N., *"Advanced Reinforced Concrete Design"*, CBS Publishers and Distributors, Delhi, 2003.
4. Syal I.C. and Goel A.K., *"Reinforced Concrete Structures"*, Wheeler and Company, Private Limited, New Delhi, 1998.
5. Ashok K Jain, *"Reinforced Concrete Limit State Design"*, New Chand Brothers, Roorkee, 2012.
6. IS 456 - 2000 Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
7. IS 3370 (Part I) - 1965 (Reestablished: 1999) - Code of Practice for Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.
8. IS 3370 (Part II) - 1965 (Reestablished: 1999) - Code of practice for Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.
9. IS 3370 (Part III) - 1965 (Reestablished: 1999) - Code of practice for Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.
10. IRC:5 - 1998 - Standard Specification and Code of Practice for Road Bridges (Section I), Bureau of Indian Standards, New Delhi.
11. IRC:6 - 1966 - Standard Specification and Code of Practice for Road Bridges (Section II), Bureau of Indian Standards, New Delhi.
12. IRC:21 - 2000 - Standard Specification and Code of Practice for Road Bridges (Section III), Bureau of Indian Standards, New Delhi.
13. Design aids for Reinforced Concrete to IS : 456 - 1978, Bureau of Indian Standards, New Delhi.

19CEE02 - ADVANCED CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1 : *Design the long column and deep beams*

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

CO3 : *Design the chimney as per IS code and bunker and silo.*

CO4 : *Understand limit analysis and serviceability*

DESIGN OF LONG COLUMNS AND DEEP BEAMS

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 SERVICEABILITY

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 with and without drop, 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.*

REFERENCES

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.*
4. *IS 4995-1978 (Part 1), Criteria for design of reinforced concrete bins for the storage of Granular and Powdery materials, Bureau of Indian Standards, New Delhi.*

19CEE03 - PRESTRESSED CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1** : Determine the losses in prestressed concrete members.
- CO2** : Design the prestressed concrete beams for flexure and shear using Limit State method of design.
- CO3** : Design the end blocks, tension and compression members.
- CO4** : Design the composite prestressed concrete beams and shear connectors.
- CO5** : Analyze the continuous prestressed concrete beams

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 FLEXURE MEMBERS

Theory and behaviour of prestressed concrete members 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, IS1343 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 stress**(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. Krishna Raju, N. "Prestressed Concrete", Tata McGraw Hill, New Delhi,2012.
2. Rajagopalan.N, "Prestressed Concrete", Alpha Science International Ltd., UK, 2005.
3. IS 1343:2012 - Code of Practice for Prestressed Concrete, Bureaus of Indian Standards, New Delhi.

REFERENCES

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, 2014.*
3. *Rajagopalan, "Prestressed Concrete", Narosa Publishers, New Delhi, 2013.*
4. *Edward G Nawy, "Prestressed Concrete", A Fundamental Approach, 3rd Edition, Prentice Hall, Upper Saddle river, NewJersy, 2000*
5. *Mallik S.K. and Gupta A.P. , "Prestressed Concrete", Oxford & IBH Publishing Co., Pvt. Ltd., India, 2nd Edition, 1986.*

19CEE04 - DESIGN OF BRIDGES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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 bridges

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. Krishna Raju, N., "Design of Bridges", Oxford & IBH Publishing Co. Pvt. Ltd., 2018.
2. Johnson Victor, D, "Essentials of Bridge Engineering", Oxford and IBH Publishing Co., 2019.

REFERENCES

1. Ponnuswamy S., "Bridge Engineering", Tata McGraw-Hill, 2019.
2. Raina.V.K, "Concrete Bridge Practice", Tata McGraw Hill, 2007
3. IRC 5:1998 Standard Specifications and code of practice for Road Bridges, Section I - General.
4. IRC 6:2014 Standard Specifications and code of practice for Road Bridges, Section I - Loadings.
5. IRC 83:2015 Standard Specifications and code of practice for Road Bridges, Bearings.
6. IRC 112:2011.Code of practice for concrete road bridges.

19CEE05 - ADVANCED STEEL STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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. (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 - Design - 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.

REFERENCES

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.

19CEE06 - ADVANCED STRUCTURAL ANALYSIS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1** : *Outline basic concepts and compute static and kinematic indeterminacy of structures*
- CO2** : *Apply energy concepts and the laws underlying the mechanics of structures in the mathematical framework of matrices.*
- CO3** : *Formulate stiffness matrix by direct stiffness method and elemental approach and apply to analyse indeterminate beams, frames and trusses.*
- CO4** : *Formulate flexibility matrix by elemental approach and apply to analyse indeterminate beams, frames and trusses.*
- CO5** : *Identify and define the basic concepts, shape functions and methods of discretization in finite element method*

BASIC CONCEPTS

Indeterminacy - Static, Kinematic - Generalized measurements - Degrees of Freedom - Constrained measurements - Behavior of Structures - Principle of Superposition - Equilibrium, Compatibility and Force displacement relations (9)

ENERGY CONCEPTS

Strain energy; stiffness and flexibility matrices for strain energy - Betti's law and its applications - Properties of stiffness and flexibility matrices - Contra gradient law- Co-ordinate transformations - Transformation of element matrices to structure matrices - orthogonal transformations. (9)

MATRIX STIFFNESS METHOD

Transformation of element stiffness matrices from local to global co-ordinates - Application of direct stiffness method to two span continuous beams and pin-jointed plane frames (frames of maximum three members) - Advantages of direct stiffness method.

Element stiffness matrices for truss, beam and plane frame elements - Development of structure stiffness matrix by element approach Analysis of statically indeterminate beams, rigid jointed and pin-jointed plane frames by matrix stiffness approach. (9)

MATRIX FLEXIBILITY METHOD

Element flexibility matrices for truss, beam and plane frame elements - Development of structure flexibility matrix by element approach -Analysis of statically indeterminate beams, rigid jointed and pin-jointed plane frames by flexibility matrix approach. Comparison of flexibility matrix and stiffness matrix methods. (9)

FINITE ELEMENT METHOD

Introduction to finite element analysis - Concept of discretization of continuum - Finite element analysis procedure - Relevant basics of elasticity - Stress-strain relation (Constitutive relation) - Strain-displacement relation - Concept of strain-displacement matrix - Types of 1-D, 2-D and 3-D finite elements -Displacement function - Convergence and compatibility requirements - Development of shape functions for truss element (2-noded and 3-noded), beam element and CST element (9)

TOTAL: 45

TEXT BOOKS

1. *Pandit G. S. and Gupta S. P., Structural Analysis - A Matrix Approach, Tata McGraw Hill, New Delhi, 2008.*
2. *Rajasekharan S. and G. Sankarasubramanian, Computational Structural Mechanics, Prentice Hall of India, New Delhi, 2012.*
3. *Krishnamoorthy C. S., Finite Element Analysis - Theory and programming, Tata McGraw Hill, New Delhi, 2008.*

REFERENCES

1. *Hibbeler R. C., Structural Analysis, Pearson Education, New Delhi, 9th ed.,2017.*
2. *Ghali A., Neville A. M. And Brown T. G., Structural Analysis - A Unified Classical and Matrix Approach, Spoon Press, London and New York, 2017.*
3. *Manicka Selvam V.K., Elements of Matrix and Stability Analysis of Structures, Khanna Publishers, Delhi, 2010.*
4. *Robert D. Cook, David S. Malkus, Concepts and Applications of Finite Element Analysis, John Wiley & Sons, Indian Edition, 2007.*
5. *William Weaver Jr. and James M. Gere, Matrix Analysis of Framed Structures, CBS Publishers, New Delhi, 2004.*
6. *Rajasekharan S., Finite Element Analysis in Engineering Design, S.Chand and Company Ltd., 2003.*

ONLINE RESOURCE

1. <https://nptel.ac.in>

19CEE07 - PREFABRICATED STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1** : Apply the principles of prefabrication towards economy, standardization, systems of prefabrication and its elements
- CO2** : Employ standard practices and techniques in precast concrete manufacturing and handling of elements
- CO3** : Apply the design principles involved in precast concrete structures
- CO4** : Choose joints and connections involved in prefabricated concrete structures
- CO5** : Apply the design principles of prefabricated structures subjected to abnormal loads

PRINCIPLES OF PREFABRICATION

Types of prefabrication - Advantages and disadvantages of prefabrication-Economy of prefabrication - Modular coordination - Standardisation - Prefabrication system and structural schemes - Prefabricated elements - Beams - Columns - Slabs-Roof and floor panels - Wall panels -Staircase. **(9)**

PRECAST CONCRETE-MANUFACTURING AND ERECTION TECHNIQUES

Standard practices and techniques of precast concrete manufacturing and handling -Cycle of precasting - Reinforcement- Preparation of moulds -Preparation and transportation of concrete- Production tolerances -Transportation and erection of prefabricated elements-Equipments for handling precast elements. **(9)**

DESIGN PRINCIPLES

Disuniting of structures-Structural behaviour of precast structures - Handling and erection stresses - Design of cross section based on efficiency of material used- Problems in design because of joint flexibility-Allowance for joint deformation. **(9)**

JOINTS AND CONNECTIONS

Types of precast element connections - Column to foundation connections -Column to column connections-Beam to column connections-Beam to beam connections-Floor to beam connections-Wall to wall connections- Joints for different structural connections - Dimensioning and detailing of joints for different structural connections - Construction and expansion joints in precast construction. **(9)**

DESIGN PRINCIPLES FOR ABNORMAL LOADS

Code provisions- Equivalent design loads for considering abnormal effects such as earthquakes, cyclones - Progressive collapse -Importance of avoidance of progressive collapse. **(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.

REFERENCES

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. IS 15916-2010: *"Indian Standard Code of Practice for Building Design and erection using Prefabricated Concrete"*, Bureau of Indian Standards, New Delhi.
4. *Structural Design Manual, "Precast concrete Connection Details"*, Society for the Studies in the use of Precast Concrete, Netherland Behor Verlag, 2009.
5. Koncz T., *"Manual of Precast Concrete Construction"*, Vol.I, II and III, Bauverlag, GMBH, 1976.

19CEE08 - ADVANCED SURVEYING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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, Drone surveying - introduction, mission and mapping, Applications of DGPS (Differential Global Positioning Systems) and Ground Penetrating Radar (GPR). **(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 - simple problems, Equipment for sounding- Sounding Party- Making Sounding- Locating Sounding- Plotting of Sounding. **(9)**

TOTAL : 45

TEXT BOOK

1. Agor R., "Advanced Surveying", Khanna Publishers, New Delhi, 2018.

REFERENCES

1. Dr. B.C. Punmia, "Surveying, Vol. I, II and III", Laxmi Publishers, New Delhi, 2016
2. Kanetkar T.P. and Kulkarni S.V., "Surveying and Levelling, Vol. I and II", VidhyarthiGruh, Pune, 2016
3. Dr. K.R. Arora, "Surveying, Vol. I, II and III", Standard Book House, New Delhi, 2019
4. Duggal S. K., "Surveying, Vol. I and II", Tata Mcgraw Hill, New Delhi, 2017
5. Basak N.N., "Surveying and Levelling", Tata Mcgraw Hill, New Delhi, 2017
6. Agor R., "Surveying and Levelling", Khanna Publishers, New Delhi, 2015
7. Roy S.K., "Fundamentals of Surveying", Prentice Hall of India, New Delhi, 2010
8. Subramanian, R., "Surveying and Leveling", Oxford University Press, New Delhi, 2013
9. Bhatia B., "Remote Sensing and GIS", Oxford University Press, New Delhi., 2011
10. Lillesand T.M., Kiefer R.W., and Chipman J.W., "Remote sensing and Image interpretation", 5th edition, John Wiley and Sons, India, 2015
11. James M Anderson and Adward M Mikhail, "Surveying : theory and practice", 7th Edition, Tata McGraw Hill Publication, 2014

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEE09 - NUMERICAL METHODS FOR CIVIL ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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 compute shear force, bending moment and deflection in beams.

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. (9)

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 plate (9)

NUMERICAL INTEGRATION

Trapezoidal Rule, Simpson's one third Rule - Gaussian quadrature formula - Application of quadrature rule to deflection of non- prismatic simple beams (9)

EIGEN VALUES AND EIGEN VECTORS

Iterative method (Power method) - Jacobi method - Applications: Principal stresses and Principal planes - Principal moment of inertia and principal axes - difference in eigen value problems to buckling of columns (9)

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 (9)

TOTAL : 45

TEXT BOOKS

1. Krishna Raju, N. and Muthu K.U., "Numerical Methods for Engineering Problems", Macmillan India Limited, 2015.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Numerical Methods", S. Chand &Company Limited, 2005.

REFERENCES

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.

19CEE10 - FINITE ELEMENT METHOD

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1** : Understand the finite element method and its application to various structural engineering problems.
- 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** : Demonstrate the physical models of trusses, beams and frames by applying finite element method for displacements, stresses and strains.
- CO5** : Apply the most relevant finite element methods in civil engineering by implementing well-structured programs for solving basic engineering problems.

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.

REFERENCES

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.

19CEE11 - INDUSTRIAL STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

The students are able to,

CO1 : Acquire the knowledge about the planning and functional requirements of Industrial structures.

CO2 : Understand the current design trends of multi storey building systems and industrial structures.

CO3 : Design the crane girder and gantry girder.

CO4 : Design the silos, bunkers and bins along with supporting structures.

CO5 : Understand and design the environmental control structures.

PLANNING AND FUNCTIONAL REQUIREMENTS

Planning of an industrial building based on the functional requirements, Lighting and ventilation - Fire safety norms - factories act, Different types of loadings. (9)

INDUSTRIAL FRAMING

Types of roofing Design of Roof, Portals, Pre Engineered Buildings - Design of multi storied deck slab, Steel platform, wind columns - Foundations and pedestals. (9)

MATERIAL HANDLING SYSTEMS

Cranes -Types-design of EOT - Manual overhead travelling cranes - Jib Cranes-Design of A-cranes, monorails. Design of conveyers, conveyer towers (9)

INDUSTRIAL STORAGE STRUCTURES

Design of silos, bins and bunkers - Design of supporting system for storage hoppers and bunkers. (9)

ENVIRONMENTAL CONTROL STRUCTURES

Concept of Electro-static precipitators, functioning and components - wet and dry scruppers- Design of chimneys - Self-supporting, Guyed and braced. (9)

TOTAL : 45

TEXT BOOKS

1. Jurgen Axel Adam, Katharria Hausmann, Frank Juttner, Klauss Daniel, "Industrial Buildings: A Design Manual", Birkhauser Publishers,2004.

REFERENCES

1. Bye law's of Inspector of Factories
2. Alexander Newman, "Metal Building System - Design and specifications", Second Edition, Mc Graw Hill, NewDelhi-2004
3. Punmia B.C., Ashokkumar Jain, "Design of Steel Structures",Laxmi Publications, New Delhi-2004
4. Gaylord E H,Gaylord N C and Stall Meyer J E, "Design of Steel Structures", Third Edition, McGraw Hill Publications, 1992

19CEE12 - SMART MATERIALS AND STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Select materials for sensor applications based on required properties.

CO2 : Comprehend the principles of operation of Piezoelectric Materials, optical fibers, actuators, and methods of analyses employed in smart materials.

CO3 : Understand and define the control methods used in smart structures

CO4 : Evaluate shape memory materials, electro rheological fluids for newer applications.

CO5 : Analyze vibration suppression, shape control, sizing and optimization of smart materials by finite element methods.

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 LVDT - 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.*

REFERENCES

3. *Brian Culshaw, "Smart Structures and Materials", Artech House, Boston, 1996*
4. *Gandhi.M.V and Thompson.B.S, "Smart Materials and Structures", Chapman and Hall, NewYork, 1992*
5. *L.S.Srinath, "Experimental stress Analysis", Tata McGraw-Hill, 1998.*
6. *Michelle Addington and Daniel L. Schodeck, "Smart Materials and Technology", Elsevier, 2005.*
7. *Yoseph Bar Cohen, "Smart Structures and Materials," The international society for optical Engineering, 2003.*

19CEE13 - SAFETY IN CIVIL ENGINEERING PRACTICE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Recognise the role and responsibility of a professional Civil Engineer in health and safety.

CO2 : Investigate and report the accident occurring at site.

CO3 : Apply safety practice and provide safety premises.

CO4 : Assess work injury and calculate various rate indices pertaining to safety.

CO5 : Apply Safety Training and Safety Education.

ROLES AND RESPONSIBILITIES

Construction Safety Management - Role of various parties, duties and responsibilities of top management, site managers, supervisors etc. role of safety officers, responsibilities of general employees, safety committee, safety training, incentives and monitoring. Writing safety manuals, preparing safety checklists and inspection reports. (9)

SAFETY AUDIT

Components of safety audit, types of audit, audit methodology, non-conformity reporting (NCR), audit checklist and report - Review of inspection, remarks by government agencies, consultants, experts - Perusal of accident and safety records, formats - Implementation of audit indication - Liaison with departments to ensure co-ordination - Check list - Identification of unsafe acts of workers and unsafe conditions in the shop floor. (9)

ACCIDENT INVESTIGATION AND REPORTING

Concept of an accident, reportable and non-reportable accidents, reporting to statutory authorities - Principles of accident prevention - Accident investigation and analysis - Records for accidents, departmental accident reports, documentation of accidents - Unsafe act and condition - Domino sequence - Supervisory role - Role of safety committee - Cost of accident. (9)

SAFETY PERFORMANCE MONITORING

ANSI (Z16.1) Recommended practices for compiling and measuring work injury experience - Permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety "t" score, safety activity rate - problems. (9)

SAFETY EDUCATION AND TRAINING

Importance of training - Identification of training needs-training methods - Programmes, seminars, conferences, competitions - Method of promoting safe practice - Motivation - Communication - Role of government agencies and private consulting agencies in safety training - Creating awareness, Awards, Celebrations, Safety posters, Safety displays, Safety pledge, Safety incentive scheme, Safety campaign - Domestic Safety and Training, Indian labour safety law reforms. (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.

19CEE14 - REMOTE SENSING AND GIS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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 - Application of aerial photo interpretation - photographs versus maps. (9)

IMAGERY

Landsat imagery - Digital image processing - Comparison with aerial photographs - Imaging devices - Aerial camera - Panoramic camera - Satellites - Geo Stationery - Sun Synchronous Satellites - Platforms and Sensors - types - Characteristics. (9)

GIS

GIS - Structure of GIS - various components of GIS - vector and raster data - analysis of data - Introduction to various GIS softwares - Introduction to GPS - Principles (9)

APPLICATIONS OF GIS AND REMOTE SENSING

Application of Remote Sensing and GIS in water resources engineering, land use studies, soil sciences, geology, agriculture, forestry, oceanography. (9)

TOTAL: 45

TEXT BOOKS

1. Bhatia S.C, "Fundamentals of remote sensing", New Delhi Atlantic Publishers, 2008.
2. M. Anji Reddy, "Text book of Remote sensing & Geographical Information Systems", 2005.

REFERENCES

1. Floyd F.Sabins, J.R., WH, "Remote Sensing Principles Interpretation", Freeman and Company and Francis Company, France, 1996.
2. Lillesand, Thomas.M and RaiphW.Kiefer, "Remote Sensing and Image Interpretation", John Wiley Sons, 2003.

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEE15 - GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : *Identify problematic soil properties and select a suitable ground improvement technique to improve the same.*

CO2 : *Acquire a fundamental knowledge on various ground improvement techniques.*

CO3 : *Design simple ground improvement techniques.*

PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES

Role of ground improvement in foundation engineering - Methods of ground improvement - Geotechnical problems in alluvial, lateritic and black cotton soils - Selection of suitable ground improvement techniques based on soil conditions. (9)

DEWATERING

Dewatering Techniques - Well points - Vacuum and electro osmotic methods - Seepage analysis for two dimensional flow for fully and partially penetrated slots in homogeneous deposits - Design for simple cases (9)

INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS

In situ densification of cohesionless soils - Dynamic compaction - Vibroflotation, Sand compaction piles and deep compaction. Consolidation of cohesive soils - Preloading with sand drains and fabric drains, Stabilization of soft clay ground using stone columns and lime piles-Installation techniques - Simple design - Relative merits of above methods and their limitations. (9)

EARTH REINFORCEMENT

Concept of reinforcement - Types of reinforcement material - Reinforced earth wall - Mechanism - Simple design - Applications of reinforced earth; Functions of Geotextiles in filtration, drainage, separation, road works and containment applications (9)

GROUTING TECHNIQUES

Types of grouts - Grouting equipments and machinery - Injection methods - Grout monitoring - Stabilization with cement, lime and chemicals - Stabilization of expansive soil. (9)

TOTAL : 45

TEXTBOOKS

1. *Purushothama Raj. P, "Ground Improvement Techniques", Firewall Media,2005.*
2. *Koerner, R.M. "Construction and Geotechnical Methods in Foundation Engineering", McGraw Hill, 1994.*

REFERENCES

1. Moseley, M.P., "Ground Improvement Blockie Academic and Professional", Chapman and Hall, Glasgow,2004.
2. Moseley, M.P and Kirsch. K., 'Ground Improvement mediation", Sponress, Taylor and Francis Group, London,2004.
3. Jones C.J.F.P. "Earth Reinforcement and Soil Structure", Thomas Telford Publising,1996.
4. Winterkorn, H.F. and Fang, H.Y. "Foundation Engineering Hand Book". Van Nostrand Reinhold,1994.
5. Das, B.M., "Principles of Foundation Engineering" (seventh edition), Cengage learning, 2010.
6. Coduto, D.P., "Geotechnical Engineering - Principles and Practices", Prentice Hall of India Pvt.Ltd. New Delhi,2011.
7. Koerner, R.M., "Designing with Geosynthetics" (Fourth Edition), Prentice Hall, Jersey, 2012.
8. IS Code 9759 : 1981 (Reaffirmed 1998) "Guidelines for Dewatering During Construction", Bureau of Indian Standards, NewDelhi.
9. IS Code 15284 (Part 1): 2003 "Design and Construction for Ground Improvement - Guidelines" (Stone Column), Bureau of Indian Standards, NewDelhi.

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEE16 - DESIGN OF DEEP FOUNDATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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.

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 weak 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. (9)

TOTAL: 45

REFERENCES

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.

19CEE17 - EARTHQUAKE RESISTANT DESIGN OF MASONRY AND TIMBER STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

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

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

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

CO4 : *Design the brick masonry and timber structures for seismic resistance 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.

REFERENCES

1. Ramchandra, V. Gehlot, "Design of Steel Structures (Vol. 1)" Scientific Publishers, 2016.
2. Duggal, S.K., "Earthquake Resistant Design of Structures", Oxford University Press, 2007.
3. IS: 1905 - Code of Practice for Structural use of Unreinforced Masonry, 1987.
4. SP20 (S & T), "Hand Book on Masonry Design and Construction", Bureau of Indian Standards, 1991.
5. IS: 883, "Code of Practice for Design of Structural Timber in Building", Bureau of Indian Standards, 1994.
6. IS: 2366, "Code of Practice for Nail- Jointed Timber Constructions", Bureau of Indian Standards, 1983.
7. IS 13827: 1993, "Improving Earthquake Resistance of Earthen Buildings-Guidelines", Bureau of Indian Standards, 1993.
8. IS 13828: 1993, "Improving Earthquake Resistance of Low Strength Masonry Buildings - Guidelines", Bureau of Indian Standards, 1993.

19CEE18 - BUILDING SERVICES AND MAINTENANCE ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1** : Evaluate and suggest appropriate fire safety system as per the NBC for buildings..
- CO2** : Formulate electrical layout for buildings based on specifications, methods, usage and codal regulations.
- CO3** : Evaluate AC loads for small halls/rooms and suggest suitable systems.
- CO4** : Finalise the plumbing layout and waste water systems required for buildings as per guidelines.
- CO5** : Formulate maintenance plan for all building services and equipment.

FIRE SAFETY INSTALLATIONS

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. Heat and smoke detectors - Fire alarm system- Firefighting pumps and water storage - Dry and wet risers - Automatic sprinklers. Special features required for physically handicapped and elderly. (9)

ELECTRICAL SYSTEMS IN BUILDINGS

Basics of Single/Three phase supply - Protective devices - Earthing, types of earthing - Types, sizes of wires, wiring systems- main and distribution boards - Load calculations -Planning electrical wiring for buildings - Back-up generator- Transformers -Solar off grid supply and back up, calculations. Lift systems- types-capacity calculations and standards. (9)

AIR CONDITIONING

Psychrometric properties - Psychrometric chart - Psychrometric processes - Cooling and Heating load calculations - air conditioning cycles - winter, summer and year round, unitary (window & split) air conditioning systems - effective temperature - comfort conditions. Duct design (theoretical treatment) - economic considerations and methods - air distributing systems - humidification - air cleaning - controls. (9)

PLUMBING AND WASTE WATER SYSTEMS IN BUILDINGS

Planning for plumbing-water supply scales-capacity calculations-UGT and OHT requirement-FU's-pipe sizing-Hazen-Williams formula/ charts-Types and design of systems for Multi-storey buildings. Waste water appliances-DU's-calculations-Pipe Layout-One/Two Pipe, Stack systems for multi storey buildings.(9)

MAINTENANCE MANAGEMENT

Building maintenance/facilities management-Planning-Budgeting-Maintenance Teams- Maintenance standardsand contracts/AMC's-MIS for building maintenance-BMS-Economic maintenance decisions. (9)

TOTAL : 45

TEXT BOOKS

1. David V Chadderton-Building Services Engineering, 5th Edition (2007)
2. Frank Booty, Facilities Management Handbook
3. Basic Electrical Engineering -T.K.Nagasarkar and M.S. Sukhija Oxford University
4. Domkundwar and Arora, "A course in Refrigeration and Air Conditioning", Dhanpat Rai and Co. (P) Ltd., 2007.
5. SP7 : 2016, National Building Code of India.

REFERENCES

1. *Barrie Chanter, Peter Swallow-Building Maintenance Management -Wiley Blackwell (2007).*
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. *SP 32 (1986) - Lighting and Ventilation.*
5. *SP 30 (2011) - National Electrical Codes.*
6. *SP 35 - Handbook on water supply and Drainage*
7. *IS 14665 (2000)- Part I, Part II, Part IV- Lifts*
8. *IS 1172(Reaffirmed 2002) -Code for basic Requirement for Water Supply, Drainage and Sanitation*
9. *IS 2065(Reaffirmed 1996) - Code of Practice for Water Supply in Buildings.*
10. *IS 1742(Reaffirmed 2002) - Code of practice for building drainage*
11. *IS 12183(Reaffirmed 2004) - Code of Practice for Plumbing in Multi-Storeyed Buildings.*
12. *Mahesh M Rathore, Thermal Engineering, Tata McGraw-Hill, 2018.*
13. *Manohar Prasad, "Refrigeration and Air Conditioning", Wiley Eastern Ltd., Third Edition, 2007.*
14. *Domkundwar and Arora, "A course in Refrigeration and Air Conditioning", Dhanpat Rai and Co. (P) Ltd., 2007.*

19CEE19 - OPTIMIZATION TECHNIQUES IN CIVIL ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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 resource allocation problems and conduct simulation analysis to examine the robustness of optimal solutions.

LINEAR PROGRAMMING

Formulation of problems - Graphical solution- Standard form - Slack, surplus and artificial variables - Canonical form - Basic feasible solution - Simplex method - Two phase method - Zi- Cj 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

Polynomial - 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 suboptimization 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

REFERENCES

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.

ONLINE RESOURCE

1. <https://nptel.ac.in>

19CEE20 - THEORY OF ARCHITECTURE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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.*
4. <https://nptel.ac.in/courses/124/107/124107012/>

ONLINE RESOURCE

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

19CEE21 - GREEN BUILDING CONCEPTS AND PRACTICES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Outline the basic concept of green building.

CO2 : Assess the different components of the green building.

CO3 : Assimilate the green building rating system.

CO4 : Apply the green building auditing for effective Management.

GREEN BUILDING PERSPECTIVE

Introduction to Green Buildings: Definition of green buildings and sustainable development - Impact of design, construction & maintenance of buildings on our environment and natural resources - Components of Green Building - Operational energy in Building and Life cycle energy - Embodied energy - Opportunities of Green Building - benefits of green buildings towards sustainable development. **(9)**

SITE SELECTION AND PLANNING

Criteria for site selection- preservation of landscape-minimizing urban heat island effect- maximize comfort by proper orientation of building facades - Rainwater harvesting methods for roof & non-roof, reducing landscape water demand with recycle and reuse of waste water systems. **(9)**

MATERIAL CONSERVATION AND INDOOR ENVIRONMENTAL QUALITY

Waste reduction during construction -materials with recycled content- local materials selection -material reuse-certified wood - Renewable building materials and furniture - day lighting -air ventilation, exhaust systems - low VOC paints, materials & adhesives -Air conditioning - Indoor air quality - Sick building syndrome -Reasons for poor IAQ- Measures to achieve Acceptable IAQ levels. **(9)**

GREEN BUILDING RATING SYSTEM

Green Building initiatives in India - Benefits Experienced in Green Buildings - Indian Green Building Council- - Launch of Green Building Rating Systems - Green Performance rating - requirements of LEED - GRIHA - Energy Conservation Building Code requirements - Concepts of Overall Thermal Transfer Value (OTTV). **(9)**

CASE STUDY

Case study on Green building Auditing- Energy management - water management - carbon footprint-preliminary Audit and Detailed audit - suggestions. **(9)**

TOTAL : 45

TEXT BOOKS

1. Kent Peterson, Standard for the design for High Performance Green Buildings, IGCC, 2009
2. Tomwoolley and Samkimings, Green Building Hand Book, Volume 1, Taylor & Francis 2009.

REFERENCES

1. *Handbook on Green Practices, Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.*
2. *Wines James & Jodido Philip, "Green Architecture - The Art of Architecture in the age of Ecology", Tachen Publishers, New York, 2000.*
3. *Mackenzie Dorothy, "Green design: design for the Environment", Laurence King, London, 1997.*
4. *Farmer John & Richardson Kenneth, "Green Shift: Changing attitudes in architecture to the Natural World", Architectural Press, Boston, 1999.*
5. *Energy Conservaton Building Code , Bureau of Energy Effeciency, Ministry of Power, Government of India, 2017.*

ONLINE RESOURCE

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

19CEE22 - DESIGN OF ENVIRONMENTAL STRUCTURES AND DRAWING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Design the various units of conventional water and wastewater treatment.

CO2 : Illustrate the different environmental structures

CO3 : Design the plumbing system for both water supply and wastewater collection

CO4 : Employ the techniques, skills, and modern engineering tools necessary for environmental engineering practices.

CO5 : Interpret the current needs to control water usage by adopting suitable technical skills in the design of water supply works.

WATER TREATMENT UNITS

Objective of Water Treatment- Layout of Water Treatment Plant - Objective, Principle, Design and Drawing of Sedimentation Tank -Clarifloculator-Slow and Rapid Sand Filter. (9)

WASTEWATER TREATMENT UNITS.

Objective of Municipal and Industrial Waste Water Treatment - Objective, Principle, Design and drawing of Screens - Grit Chamber - Primary and Secondary Settling Tanks - Trickling filter - Activated Sludge Process. (9)

DIGESTION AND DISPOSAL UNITS

Objective, Principle, Design and Drawing of -UASB Reactor- Sludge Digestion Tank - Sludge Drying Bed - Septic Tank with Dispersion Trench and Soak Pit - Imhoff Tank. (9)

SEWAGE TREATMENT PLANT WORKS

General Layout of Sewage Treatment Plant - Design and Drawing of Domestic Sewage Treatment Plant for a Town - General Principles Governing the Design of Sanitary Plumbing System - Minimum Sanitary Fixtures for Different types of Buildings (Indian standards) - Systems of Plumbing of Drainage work in a Building. (9)

WATER TREATMENT PLANT WORKS

Water piping systems in buildings - Design Considerations - Water Demand for a Building - Required flow for various water supply fixtures and drawing - Design and Drawing of Rain water Harvesting system - Design and drawing of water treatment plant for a town. (9)

TOTAL : 45

TEXT BOOKS

1. Garg S. K., "Environmental Engineering", Vol. I Khanna Publishers, New Delhi, 33rd edition.
2. Garg S. K., "Environmental Engineering", vol. II, Khanna Publishers, New Delhi, 39th edition.
3. Metcalf and Eddy, "Wastewater Engineering Treatment, Disposal and Reuse", McGraw-Hill Publishing Co, Indian Edition, New Delhi, 2005.

REFERENCES

1. *Mark J. Hammer, "Water and Waste Water Technology", Prentice hall of India 2008.*
2. *Hussain S. K., "Text Book of Water Supply and Sanitary Engineering", Oxford and IBH, 1994.*
3. *Duggal K.N., "Elements of public Health Engineering", S.Chand and Company Ltd, New Delhi, 1998.*
4. *Manual on Sewerage and Sewage Treatment Systems, CPHEEO Manuals, Ministry of Housing and Urban Affairs, Govt. of India, New Delhi, 2013.*

ONLINE RESOURCES

1. www.digimat.in/nptel/courses/video/105106119/L01.html

19CEE23 - AIR POLLUTION AND CONTROL

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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. Pareira, YungTse Hung, "*Air Pollution Control Engineering*", Tokyo, 2004.
3. C.S.Rao., "*Environmental Pollution Control Engineering*", Wiley Eastern Ltd, Delhi.

REFERENCES

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.

19CEE24 - SOLID AND HAZARDOUS WASTE MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Outline the salient features of solid waste management and handling of solid waste.

CO2 : Deduce source reduction, recycling and reuse techniques for solid waste.

CO3 : Analyze the collection systems and methods of transfer of solid waste.

CO4 : Describe the processing techniques for solid and hazardous waste.

CO5 : Select 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 waste - 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. *George Tchobanoglous, Hilary Thesisen and Samuel A Vigil, "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.*
3. *Charles, A.W., "Hazardous Waste Management", Mc Graw-Hill Pub. 2002.*

REFERENCES

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.*
3. *CPHEEO, "Manual on Municipal Solid Waste Management, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi.*

19CEE25 - ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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.*

REFERENCES

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.*

19CEE26 - INDUSTRIAL WASTEWATER MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1** : *Outline the waste water characteristics and environmental implications of various industrial effluents*
- CO2** : *Interpret the Wastewater minimization techniques.*
- CO3** : *Illustrate the importance of Advanced Wastewater Treatment systems.*
- CO4** : *Interpret the manufacturing processes of industries and compare the characteristics of Industrial effluents.*
- CO5** : *Implement 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 Liquid discharge, effluent treatment - individual and common effluent treatment plant (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, paper and pulp industry. (9)

CASE STUDIES - 2

Process description, wastewater characteristics and effluent treatment for tannery, distilleries, diary and textiles - Dyeing. (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.*
3. *Eckenfelder (jr), "Industrial Water Pollution Control", McGraw-Hill Book Co, New York, 2000.*

REFERENCES

1. Nemerow N. L., *"Industrial Water Pollution"*, Addison - Wesley Publishing Company Inc., USA, 1996.
2. Mahajan S. P. *"Pollution Control in process industries"*, Tata McGraw Hill Publishing Co Ltd., New Delhi, 1989.
3. World Bank Group, *"Pollution Prevention and Abatement Handbook - Towards Cleaner Production"*, World Bank and UNEP, Washington D.C., 1998

ONLINE RESOURCES

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

19CEE27 - GEO ENVIRONMENTAL ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

On completion of the course, the student is expected to

CO1 : Understand basic knowledge of concepts and principles of Geo-environmental Engineering..

CO2 : Be capable of selecting site for safe disposal of waste.

CO3 : Aware of soil stabilization by utilizing solid waste.

CO4 : Assess the contamination in the soil and to select suitable remediation methods based on contamination.

CO5 : Prepare the suitable disposal system for particular waste.

GENERATION OF WASTES AND CONSEQUENCES OF SOIL POLLUTION

Introduction to Geo environmental engineering - Environmental cycle - Sources, production and classification of waste - Causes of soil pollution - Factors governing soil pollution-interaction of clay minerals - Failures of foundation due to waste movement. **(9)**

SITE SELECTION AND SAFE DISPOSAL OF WASTE

Safe disposal of waste - Site selection for landfills - Characterization of land fill sites and waste - Risk assessment - Stability of landfills - Current practice of waste disposal - Monitoring facilities - Passive containment system - Application of geosynthetics in solid waste management - Rigid or flexible liners. **(9)**

TRANSPORT OF CONTAMINANTS

Contaminant transport in sub surface-Advection, Diffusion, Dispersion-Governing equations -Contaminant transformation - Sorption - Biodegradation - Ion exchange - Precipitation -Hydrological consideration in land fill design - Ground water pollution **(9)**

WASTE STABILIZATION

Stabilization - Solidification of wastes - Micro and macro encapsulation - Absorption, Adsorption, Precipitation - Detoxification - Mechanism of stabilization - Organic and inorganic stabilization - Utilization of solid waste for soil improvement **(9)**

REMEDIATION OF CONTAMINATED SOILS

Exsitu and insitu remediation - Solidification, bio-remediation, incineration, soil washing, electro kinetics, soil heating, vitrification, bio-venting. **(9)**

TOTAL : 45

TEXT BOOKS

1. Manoj Datta," Waste Disposal in Engineered landfills", Narosa Publishing House, 1997.
2. Manoj Datta, B.P. Parida, B.K. Guha, "Industrial Solid Waste Management and Landfilling Practice", Narosa Publishing House, 1999.

REFERENCES

1. *Hari D. Sharma and Krishna R. Reddy, "Geo-Environmental Engineering" -John Wiley and Sons, INC, USA, 2004.*
2. *Daniel B.E., "Geotechnical Practice for waste disposal", Chapman & Hall, London 1993.*
3. *Westlake, K, "Landfill Waste pollution and Control", Albion Publishing Ltd., England, 1995.* 4. *Wentz, C.A., "Hazardous Waste Management", McGraw Hill, Singapore, 1989.*

ONLINE RESOURCES

<https://nptel.ac.in>

19CEE28 - PAVEMENT ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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- 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 pavement- IRC 58 method and PCA method. (9)

PAVEMENT DISTRESS, EVALUATION AND REHABILITATION

Flexible pavement distress - rigid pavement distress - pavement 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, 2004.
2. Sharma S. K., "Principles, Practice and Design of Highway Engineering", S. Chand and Company Ltd., New Delhi, 2014.

REFERENCES

1. *Yoder E. J. and Witezak M. W., "Principles of Pavement Design", John Wiley and Sons Inc., New York, 2011.*
2. *Yang H. Huang, "Pavement Analysis and Design", Pearson Education, 2008*
3. *IRC: 37-2018, Guidelines for the Design of Flexible pavements, Indian Road Congress, New Delhi, 2018.*
4. *IRC: 58-2015, Guidelines for the Design of Rigid Pavements for Highways, Indian Road Congress, New Delhi, 2015.*
5. *IRC: SP: 72 - 2015, Guidelines for the design of flexible pavements of low volume rural roads, Indian Road Congress, New Delhi, 2015.*

ONLINE RESOURCES

1. <https://nptel.ac.in>
2. <http://www.digimat.in/nptel/courses/video/105105107/L37.html>

19CEE29 - AIRPORT AND HARBOUR ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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., Arora M.G., and S. S. Jain, "Airport Planning and Design", Nem Chand, Roorkee, 2017
2. Saxena S. C, " Airport Engineering Planning and Design", CBS Publications, 2020
3. Hasmukh P. Oza and Gautam H. Oza., "Dock and Harbour Engineering", Charotar Publishing House, Anand, Gujarat, 2016.
4. S.P. Bindra, " Dock and Harbour Engineering", Dhanpar Rai Publishers, 2010

REFERENCES

1. Robert Horonjeff., *"The Planning and Design of Airports"*, McGraw Hill Book Co., 1994.
2. Quinn, *"Design and Construction of Port and Marine Structures"*, McGraw Hill, 1972.
3. *BIS IS 4651-4, 2014, Code of Practice for Planning and Design of Ports and Harbours, General Design Consideration*, BIS, New Delhi.

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEE30 - TRAFFIC ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Understand the traffic parameters and systems

CO2 : Design Channelized islands, Intersections, signals and parking arrangements

CO3 : Develop an effective Traffic management System

TRAFFIC CHARACTERISTICS

Physical, Physiological, Psychological, Environmental Characteristics, PIEV Theory -Traffic Stream Characteristics, Vehicle Characteristics -Urban Road and Road Characteristics - Geometric Design-Overview. (9)

SURVEYS AND STUDIES IN TRAFFIC ENGINEERING

Conventional and Modern Methods of Traffic Survey and Studies - Volume and Capacity - Level of service (LOS) for uninterrupted traffic flow - Headway concepts and applications - Speed and Delay - Origin and Destination, Parking, Accident. (9)

DESIGN OF TRANSPORT INFRASTRUCTURE

Design of roads - Design Speed, Terrain, Gradient curves - Horizontal and Vertical, Super elevation, Sight Distance -Traffic Sign, Road Markings, Traffic Control Aids, simple problems. (9)

INTERSECTION DESIGN AND CONTROL

Design of Intersection - At grade intersection - Uncontrolled, Channelization, Rotary, Traffic Signal Control, Signal Co-ordination, Grade Separated Intersection - Types, Design and Analysis. (9)

TRAFFIC MANAGEMENT

Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, Congestion and parking pricing, Intelligent Transport System (9)

TOTAL : 45

TEXT BOOKS

1. Kadiyali.L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 2012.
2. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management, 2018
3. Salter. R.I and Hounsell N.B, "Highway Traffic Analysis and design", Macmillan Press Ltd.1996.

REFERENCES

1. Wolfgang S. Homburger et.al., "Fundamentals of Traffic Engineering" 15th Edition, Institute of Transportation Studies, University of California, Berkely, 2001
2. James L. Pline (Edr) "Traffic Engineering Hand Book", Institute of Transportation Engineers,

3. *Nicholas T.Garber, Lester A Hoel, "Traffic and Highway Engineering", Revised Second Edition, ITP, California, USA, 1999*
4. *Thomas Curinan, "An Introduction to Traffic Engineering - A Manual for Data Collection and Analysis, Books Cole, UK, 2001*
5. *Washington DC, USA, 1999Pignataro, L.J., Traffic Engineering - Theory & Practice, John Wiley, 1985. 6 AASHTO A Policy on Geometric Design of Highway and Streets*
6. *Highway Capacity Manual (2000), Transportation Research Board, USA.*

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEE31 - URBAN TRANSPORTATION PLANNING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Design, conduct and administer surveys to provide the data required for transportation planning.

CO2 : Develop and calibrate modal split, trip generation rates for specific types of land use developments.

CO3 : Adopt the steps that are necessary to complete a long-term transportation plan.

UNIT I PRINCIPLES OF TRANSPORTATION PLANNING

Introduction - Interdependence of land use and traffic - transportation planning - different stages - various surveys - difficulties in planning - Collection of data - Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques (10)

UNIT II TRIP GENERATION AND DISTRIBUTION

Purpose of Trip - Trip Generation - Trip Distribution - factors - various models - analysis - traffic assignment - modal split - simple problems (10)

UNIT III DESIGN OF VARIOUS ELEMENTS

Design of intersections - at grade - grade separated interchanges - Parking - Demand - type of parking - Design of Multi Storied and Surface Parking facility - traffic signal design - methods - simple problems (10)

UNIT IV URBAN TRANSPORTATION MODES

Public transport - planning - fares and subsidy - Intermediate public transport - types - characteristics - other urban transportation modes (6)

UNIT V URBAN TRANSPORTATION PROBLEMS

Problems in Present Traffic conditions -- traffic and Environment - Air Pollution - Noise Pollution - fuel crisis - remedial measures (9)

TOTAL : 45

TEXT BOOKS

1. Kadiyali.L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 2012.
2. Hutchinson, B.G, 'Principles of Urban Transport Planning', McGraw Hill. 1974
3. Khisty C.J. and Kent B Lall, 'Transportation Engineering' Prentice Hall. 2017
4. Papacostas, 'Transportation Engineering and planning', Tata McGraw Hill, 2015

REFERENCES

1. Mayer M and Miller E, 'Urban Transportation Planning: A decision oriented Approach', McGraw Hill.
2. Bruton M.J., 'Introduction to Transportation Planning', Hutchinson of London.
3. Dicky, J.W., 'Metropolitan Transportation Planning', Tata McGraw Hill.

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEE32 - INTELLIGENT TRANSPORT SYSTEM

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Understand the concepts and need for Intelligent Transport Systems.

CO2 : Acquire the basic knowledge on data collection using ITS.

CO3 : Incorporate the knowledge of management and automation of traffic systems

CO4 : Apply the concepts of ITS in the field of Transportation planning

INTRODUCTION TO ITS

Introduction to Intelligent Transport System (ITS) - Definition of ITS and Identification of ITS- Need for ITS, Objectives, Historical Background, Benefits of ITS (9)

DATA COLLECTION TECHNIQUES

ITS Data collection techniques - Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection (9)

FUNCTIONAL AREAS

Telecommunication in ITS - functional areas of ITS - Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS) (10)

TRAFFIC MANAGEMENT AND AUTOMATION

ITS User Needs and Services - Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management, Mobile Applications; Automated Highway Systems - Overview of ITS implementations in developed countries, ITS in developing countries. (10)

ITS IN INDIAN CITIES

Incorporation of ITS technologies in Indian cities - Transportation Planning applications - Metro rail systems - user friendly apps - case studies (7)

TOTAL : 45

TEXT BOOKS

1. Srinivasa R Kumar 'Intelligent Transport Systems', Orient Blackswan Pvt Ltd, 2021
2. Pradip Kumar Sarkar & Amit Kumar Jain 'Intelligent Transport Systems', PHI Learning, 2018
3. Dr. L. R. Kadiyali 'Traffic Engineering and Transport Planning', Khanna Publishers, 2012

REFERENCES

1. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles

ONLINE RESOURCES

1. <https://nptel.ac.in>
2. National ITS Architecture Documentation, US Department of Transportation, 2007 (CD-ROM).

19CEE33 - HYDRAULIC STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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 siphon aqueducts - Canal outlets and fumes (Theoretical aspects only) **(9)**

STORAGE STRUCTURES - GRAVITY DAMS

Gravity Dams - Description - Forcesacting - Elementary and Practical profile -Design (procedure only) of high and low gravity dam- Zoning of gravity dam - Galleries - Types -Joints, Water stops and Key ways - Types - Spillways - Types - Functions. **(9)**

STORAGE STRUCTURES - EARTHEN DAMS

Earthdams - 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 sluicewing wall type sluice (Description only)-Tank regulation arrangements. **(9)**

TOTAL : 45

TEXT BOOK

1. GargS.K , "Irrigation Engineering and Hydraulic Structures ",Khanna Publishers ,New Delhi ,2009.

REFERENCES

1. Punmia B.C, Pande,B.B. Lal., "Irrigation and Water Power Engineering", Laxmi Publications, New Delhi,2009.
2. Sahasra BudheS.R. , "Irrigation Engineering and Hydraulic Structures Including Hydrology and Water Power Engineering", S.K.Kataria Publications, Sixth Edition, 1996(Reprint2000).

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEE34 - ENGINEERING HYDROLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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 - Water shed hydrology - Geomorphology - Effect and 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 - Scurve Technique **(9)**

FLOOD AND STREAM FLOW MEASUREMENTS

Flood estimation - Flood 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., NewDelhi, 2nd Revised Edition2007*
2. *Raghunath H.M., "GroundWater" ,New Age International (P)Ltd. ,NewDelhi, 2nd Edition, Reprint2003*

REFERENCES

1. Jayarami Reddy P., "A Text Book of Hydrology "University Science Press, (Unit of Laxmi Publications) NewDelhi, 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", TataMc GrawHill Publishing Company Ltd.,2000
4. Chow V.T.," Applied Hydrology",Tata McGraw Hill Publishing Company Ltd.,1988

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEE35 - VALUATION OF IMMOVABLE PROPERTIES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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.

CO4 : Understand the emerging property valuation concept.

CO5 : Understand the laws and acts relating to immovable properties.

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

REFERENCES

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.

19CEE36 - ENGINEERING ECONOMICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Recognize the fundamental economic concepts applicable to engineering.

CO2 : Select appropriate 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, Macro economics and micro economics - 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 - PV 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

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.

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEE37 - MAINTENANCE AND REHABILITATION OF STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

On completion of the course the students will be able to

CO1 : Assess the strength and quality of existing concrete structures by NDT

CO2 : Evaluate the damages in concrete structure due to climate, temperature, chemicals, corrosion.

CO3 : Plan and Suggest suitable repair materials and techniques for repairing of distressed concrete structures.

CO4 : Dismantle and demolish structures which cannot be repaired in an environment friendly, with maximum saving of materials and in a safe way.

SERVICEABILITY AND DURABILITY OF CONCRETE

Quality assurance for concrete construction - concrete preparation - strength, permeability, thermal properties, cracks - effects due to climate, temperature, chemicals, corrosion - construction errors - strength evaluation of existing structures by NDT (Rebound Hammer Test, Ultrasonic Pulse Velocity Test). **(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 AND DEMOLITION 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 BOOKS

1. Varghese.P.C "Maintenance Repair and Rehabilitation and Minor works of building", Prentice Hall India Pvt Ltd 2014.
2. Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", Longman Scientific and Technical UK, 1991.
3. Vidivelli.B "Rehabilitation of Concrete Structures", Standard Publishes Distribution. 1st edition 2009.

REFERENCES

1. Dodge Woodson.R *“Concrete Structures, Protection”, Repair and Rehabilitation*, Butterworth-Heinemann, Elsevier, New Delhi 2012
2. Allen R.T. & Edwards S.C, *“Repair of Concrete Structures”, Blakie and Sons, UK, 1987*
3. Shetty M.S. *“Concrete Technology-Theory and Practice”, S.Chand and Company, 2008.*
4. Dov Kominetzky.M.S., *“Design and Construction Failures”, Galgotia Publications Pvt. Ltd., 2001*
5. Ravishankar.K., Krishnamoorthy.T.S, *“Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures”, Allied Publishers, 2004.*
6. CPWD and Indian Buildings Congress, *“Hand book on Seismic Retrofit of Buildings”, Narosa Publishers, 2008.*
7. Gambhir. M. L., *“Concrete Technology”, McGraw Hill, 2013*
8. SP:25 *“Causes, Prevention and Remedies of Cracks in Building” and National Building Code of India 2016*

19CEE38 - ADVANCED CONSTRUCTION TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Demonstrate the advanced construction techniques for sub structure and super structure

CO2 : Identify suitable underground construction technique for a given soil strata

CO3 : Discuss the methods, equipments and features involved in offshore construction.

CO4 : Explain the methods and techniques of Long span bridge construction.

CO5 : Express the basic aspects and stages of precast and prefabrication construction

SPECIALIZED CONSTRUCTION TECHNIQUES

Construction aspects and procedures of specialized construction techniques - 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 method (9)

UNDERGROUND CONSTRUCTION

Site investigation and Geological studies - Drilling - Pneumatic breakers - Explosives - Blasting. Tunneling technology- Mechanized shield- Micro method- Cut and cover method-Pipe Jacking - Hazards and safety measures in underground construction. (9)

OFFSHORE CONSTRUCTION

Underwater construction - Stages of offshore structure, Construction, Facilities and Methods of fabrication-Equipments- Crane barges derrick barges - Drilling vessels (9)

BRIDGE CONSTRUCTION TECHNIQUES

Types of Bridge- Based on span- Material- Type of super structure- Support condition -Position of floor - High flood level- Bridge construction methods - In situ and Precast 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 Precast and Prefabrication constructions - Materials, Moulds and Modular Coordination, Standardization - Precast systems - Joints in Precast constructions- Curing techniques- Handling- Transportation and Erection techniques - Fabrication and Erection of Steel Structural Elements. Case study - Precast and prefabricating technology for Low cost and Mass Housing Schemes. (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.

REFERENCES

1. Levitt, "Precast concrete - Materials, manufacture properties and usage", Taylor & Francis, 2007.
2. Hurd M. K., "Formwork for concrete", American Concrete Institute, Detroit, 1995.
3. Chew Yit Lin, Michael, "Construction Technology for Tall Buildings", Singapore University Press, World Scientific Publishing company, 2009.
4. Richardson, J.G., "Pre-cast concrete Production", Cement and Concrete Association, 1973.

19CEE39 - CONTRACT MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Recognize, Explain & Relate to Contract Types and Identify where/when Administered.

CO2 : Employ the procedure for contractor's selection through tendering process.

CO3 : Indicate Best Choice & Apply Construction Contracting Practices Used at Industry-Level.

CO4 : Proactively identify construction contract conflicts and resolve through arbitrations and legal procedures.

CO5 : Assess the impact of labor regulations and their impact on managing contracts.

CONSTRUCTION CONTRACTS

Elements of Contracts - Types of Contracts - Features - Suitability - Salient Features of Indian contract Act 1872 as Relevant to Construction Contracts - Design of Contract Documents - International Contract Document - Standard Contract Document - Law of Torts- Contract for Engineering and Architectural Services- Contract between Owner and Contractor. (9)

TENDERS

Types of Tenders - Notice Inviting Tender - Prequalification - Preparation and Submission of -Bid Documents & Tenders - Bidding - Acceptance/Rejection of Tenders - Evaluation of Tender from Technical, Contractual and Commercial Points of View - Contract Formation and Interpretation - Potential Contractual Problems - World Bank Procedures and Guidelines - Tamilnadu Transparency in Tenders Act - Local and International Competitive Bidding - Global Tendering. (9)

CONTRACT ADMINISTRATION AND MANAGEMENT

Selection of Project Management Team - Possession of Construction Site - Duties of Employers - Duties of Contractors - Selection of Sub-contractors - Handling of Contract Matters - Settlement of Variations & Clarifications in Construction - Documentation and Maintenance of Construction Progress Records - Field Diary -Maintenance of Feed Back Reports and Documentation - Quality control Inspection Reports and Outcomes. (9)

ALTERNATE DISPUTE RESOLUTION

Claims and Disputes in Construction contracts - Various Methods of Settlement of Disputes - Alternate Dispute Resolution - Negotiation, Mediation, Conciliation and Arbitration - Salient Features of The Arbitration and Conciliation Act 1996 - Formation of Arbitration Tribunal - Interim Award - Conduct of Arbitration Proceedings - Award Writing and Setting aside of Award. (9)

LEGAL REQUIREMENTS IN CONSTRUCTION INDUSTRY

Insurance and Bonding - Tax Laws - Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs - Legal Requirements for Planning - Property Law - Agency Law - Local Government Laws for Approval - Statutory Regulations - Social Security - Welfare Legislation - Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration - Insurance and Safety Regulations - Workmen's Compensation Act - Indian Factory Act - Tamilnadu Factory Act - Child Labour Act - Other Labour Laws. (9)

TOTAL : 45

TEXT BOOKS

1. *Jimmie Hinze, Construction Contracts, McGraw Hill, 2001*
2. *B. S. Ramaswamy, Contracts and Their Management, LexisNexis Butterworths, 2005*
3. *Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M.Tripathi Private Ltd., Bombay, 1982*

REFERENCES

1. *Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M.Tripathi Private Ltd., Bombay, 1982*
3. *Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.*
4. *Kwaku, A., Tenah, P.E. Jose M.Guevara, P.E., Fundamentals of Construction Management and Organisation, Printice Hall, 1985.*
5. *Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited, 2006.*

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEE40 - CONSTRUCTION EQUIPMENTS AND TECHNIQUES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

Importance of construction equipments their classification, selection and contribution rate of production (Output), Owning and operating cost.

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 - 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 Foundation, Pile driving equipment, micropiling - Equipment for compaction, Equipment for dewatering and grouting. Equipment for Demolition. 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. Launching girders, bridge decks - Eco buildings and Green building concept - Natural buildings - Passive buildings - Intelligent (smart) buildings - Building automation - Energy efficient buildings for various zones (9)

TOTAL : 45

TEXT BOOKS

1. Sharma S.C. "Construction Equipment and Management", Khanna Publishers New Delhi, 2017.
2. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 9th Edition, McGraw Hill, 2018.

3. Arora S.P. and Bindra S.P., "*Building Construction, Planning Techniques and Method of Construction*", Dhanpat Rai and Sons, 2010.
4. Deodhar, S.V. "*Construction Equipment and Job Planning*", Khanna Publishers, New Delhi, 2012.
5. Varghese, P.C "*Building construction*", Prentice Hall of India Pvt. Ltd., New Delhi.
6. Dr. Mahesh Varma, "*Construction Equipment and its Planning and Application*", Metropolitan Book Company, New Delhi, 2005.

REFERENCES

1. Rangwala, S.C., "*Construction of Structures and Management of Works*", 5th edition, Charotar publishers , 2005
2. Sankar, S.K. and Saraswati, S., "*Construction Technology*", Oxford University Press, New Delhi, 2008.
3. "*Construction Equipment Management*" by John Schaufelberger.

ONLINE RESOURCE

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

19CEE41 - FORMWORK FOR CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1** : Identify the various formwork systems and prepare cost effective and detailed planning of formwork, plant & site equipments.
- CO2** : Apply economy and safety principles and considerations in formwork design.
- CO3** : Gain engineering judgment on formwork materials and their allowable stresses.
- CO4** : Apply formwork analysis and design, erect and inspect formwork, scaffolding and shoring in construction projects.
- CO5** : Identify and gain understanding on the latest methods of form construction for high rise and complicated structures like domes and tunnels with deep insights on slipform & scaffolds.

PLANNING, SITE EQUIPMENT & PLANT FOR FORM WORK

Introduction - Formwork as a temporary structure - Requirements for formwork - classification of formwork- Key areas of cost reduction of formwork - Economical planning of form materials- Planning for Safety - Overall Planning - Detailed planning - Standard units - Corner units - Pass units - Calculation of labour constants - Formwork hours - Labour Requirement - Overall programme - Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant (9)

MATERIALS, ACCESSORIES, PROPRIETARY PRODUCTS & PRESSURES

Lumber - Types - Finish - Sheathing boards working stresses - Repetitive member stress - Plywood - Types and grades - Jointing Boarding - Textured surfaces and strength - Reconstituted wood - Steel - Aluminum - Hardware and fasteners - Nails in Plywood - Allowable withdrawal load and lateral load. Pressures on formwork - Examples - Vertical loads for design of slab forms - Uplift on shores - Laterals loads on columns and walls. (9)

DESIGN OF FORMS AND SHORES

Basic simplification - Beam formulae - Allowable stresses - Deflection, Bending - Lateral stability - Shear, Bearing - Design of Wall forms - Slab forms - Beam forms - Column forms - Examples in each. Simple wood stresses - Slenderness ratio - Slab props - Heavy Duty props. (9)

BUILDING AND ERECTING THE FORM WORK

Carpentry Shop and job mill - Forms for Footings - Wall footings - Column footings - Sloped footing forms - Strap footing - Stepped footing - Slab form systems - Flying system forms- Prefabricated panel systems -Giant forms- curved wall forms- Beam or girder forms - suspended forms. Various causes of failures - ACI - Design deficiencies - Permitted and gradual irregularities. (9)

FORMS FOR DOMES AND TUNNELS, SLIP FORMS AND SCAFFOLDS

Formwork for domes - Tunnel forming components - Curb forms invert forms - Arch forms - Concrete placement methods - Cut and cover construction - Bulk head method - Continuous Advancing Slope method. Slip Forms - Principles -Types - advantages - Functions of various components - Safety in slip forms special structures built with slip form Technique - Types of scaffolds - timber scaffolds, metal scaffolds and some proprietary scaffolds - possible causes for collapse of scaffold systems. (9)

TOTAL : 45

TEXT BOOKS

1. *Kumar Neeraj Jha., Formwork for concrete structures, McGraw Hill Education (India) Private Limited, New Delhi, 2017.*
2. *Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996.*

REFERENCES

1. *Austin, C.K., Formwork for Concrete, Cleaver -Hume Press Ltd., London, 1996.*
2. *Michael P. Hurst, Construction Press, London and New York, 2003.*
3. *Robert L. Peurifoy and Garold D. Oberlender, Formwork For Concrete Structures, McGraw Hill , 1996.*

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEE42 - ENTREPRENEURSHIP IN CIVIL ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1** : *Define the concepts of entrepreneurship and analyze the business environment in order to identify business opportunities*
- CO2** : *Define the industrial enterprises and identify the elements of success of entrepreneurial ventures*
- CO3** : *Explain the basic structure and key rules of business taxation law*
- CO4** : *Demonstrate knowledge of the legal and ethical environment impacting business*
- CO5** : *Define the banking financial services, auditing and insurance for enterprises and consider the legal and financial conditions for starting a business venture*

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 Enterprises (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, 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)**

CORPORATE BUSINESS LAW AND AUDITING

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

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

TEXT 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.*

REFERENCES

1. *B.N. Tandon, S. Sudharsanam, S. Sundharabahu., "A Handbook of Practical Auditing", S.Chand Limited, 2006.*
2. *B. Santhanam., "Banking and Financial Systems", Margham Publishers, 2012.*
3. *B. Santhanam., "Financial Services", Margham Publishers, 2016.*
4. *Dr. M.N. Mishra., "Law of Insurance", Central law agency.*
5. *H.P. Machiraju., "Indian Financial System", Vikas Publishing House Pvt. Ltd, 2007.*
6. *S. Badre Alam., P. Saravanel , "Mercantile Law".*
7. *Vinod K. Singhania., "Indirect Tax".*

ONLINE RESOURCE

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

ONE CREDIT COURSES

19CEOC01 - BUILDING CONSTRUCTION PROCESS- AN OVERVIEW

L	T	P	C
1	0	0	1

1. Introduction of building Construction Process - Step by Step

- a. Site Selection
- b. Marking
- c. Earth works excavation
- d. Concreting
- e. Brick works
- f. Plastering
- g. Flooring
- h. Painting (2)

2. Quantity measurement of Building

- a. Quantity Calculation of each element
- b. Material calculation
- c. Rate arriving per unit (2)

3. Building Material and its Selection process

- a. What are materials available in the market and How to select with practical approach? (2)

4. Good Concrete making

- a. Batching
- b. Mixing
- c. Transporting
- d. Compacting
- e. Finishing
- f. Curing (2)

5. Construction Practices

- a. Do's and don'ts in construction practices (2)

6. Cement Manufacturing Process, Types of cement and It's application

- a. Cement Manufacturing process
- b. Types of cement
- c. What are the cements available in the market
- d. Testing of cement - Physical and Chemical
- e. Application of cement in construction (2)

TOTAL : 12+3 (Evaluation) = 15

19CEOC02 - APPLICATIONS OF IoT IN CIVIL ENGINEERING

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1 : Describe what IoT is and how it works today

CO2 : Design and program IoT devices

CO3 : Design an IoT device to work with a Cloud Computing infrastructure.

CO4 : Transfer IoT data to the cloud and in between cloud providers

CO5 : Define the infrastructure for supporting IoT deployments

INTRODUCTION TO IoT DEFINING IoT

Characteristics of IoT - Physical design of IoT - Logical design of IoT - Functional blocks of IoT - Communication models & APIs (3)

IoT STANDARDS AND COMPONENTS

Requirement of international standard (case study) - Design of IOT systems - Development of prototypes for civil engineering projects. (2)

RELEVANCE OF IoT FOR THE FUTURE.

IOT in Construction site - Internet of Everything - IOT and Individual Privacy. (3)

IoT IN INDIAN SCENARIO

IOT and Aadhaar - IOT for concrete and curing services - IOT for rural empowerment (2)

IoT APPLICATIONS (CASE STUDIES)

Intelligent Traffic systems - Smart Parking - IOT for smart cities. (2)

TOTAL : 12+3 (Evaluation) = 15

TEXT BOOKS

1. Micahel Miller "*The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World*", Pearson Education, USA, 2015.
2. Vijay Madisetti and Arshdeep Bahga, "*Internet of Things (A Hands-onApproach)*", 1st Edition, VPT, 2014

REFERENCES

1. Francis daCosta, "*Rethinking the Internet of Things: A Scalable Approach to Connecting Everything*", 1st Edition, Apress Publications, 2013

19CEOC03 - CERTIFICATION AND CAREER ROAD MAP IN CIVIL ENGINEERING

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOME

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

CO1 : Understand the District Town and Country Planning approval process

INTRODUCTION

Planning Approval Meaning, Controls / Regulating Competent Authority, Types of Approval, Checklist for Approval, E-DCR Online Drawing Submission (2)

CORPORATION/LOCAL BODY APPROVAL

Residential - Group Housing / Villas, Apartments, Commercial include office buildings, warehouses, and retail buildings, Industrial & Institutional - Factories and other premises used for manufacturing, altering, repairing, Schools & Colleges or any other educational Institutions. (2)

THE DISTRICT TOWN & COUNTRY PLANNING OFFICE

Residential - Group Housing / Villas, Apartments, Commercial include office buildings, warehouses, and retail buildings, Industrial & Institutional - Factories and other premises used for manufacturing, altering, repairing, Schools & Colleges or any other educational Institutions. (3)

DTCP CHENNAI APPROVAL

Residential - Group Housing / Villas, Apartments, Commercial include office buildings, warehouses, and retail buildings, Industrial & Institutional - Factories and other premises used for manufacturing, altering, repairing, Schools & Colleges or any other educational Institutions. (3)

E-DCR ONLINE DRAWING APPROVAL

E-DCR online drawing submission, E-DCR stages, E-DCR scrutiny process, Scope of the E-DCR system, E-DCR drawing specification, (2)

TOTAL : 12+3 (Evaluation) = 15

REFERENCE

1. *Guidelines on Preparation of Layout & Building Plans under Tamilnadu Combined Development and Building Rules, 2019*

19CEOC04 - ENVIRONMENTAL MONITORING

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : *Outline the significant aspects of environmental monitoring and sampling*

CO2 : *Assess the air and water quality monitoring methods*

CO3 : *Interpret the status and trends using monitoring data collected for water and air.*

CONCEPTS OF ENVIRONMENTAL MONITORING

Objectives and functions of monitoring - Selection of monitoring sites - Sampling: Grab Sampling, Composite Sampling, Integrated Composite Sampling - Sampling Frequency and Preservation - Preparation of standard solutions: primary standards, secondary standards, stock solution, standard solution, normality, molarity, percent solution, standardization of solutions, Expression of results; mg/l, ppm. **(3)**

AIR QUALITY MONITORING

Ambient air quality monitoring - Source of air quality monitoring - Frequency and mode of sampling: Sampling time and sampling locations for air quality monitoring - Environmental procedures for determination of: NO_x, Sox, CO, PM (Particulate Matter) - Structure of monitoring report for air quality monitoring. **(4)**

WATER QUALITY MONITORING

Physical water characteristics: Colour True and apparent colour, Temperature, Odor - Threshold method, Turbidity - Visual and Instrumental method, Solids - Total solids, Total suspended solids, total dissolved solids - Inorganic and non-metallic constituents: pH, Potentiometric method, Alkalinity, Hardness, Acidity, Chlorides and Sulphates, Metallic constituents: Chromium, Fe, by spectrophotometer - Organic constituents: BOD and COD - Structure of monitoring report for water quality monitoring. **(5)**

TOTAL : 12+3 (Evaluation) = 15

TEXT BOOKS

1. *Maiti, S.K., "Handbook of methods in Environmental Studies (Vol.I and II)", Oxford Book Company, 2004*
2. *Garg S. K., "Environmental Engineering", Vol. I Khanna Publishers, New Delhi, 33rd edition.*
3. *Garg S. K., "Environmental Engineering", vol. II, Khanna Publishers, New Delhi, 39th edition.*
4. *H.V.N. Rao and M.N. Rao, "Air Pollution", Tata McGraw-Hill Publishing Company Limited, 2004.*

REFERENCES

1. *IS: 5182, Methods for measurements of air pollution (Part- I, II, IV, V, X), Bureau of Indian Standards, New Delhi, 2003.*
2. *IS 3025, Methods of sampling and test (physical and chemical) for water and wastewater. Bureau of Indian Standards, New Delhi, 1986.*

ONLINE REFERENCE

1. <https://nptel.ac.in>

19CEOC05 - PYTHON FOR CIVIL ENGINEERS

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1 : Develop simple Python program in interactive and script mode.

CO2 : Construct Python programs using functions and strings.

CO3 : Make use of Python lists, set, tuples, dictionaries to represent compound data.

CO4 : Build Python Programs to read and write data from/to files.

CO5 : Develop python programs to handle exceptions.

BASICS OF PYTHON PROGRAMMING

Introduction-Python interpreter- interactive and script mode; values and types, operators, expressions, statements, precedence of operators, Multiple assignments, comments. **(2)**

CONTROL STATEMENTS AND FUNCTIONS IN PYTHON

Conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Functions: Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion. **(3)**

DATA STRUCTURES: STRINGS, LISTS, SET

Strings: string slices, immutability, string methods and operations; Lists: creating lists, list operations, list methods, mutability, aliasing, cloning lists, list and strings, list and functions ; list processing : list comprehension, searching and sorting, Sets: creating sets, set operations. **(3)**

DATA STRUCTURES: TUPLES, DICTIONARIES

Tuples: Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value; Dictionaries: operations and methods, Nested Dictionaries. **(2)**

CIVIL ENGINEERING APPLICATIONS

Programming for Concrete Mix Design, Concrete quantity calculation, Brickwork material Calculation, Cement and Sand material calculation for Mortar. **(2)**

TOTAL : 12+3 (Evaluation) = 15

TEXT BOOKS

1. Ashok NamdevKamthane,Amit Ashok Kamthane, *Programming and Problem Solving with Python* , Mc-Graw Hill Education,2018.
2. Timothy A. Budd, *Exploring Python*, Mc-Graw Hill Education (India) Private Ltd., 2015.

REFERENCE

1. Robert Sedgewick, Kevin Wayne, Robert Dondero, *Introduction to Programming in Python: An Inter-disciplinary Approach*, Pearson India Education Services Pvt. Ltd., 2016.

19CEOC06 - 3D PRINTING OF CIVIL ENGINEERING STRUCTURES

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

On successful completion of this course, the student will be able to

- CO1** : Describe about 3D printing methodology.
- CO2** : Identify the process required for fabricating.
- CO3** : Draft the necessity models in the CADD Software.
- CO4** : Design the concrete mix with various materials.
- CO5** : Identify the challenges in the field for new methodology.

INTRODUCTION

Three-Dimensional Printing - Introduction, Prototyping fundamentals, Historical development, Classification, Commonly used terms. (2)

ADDITIVE MANUFACTURING TECHNOLOGY

Definition, Additive vs Conventional Manufacturing, Advantages of AMT, Classification of AMT Process - Stereolithography - Fused Deposition Modelling - Selective Laser Sintering - 3D Printing, Applications to various fields. (3)

3D PRINTING IN CONSTRUCTION

Problems in Construction Industry - Need for Automation, Application of 3D Printing - Contour Crafting - Advantages and Limitations, 3D Printing software - Computer Aided Drafting. (2)

CONCRETE MIX FOR 3D PRINTING

Mix goals - Criteria - Compressive strength - Extrudability - Flowability - Buildability - Setting time, Materials - binders - additives - mineral admixtures - fibres, Mix proportioning. (2)

CASE STUDIES AND CHALLENGES

3D printed structures using contour crafting, 3D printed buildings in India, Challenges in 3D printing - curing time - bonding - automated fabrication -connections. (3)

Total : 12+3 (Evaluation) = 15

TEXT BOOKS

1. CK Chua, Kah Fai Leong, "3D Printing and Rapid Prototyping- Principles and Applications", World Scientific, 2017
2. Sabrie Soloman, "3D Printing and Design", Khanna Publishing House, Delhi

REFERENCES

1. J.D. Majumdar and I. Manna, "Laser-Assisted Fabrication of Materials", Springer Series in Material Science, 2013.
2. Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer New York, 2014.
3. Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing", Carl Hanser Verlag GmbH & Co Publisher, 2011.

19CEOC07 - ALTERNATIVE BUILDING MATERIALS FROM WASTE

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : Identify the characteristics related to waste

CO2 : Evaluate the properties of blended materials for non-load bearing purpose

CO3 : Evaluate the properties of blended materials for load bearing purpose

INTRODUCTION

Environmental issues - Global warming - Eco friendly materials - Materials related to less energy consumption and carbon di oxide emission (2)

BLOCKS & BRICKS

Waste based blocks and bricks - Advantages - Disadvantages - Applications (2)

CEMENTS

Pozzolana - Types - Agro and industrial based waste - Characterization - - Process adopted to improve properties - Applications in cement / mortar / concrete (3)

AGGREGATES

Artificial aggregates - Waste as replacement for aggregates - Characterization - Applications in Cement / mortar / concrete

Recycled coarse aggregate - Recycled fine aggregate (3)

MISCELLANEOUS ELEMENTS

Wastes used for non-structural elements - Partitions - Walls - Roofing system - windows (2)

TOTAL : 12+3 (Evaluation) = 15

REFERENCES

1. Neville, A. M., "Properties of concrete", Pearson Education Limited, 2012.
2. Santhakumar A. R., "Concrete Technology", Oxford University Press, New Delhi, 2018.

19CEOC08 - STRUCTURAL DRAWING

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

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

- CO1** : Describe and write the design procedures for steel and concrete elements and structures
- CO2** : Draw details of connections, splices, columns, column bases and plate girders as per IS code
- CO3** : Draw the different concrete and steel elements and structural components to appropriate scale as per design and codal requirements
- CO4** : Draw details of slabs, beams, columns, footings, water tanks and retaining walls as per IS code

STEEL

Detailed 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 drawing of the following structure

1. One way floor slab and two way floor slab.
2. Continuous beams.
3. Column with footing
4. Dog legged staircase
5. Water tanks.
6. Retaining walls

TOTAL : 12+3 (Evaluation) = 15

TEXT BOOKS

1. Krishnamurthy,D, "Elementary Structural Design and Drawing", CBS Publishers and Distributors, 2018.
2. Duggal, SK, "Limit State Design of Steel Structures", Tata McGraw Hill Publication, 2017.
3. Sinha, SN, "Handbook of Reinforced Concrete Design", Tata McGraw Hill Publication, 2006.

REFERENCES

1. Krishna raj, N, "Structural Design and Drawing", Universities Press, 2009
2. Bhavikatti, SS, "Design of Steel Structures by Limit State Design", IK International Pvt. Ltd., 2011.
3. Shiyekar, MR, "Limit State Design in Structural Steel", PHI learning Pvt. Ltd., 2013.
4. Gambhir, ML, "Design of Reinforced Concrete Structures", PHI learning Pvt. Ltd., 2008

19CEOC09 - SUSTAINABILITY IN CONSTRUCTION

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

- CO1** : Understand the definition, concept & objectives of sustainable construction.
- CO2** : Integrate with architects, designers and builders, to improve a building's performance.
- CO3** : State the concept of energy efficient design used in construction.
- CO4** : Select the suitability of eco-friendly building materials for construction.
- CO5** : Assess the appropriate technology for sustainable construction practice.

FUNDAMENTALS OF SUSTAINABLE BUILDING

The context and principles of sustainable design - A view of the current state of sustainable building in national and internationally - Physical, psychological and financial benefits of Sustainable construction.

(3)

SUSTAINABLE ARCHITECTURE AND DESIGN

Role of architecture in sustainable construction - An introduction to sustainable site planning and ecological design - Importance of transportation planning, siting and relationship to sustainability - Benefits of adopting a natural systems-based approach - Bio-mimicry as a design tool based on ecosystem analogy.

(3)

ENERGY EFFICIENT DESIGN

Importance of building energy systems - impacts of energy with human experience and the global environment -Low Energy Building Strategies - Fundamental building energy systems: HVAC, lighting and water conservation.

(3)

SUSTAINABLE MATERIALS SELECTION

Factors in material selection-Material considerations when designing a green construction - Eco friendly building materials: Environmental impact study of building materials about composition, production and recycling, physical properties - Life cycle assessment.

(3)

SUSTAINABLE BUILDING TECHNOLOGIES

Introduction to alternative building technologies: Traditional, vernacular, advanced technological such as interlocking blocks, composite beam and panel, cavity walls, core unit slabs, filler slabs, ferro-cement walls and earthen buildings.

(3)

TOTAL : 12+3 (Evaluation) = 15

TEXT BOOKS

1. *Sustainable Construction - Green Building Design & Delivery*, Kibert, Wiley 4th Edition, 2016
2. *Sustainable Building - Design Manual Pt 1 & 2*, The Energy and Resources Institute, TERI, 2004
3. *Alternative Building Materials and Technologies*, K S Jagadeesh, B V Venkatta Rama Reddy & K S NanjundaRao - New Age International Publishers, 2017
4. *Green Building: Project Planning and Cost Estimating*, Karolidis, A, R S Means - 3rd Edition 2010
5. *Integrated Sustainable Design of Buildings*, Paul Appleby, Routledge; 1st edition - 2015

19CEOC10 - INTRODUCTION TO IMAGE PROCESSING AND GIS

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1 : *Carry out remote sensing and GIS applications of various industrial needs.*

CO2 : *Demonstrate the various environmental change detections.*

CO3 : *Use the instrumental data for decision support system*

CO4 : *Create a map incorporating the required features as required.*

CO5 : *Analyze, model and create a database management system*

LIST OF EXPERIMENTS

1. Starting up a GIS map and layer editing & exploring
2. Using tools : Hyperlink, identify and navigate
3. Exploring feature- attribute relationship
4. Exploring benefits of the feature-attribute relationship
5. Creating a map layout
6. Reversing a map layout
7. Finding places by using coordinates
8. Determination of Measurements on maps using Mercator projection, Mollweide projection and Winkel Tripel projection
9. Implementation of Vector and Raster data in ArcMap
10. Working with geographic data and exploring
11. Exploration of Query data based on attributes and locations
12. Analyzing data using Buffer and Overlay
13. Analyzing the GIS analysis process using tools, query and combinations

TEXT BOOKS

1. *Floyd F.Sabins, J.R., WH, "Remote Sensing Principles Interpretation", Freeman and Company and Francis Company, France, 1996.*
2. *Lillesand, Thomas.M and Raiph W.Kiefer, "Remote Sensing and Image Interpretation", John Wiley Sons, 2002.*

REFERENCES

1. *Burrough.P.A., "Principles of GIS for Land Resources Assesment, Oxford Publication, 1998.*
2. *Thomas.M.Lillesand and Ralph.W.Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, Inc, 2003.*

OPEN ELECTIVES

19CEOE01 - TOWN PLANNING AND ARCHITECTURE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : interpret the geometric forms and aesthetic qualities of Architecture

CO2 : integrate the various elements of architecture and orientation of buildings

CO3 : describe the development plans and planning regulations

CO4 : incorporate the development control rules in town and country 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. (7)

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 - open spaces - minimum standard dimensions (11)

TOTAL : 45

TEXT BOOKS

1. Rangwala S.C., "Town Planning", Charotar Publishing House, Anand, 2013.
2. Francis D.K., Ching, "Architecture Form, Space and Order", Oxford University Press, 2014.

ONLINE RESOURCE

1. <https://nptel.ac.in>

19CEOE02 - CLIMATE CHANGE AND ADAPTATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1 : Outline the earth's system which influences the climatic factors of the earth.*
- CO2 : Infer the evidences and observed changes in the climate and environment on a global scale and in India.*
- CO3 : Analyse the impacts of climate change on various sectors and the uncertainties over the projected impacts of climate change.*
- CO4 : Investigate the various adaptation and mitigation options in various sectors and examine the mitigation efforts made in India.*
- CO5 : Correlate future clean technology and alternate energy options inferred in clean development mechanism.*

EARTH'S CLIMATE SYSTEM

Introduction-Climate in the spotlight-The Earth's Climate Machine - Climate Classification - Global wind systems - Trade Wind Systems - Trade Winds and the Hadley Cell - The Westerlies - Cloud formation and Monsoon Rains - Storms and Hurricanes - The Hydrological Cycle - Global Ocean Circulation - El Nino and its Effect - Green House Gases and Global Warming - Carbon Cycle. (9)

OBSERVED CLIMATE CHANGE AND ITS CAUSES

Observation of Climate Change - Changes in pattern of temperature, precipitation and sea level rise - Observed effects of Climate Changes - Patterns of Large Scale Variability - Drivers of Climate Change - Feedbacks - The Montreal Protocol - UNFCCC - IPCC - Evidences of Changes in Climate and Environment - on a Global Scale and in India. (9)

IMPACTS OF CLIMATE CHANGE

Impacts of Climate Change on various sectors - Agriculture, Forestry and Ecosystem - Water resources - Human Health - Industry, Settlement and Society - Methods and Scenarios - Projected Impacts for different regions - Uncertainties in the Projected Impacts of Climate Change. (9)

CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES

Adaptation Strategy/options in various sectors - Water - Agriculture - Infrastructure and Settlement including coastal zones - Human Health - Tourism - Transport - Energy - Key Mitigation Technologies and practices - Energy supply - Transport - Buildings - Industry - Agriculture - Forestry - Carbon sequestration - Carbon Capture and Storage (CCS) - Mitigation Efforts in India and Adaptation funding. (9)

CLEAN TECHNOLOGY AND ENERGY

Clean Development Mechanism - Carbon Trading - Examples of future Clean Technology - Biodiesel - Natural Compost - Eco-friendly Plastic - Alternate Energy - Hydrogen - Bio-fuels - Solar Energy - Wind - Hydroelectric Power. (9)

TOTAL : 45

TEXT BOOKS

1. Dash Sushil Kumar, "Climate Change - An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.
2. UNIPCC Fifth Assessment Report, 2014.
3. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

REFERENCES

1. Anil Markandya, *Climate Change and Sustainable Development: Prospects for Developing Countries*, Routledge, 2002.
2. Heal, G. M., *Interpreting Sustainability, in Sustainability: Dynamics and Uncertainty*, Kluwer Academic Publ., 1998.
3. Jepma, C.J., and Munasinghe, M., *Climate Change Policy - Facts, Issues and Analysis*, Cambridge University Press, 1998.
4. Dash Sushil Kumar, *"Climate Change - An Indian Perspective"*, Cambridge University Press India Pvt. Ltd, 2007.

ONLINE RESOURCES

1. "An Inconvenient truth (2006)"- video
2. <https://climate.nasa.gov>
3. <https://unfccc.int>
4. <https://environment.gov.au>

19CEOE03 - METRO SYSTEMS AND ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Integrate the basic elements of MRTS, BRTS, LRTS and other transportation systems

CO2 : Illustrate the components of metro rail systems

CO3 : Apply the concepts of ITS in the field of Transportation Engineering

PRINCIPLES OF TRANSPORTATION SYSTEMS

Transportation systems in India - various modes of transport - public transport - Intermediate public transport - types - characteristics - other urban transportation modes - drawbacks- various transit systems (9)

MRTS

Definition - Mass Rapid Transit System - History of MRTS - Need for MRTS - connectivity in Indian conditions - cities having MRTS - infrastructure - operations - fares and ticketing - case study. (8)

BRTS and LRTS

Bus Rapid Transit System - terminology - history -features - performance - cost - drawbacks - Light Rail Transit System - necessity - types - gauge- capacity integration with cycles - comparison to other rail modes (9)

METRO RAIL SYSTEMS

History of Metro trains - Need for Metro rail - connectivity in Indian conditions - cities having Metro - construction techniques adopted in Metro Rail stations - Case study - Delhi Metro (DMRC) - Chennai Metro (CMRL) (10)

ITS

Definition - Intelligent Transport System - Principles - Application of ITS technologies in various countries - smart transportation - case studies (9)

TOTAL : 45

TEXT BOOKS

1. Pradip Kumar Sarkar, Vinay Maltri, G. J. Joshi · "Transportation Planning Principles, Practices and Policies", Prentice Hall India Pvt., Limited 2017
2. D. Johnson Victor, S. Ponnuswamy, "Urban Transportation Planning, Operation and Management" Tata McGraw-Hill Education, 2012
3. Mashrur A. Chowdhury, Adel Wadid Sadek "Fundamentals of Intelligent Transportation Systems Planning" Artech House · 2003
4. Sumit Ghosh, Tony S. Lee, "Intelligent Transportation Systems Smart and Green Infrastructure Design, Second Edition" CRC Press · 2010

ONLINE RESOURCES

1. https://nptel.ac.in/content/storage2/courses/105101008/downloads/cete_48.pdf

19CEOE04 - RENEWABLE ENERGY RESOURCES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1 : Infer the current energy scenario and future energy usage in India.
- CO2 : Interpret 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 : Correlate 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 BOOKS

1. Sukathme, S.P, Nayak J.K., "Solar Energy", Tata McGraw-Hill Book Co., New Delhi, 2017.
2. Rai, G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2010.
3. P.Kothari, K.C Singal, Rakesh Ranjan "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt.Ltd, New Delhi, 2013.
4. Scott Grinnell, "Renewable Energy & Sustainable Design", CENGAGE Learning, USA, 2016.

REFERENCES

1. *Richard A. Dunlap, "Sustainable Energy" Cengage Learning India Private Limited, Delhi, 2015.*
2. *Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.*
3. *Shobh Nath Singh, 'Non-conventional Energy resources' Pearson Education, 2015.*

ONLINE RESOURCES

1. https://swayam.gov.in/nd1_noc20_ge06/preview
2. https://swayam.gov.in/nd2_nou20_cs09/preview

19CEO05 - PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1 : Identify the components, factors and environmental issues affecting Sustainable development.
- CO2 : Assess the role of International summits, conventions and Environmental aspects on Sustainable development.
- CO3 : Interpret the necessity and importance of Indian and International Socio -economical and legal aspects in Sustainability.
- CO4 : Illustrate the different strategies to achieve Sustainable development.
- CO5 : Assess the role of Life cycle Assessment, Cleaner Production and Sustainable Chemistry to achieve sustainable development.

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 (9)

ENVIRONMENTAL ASPECTS

International Environmental summits, conventions and agreements-Tiwari committee recommendation - Role of Pollution Control Board - Transboundary issues - Ecological indicators- Ecological foot print- Carbon foot print - Basic concept of Environmental impact assessment (9)

SOCIO ECONOMIC AND JUDICIAL ASPECTS

UN Sustainable development policies through trade- World Trade Organization-International monetary fund and World bank - Circular Economy and Sustainable Development - Socio economic policies for sustainable Development- Role of Judiciary in Sustainable Development - Major Environmental Cases in India - Development of Environmental Policies in India - Environment Protection Act, 1986 - EIA notification 2006 - National Conservation Strategy and Policy Statement on Environment and Development, 1992 - Policy Statement for the Abatement of Pollution, 1992 - National Environment Policy, 2006. SDG India Index - Baseline Report 2018 (9)

STRATEGIES FOR SUSTAINABLE DEVELOPMENT

Economic growth and Sustainable Development - Resource depletion and resource protection- - Internet of things and Sustainable Development - Sustainable Management of Forest, Land, water- Natural Disaster management- case studies. (9)

CLEANER PRODUCTION, LIFE CYCLE ASSESSMENT - GREEN/SUSTAINABLE CHEMISTRY

Cleaner Production, definition, aim, application-Generic process of Cleaner Production Assessment- Life cycle Assessment - definition, necessity and elements- ISO Environmental standards- Environmental Audit -Green Chemistry - twelve Principles of Green Chemistry - case studies. (9)

TOTAL : 45

TEXT BOOKS

1. Ramakrishnan, P. S., "Ecology and Sustainable Development", National Book Trust, New Delhi, 2001
2. Paul Robbins, John Hintz, and Sarah A. Moore, "Environment and Society: A Critical Introduction", Wiley-Blackwell, 2014
3. Bimal N. Patel and Ranita Nagar, "Sustainable Development and India", Oxford University Press, 2018.

REFERENCES

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. Kirkby, J.O., Keefe, P., and Timberlake, *"Sustainable Development"*, Earthsean Pub., London, 2001

ONLINE RESOURCES

1. <https://nptel.ac.in>

19CEOEO6 - DISASTER MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After successful completion of the course, 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 - Role of Engineers in Disaster Management. (9)

TOTAL : 45

TEXT BOOKS

1. R. Subramanian, "Disaster Management" Vikas Publishing House Pvt. Ltd, New Delhi, 2018.
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2017.

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.
4. Singhal J.P. "Disaster Management", Laxmi Publications, 2010.

5. *Khanna BK, "All You Wanted To Know About Disasters", New India Publishing Agency, New Delhi, 2005.*
6. *Ramana Murthy, "Disaster Management", Dominant, New Delhi, 2004.*
7. *Rajdeep Dasgupta, "Disaster Management and Rehabilitation", Mittal Publishers, New Delhi, 2007.*

19MEOE01 - DESIGN OF EXPERIMENTS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1** : *Demonstrate the fundamental concepts applied with mathematical knowledge, methodologies to bring knowledge of characterize, analyse and solve a wide range of problems between the purpose of a model and the appropriate level of complexity and accuracy.*
- CO2** : *Plan, design and conduct experimental investigations efficiently and effectively; choose an appropriate experiment to evaluate a new product design or process improvement through experimentation strategy, data analysis, and interpretation of experimental results.*
- CO3** : *Analyse the nature of variables, statistical inference, influence parameter selection, factorial concepts, Conduct Design of experiments; interpret the direct and interaction effects using RSM.*

INTRODUCTION

Strategy of Experimentation, Typical applications of Experimental design, Basic Principles, Guidelines for Designing Experiments. (7)

BASIC STATISTICAL CONCEPTS

Concepts of random variable, probability, density function cumulative distribution function. Sample and population, Measure of Central tendency; Mean median and mode, Measures of Variability, Concept of confidence level. Statistical Distributions: Normal, Log Normal & Weibull distributions. Hypothesis testing, Probability plots, choice of sample size. Illustration through Numerical examples. (9)

EXPERIMENTAL DESIGN

Classical Experiments: Factorial Experiments: Terminology: factors, levels, interactions, treatment combination, randomization, Two-level experimental designs for two factors and three factors. Three-level experimental designs for two factors and three factors, Factor effects, Factor interactions, Fractional factorial design, Saturated Designs, Central composite designs. Illustration through Numerical examples. (11)

ANALYSIS AND INTERPRETATION METHODS

Measures of variability, Ranking method, Column effect method & Plotting method, Analysis of variance (ANOVA) in Factorial Experiments: YATE's algorithm for ANOVA, Regression analysis, Mathematical models from experimental data. Illustration through Numerical examples. (9)

EXPERIMENT DESIGN USING TAGUCHI'S ORTHOGONAL ARRAYS

Types of Orthogonal Arrays, selection of standard orthogonal arrays, Linear graphs and Interaction assignment, Dummy level Technique, Compound factor method, Modification of linear graphs. Illustration through Numerical examples. (9)

TOTAL :45

TEXT BOOKS

1. C.F. Jeff Wu & Michael Hamada, "Experiments-Panning, Analysis, and Optimization", 3rd Edition, John Wiley & Sons. Inc., 2021.
2. D.C. Montgomery, "Design and Analysis of Experiments", 10th Edition, John Wiley & Sons. Inc. 2019.

REFERENCES

1. *T.B. Barker, Andrew Milivojevic, "Quality by Experimental Design", 4th Edition, CRC Press, 2021*
2. <https://nptel.ac.in/courses/110/105/110105087/>
3. <https://nptel.ac.in/courses/111/104/111104075/>

19MEOE02 - ENGINEERING OPTIMIZATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1** : Formulate single or multi-variable engineering optimization problems and comply with the appropriate objective functions.
- CO2** : Select the appropriate optimization technique for the specified engineering problems based on number of variables and constraints.
- CO3** : Derive, develop and utilize the possible randomness or any other associated factors that would possibly occur during constrained and unconstrained optimization situations.

INTRODUCTION

Problem formulation - design variables, constraints, constraint surfaces, objective functions, objective function surfaces. Classification of optimization - based on existence of constraints, nature of design variables, structure of the problem, nature of equation involved, permissible value of the design variables, deterministic nature of the variables, separability of the functions and the number of objective functions. Example of engineering optimization problems. (11)

SINGLE VARIABLE OPTIMIZATION

Optimal criteria - bracketing method - exhaustive search method, region elimination method - interval halving, Fibonacci, golden search method, point estimation method - successive quadratic approximation, gradient search method - Newton Raphson's method. (10)

MULTIVARIABLE OPTIMIZATION WITH CONSTRAINTS

Multivariable optimization - semi definite case - saddle point. Multivariable optimization with equality constraints - solution by direct substitution - solution by the method of constrained variation - solution by the method of Lagrange multipliers. Multivariable optimization with inequality constraints - Kuhn-Tucker conditions, constraint qualification. (12)

UNCONSTRAINED OPTIMIZATION

Introduction - classification of unconstrained minimization methods - general approach - rate of convergence - scaling of design variables. Direct Search Methods - random search methods - random walk method with direction exploitation - advantages of random search methods. Indirect Search Methods - gradient of a function - evaluation of the gradient - rate of change of function along a direction - steepest descent (Cauchy) method. (12)

TOTAL : 45

TEXT BOOKS

1. S. S. Rao, "Engineering Optimization: Theory and Practice", 5th Edition, John Wiley & Sons, 2019.
2. K. Deb, "Optimization for Engineering Design - Algorithms and Examples", 2nd Edition, Prentice Hall India, 2013.

REFERENCES

1. J. S. Arora, "Introduction to Optimum Design", 4th Edition, Academic Press, 2016.
2. Ashok D. Belegundu & Tirupathi R. Chandrupatla, "Optimization Concepts and Applications in Engineering", 3rd Edition, Kindle Edition, Cambridge University Press, 2019.

3. A. Ravindran, K. M. Ragsdell, Reklaitis G.V., "Engineering Optimization: Methods and Applications", John Wiley & Sons, Inc., 2006.
4. <https://nptel.ac.in/courses/112/105/112105235/>
5. <https://nptel.ac.in/courses/105/108/105108127/>
6. <https://nptel.ac.in/courses/112/101/112101298/>

19MEOE03 - ENGINEERING POLYMERS, COMPOSITES AND ALLIED MANUFACTURING PROCESSES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1 : Choose manufacturing processes for polymers and PMC materials to obtain required shapes by applying product design considerations*
- CO2 : Find the processes to develop new ceramic and cermet materials for manufacturing of high temperature cutting tools by applying design considerations*
- CO3 : Develop and characterize the Nano-composites, MMCs, CMCs and PMCs for the engineering applications using secondary processing methods*
- CO4 : Synthesize, characterize, compaction and sintering of metal powders for application of P/M parts using powder metallurgy techniques*
- CO5 : Synthesize and characterize the nanostructured materials for fabricating electronic devices, MEMS, magnetic, electronic and optical sensors and fabricating carbon nano structured materials for fuel cell and energy storage applications*

SHAPING PROCESSES FOR PLASTICS

Properties of polymer melts - extrusion - production of sheet and film - fibre and filament production (spinning) - coating processes - injection moulding - compression and transfer moulding - blow moulding and rotational moulding - thermoforming. Casting - polymer foam processing and forming - product design considerations. (8)

RUBBER-PROCESSING TECHNOLOGY

Rubber processing and shaping - manufacture of tyres and other rubber products - product design considerations. (5)

SHAPING PROCESSES FOR POLYMER MATRIX COMPOSITES

Materials for PMC - open mold processes - closed mold processes - filament winding - pultrusion process - other PMC shaping processes. (4)

PROCESSING OF CERAMICS AND CERMETS

Processing of traditional ceramics - processing of new ceramics - processing of cermets - product design considerations. (4)

APPLICATION OF COMPOSITES

Composites including Nano-composites for electrical, superconducting and device applications, fabrication of Nano-composites, secondary processing and joining of various composite materials for structural applications and their fracture behavior and safety. (9)

POWDERS

Production and characterization of powders, compaction of metal powders - die compaction, isostatic pressing, powder forging, powder rolling and extrusion, pressure less compaction techniques, hot pressing and hot isostatic pressing, sintering of powder compacts, liquid phase sintering, sintering furnaces, post sintering operations, applications of P/M parts. (7)

INTRODUCTION TO NANOMATERIALS

Nano structured materials, low-dimensional structures: quantum wells, quantum wires, and quantum dots, Nano clusters & Nanocrystals, electronic and optical properties of Nano crystallites, metallic and semiconducting superlattices, synthesis of nanostructured materials, fabrication and characterization of Nano electronic devices and MEMS, basics of synthesis and

characterization of Nano-multi-component systems for sensors (magnetic, electronic and optical) and electrodes, synthesis and fabrication of carbon Nano structures for fuel cell and energy storage applications.

(8)

TOTAL : 45

TEXT BOOKS

1. Mikell P. Groover, *"Fundamentals of Modern Manufacturing Materials, Processes and Systems"*, 4th Edition, John Wiley & sons, Inc. 2015.
2. Ajayan P. M., Schadler L. S., & Braun P. V, *"Nano composite Science and Technology"*, John Wiley & Sons, Inc., 2014.

REFERENCES

1. Charles A. Harper, *"Modern Plastics Handbook"*, McGraw-Hill, 2010.
2. Sperling L.H., *"Introduction to Physical Polymer Science"*, 3rd Edition, John Wiley & Sons, 2011.
3. Chawla K.K., *"Ceramic matrix composites"*, 1st Edition, Chapman & Hall, 2013.
4. Randall M German, *"A-Z of Powder Metallurgy (Metal Powders Technology)"*, Elsevier Science, 2007.
5. Upadhyaya G. S., *"Powder Metallurgy Technology"*, Cambridge International Science Publishing, 2002.

19MEOE04 - INDUSTRIAL ROBOTICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

At the end of the 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.*
- CO3 : Calculate mass and inertia for the links of a robot manipulator and also find its forward and inverse dynamics.*
- CO4 : Choose an appropriate vision system for the robot and then extract these images to get the desired output.*
- CO5 : Write a program to determine path for obstacle avoidance for a specific task and can solve 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. (3)

GENERAL CONSIDERATION OF ROBOTIC MANIPULATORS

Introduction - Brief history of robotics- Robot geometrical configurations - wrist and gripper subassemblies - robot drive systems - robot software. (5)

KINEMATICS OF ROBOT MANIPULATORS

Homogeneous representation of objects, robot manipulator joint coordinate system, Euler angles and Euler transformations, Denavit- Hartenberg (D-H) representations, direct kinematics in robotics, inverse kinematic solutions, geometrical approach in inverse Kinematics, Jacobian of transformation in robotic manipulation. (12)

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. (8)

MOTION CONTROL OF ROBOTIC MANIPULATORS

General arm control system - open and closed loop control systems error controlled robotic dynamics - control structure of amplifier- control of a single axis robotic arm, common control systems for industrial robots, force control of robotic manipulators. (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. (8)

TOTAL : 45

TEXT BOOK

1. *Fu.K S, Gonzales .R.C., & Lee.C.S.G., "Robotic Control, Sensing, Vision and Intelligence", McGraw Hill International, 2006.*
2. *Ashitava Ghushal "Robotics : Fundamental Concepts and Analysis", Oxford, 2006.*

REFERENCES

1. *Mikell.P.Groover, Mitchell Weiss, Tooger. N. Nager, & Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", McGraw Hill International, 2004.*
2. *Richard. D. Klafter, Thomas. A. Chmielewski, & Michaelnegin, "Robotic Engineering - An Integral Approach", Prentice Hall of India, 2002.*
3. <https://nptel.ac.in/courses/112/105/112105249/>

19MEOE05 - BUSINESS PROCESS REENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

- CO1 : Gain knowledge about BPR, Factors affecting BPR operations and design BPR techniques.*
- CO2 : Use BPR tools, utilize concepts of BPR, analyse cost / Benefit and appreciate the need of IT in BPR.*
- CO3 : Incorporate changes in the business operation based on market demand and implement the same in the manufacturing system.*
- CO4 : Select an appropriate practice of the business re-engineering project by taking the practical situations into consideration.*
- CO5 : Provide the most feasible practical solution to the problem keeping in mind the considerations of business automation, value, processes and risks in launching the business reengineering project.*

INTRODUCTION TO BPR

Definition; the paradigm shifts in production; the need for BPR, advantages and benefits of BPR, constraining factors, challenges, the positioning concept; the re-engineering visions; The BPR Life Cycle Methodology, Guidelines for BPR steps, Role of Information Technology in BPR; process Improvement and Process Redesign; BPR Experience in Indian Industry. (9)

METHODOLOGIES AND TOOLS FOR BPR

Process management; dynamic business re-engineering change framework; steps to reengineer the process. Tools used in Modelling the Business: flow-charting, business activity maps, relational diagrams, benefit/cost analysis. The enabling role of information technology in business re-engineering. Conceptual Foundation of Business Process Re-engineering; Process Identification and Mapping; Role/Activity Diagrams. (9)

CHANGE MANAGEMENT

Planned changes in business re-engineering projects; challenges of business change; business change development. Success factors in re-engineering. The assessment of business re-engineering. Process Visioning and Benchmarking. Business process Improvement, Business Process Redesign; Man Management for BPR implementation; Re-organizing People and Managing Change. (9)

GOVERNANCE & BPR

Total Quality Management, Risk Management, Organizational Structures, BPR Project Management, The Power of Habit in organizations. The role of eLearning environments. Applications, gaming, BPR facilitation, BPR in Software Development, Basic principles, Relation to BPR. (9)

BEST PRACTICES IN BPR

Research & Practice, Perspectives in BPR, Discussion on research challenges, and practice challenges for industry and governments Case studies: Nissan, Chrysler, Hewlett Packard etc. Workflow systems, Imaging technology, Floware, Business design facility tools, Risk and impact measurement. (9)

TOTAL : 45

TEXT BOOKS

1. *Davenport, "Process Innovation: Reengineering work through information technology". Harvard Business School Press, 1993.*
2. *Hammer & Champy, "Reengineering the Corporation: A Manifesto for Business Revolution" Harper Business Books, 1993.*

3. Hammer & Stanton, *"The Reengineering Revolution"* Harper Collins. London, 1995.
4. Henry J Johansson, Patrick McHugh, John Pendlebury & William A. Wheeler, *"Business Process Reengineering: Break Point Strategies for Market Dominance"*, Wiley, New Delhi, 1993.

REFERENCES

1. Harmon, P, *"Business Process Change: A Guide for Business Managers and BPM and Six Sigma Professionals"*, Elsevier/Morgan Kaufmann Publishers, 2007.
2. R. Anupindi et al., *"Managing Business Process Flows: Principles of Operations Management"*, Pearson Education Inc, 2006.
3. Kock, N.F., *"Process Improvement and Organizational Learning: The Role of Collaboration Technologies"*, Idea Group, 1999.
5. Walford, R.B., *"Business Process Implementation for IT Professionals and Managers"* Artech Business Process Reengineering" Prentice Hall, New Delhi, 1993.

19MEOE06 - ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : Analyze the demand and supply and sketch a demand and supply curve.

CO2 : Determine the Breakeven point and find out the strength and weakness of the Market Structure.

CO3 : Sketch the curve for cost behavior for the short run concept.

CO4 : Analyze and specify the causes and provide the solution to each cause.

CO5 : Formulate the steps involved in a recruitment process as a chart and interpret it.

INTRODUCTION

Definition -Nature and Scope-Significance of Economics for Engineers. (5)

BASICS OF MICRO ECONOMICS

Demand Analysis and Supply Analysis - Elasticity of Demand and Supply - Case Study in Demand Forecasting - Cost concepts - Classifications - Short run and Long run cost curves - Break-even Analysis. (8)

MARKET STRUCTURE

Classification of Market - Perfect Competition-Characteristics -Monopoly - Monopolistic Competition - Oligopoly and Duopoly - Price Discrimination under different markets - Price and output determination in short run and long run. (8)

MONEY AND BANKING

Money - Quantity theory of Money -Supply of Money - RBI Measures of Money Supply - Banking - Functions of Commercial Banks and Central Banks- Balance of Payments - Meaning and methods of Exchange control Methods of Foreign Payments - IMF, IBRD, WTO- Agreements of WTO and its Impact on Indian Economy. (9)

NATIONAL INCOME

Meaning - National Income - Concepts -Methods of Calculating and Problems in calculating National Income - Inflation - Causes - Measures -Deflation - Stagflation - Phillips Curve - Unemployment New Environment Policy- Liberalisation -Privatisation - Globalisation. (8)

HUMAN RESOURCE MANAGEMENT

Principles of Management, Evolution of Management, Development of Managerial Skills- Human Resource Management-Importance- Objectives- Job Analysis- Recruitment- Selection and Placement and Training Development. (7)

TOTAL : 45

TEXT BOOKS

1. Dewett. K. K., & Navalur M.H., "Modern Economic Theory", S. Chand and Company Ltd, New Delhi, 2014
2. Lipsey & Chrystal, "Economics", Oxford University Press, 2010
3. V. S. Bagad, "Principles of Management", Technical Publication, Pune

REFERENCES

1. Paul A Samuelson & William, "Economics", Tata McGraw Hill, New Delhi, 2012.
2. Francis Cherunullem, "International Economics", McGraw Hill Education, 2011.
3. William A McEachern & Smrit Kaur, "Micro Economics", Cengage Learning, 2013.
4. William A McEachern & Indira A., "Macro Economics", Cengage Learning, 2014.
5. Lipsey & Chrystal, "Economics", Oxford University Press, 2010.
6. <https://nptel.ac.in/courses/112/107/112107209/>

19EEOE01 - ENERGY AUDITING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

- CO1* : Exhibit Conceptual knowledge of the technology, economics and regulation related issues associated with energy conservation and energy auditing
- CO2* : Compute the thermal efficiency of various thermal utilities and use the energy audit methods learnt to identify the areas deserving tighter control to save energy expenditure.
- CO3* : Analyse the cost- benefit of various investment alternatives for meeting the energy needs of productive processes through energy conservation study.
- CO4* : Illustrate the energy saving techniques to reduce power consumption of the non- productive loads
- CO5* : Advocacy of strategic and policy recommendations on energy conservation and energy auditing.

ENERGY AUDIT

Global energy scenario - Heat and Electrical energy - Role of energy managers in industries - Energy auditing -Types of energy audit- Data to be collected in auditing - Needs, methodology and types of energy audits - Simple payback period - Net present value of saving- Energy audit report (9)

ELECTRICAL ENERGY CONSERVATION

Basic Industrial electrical distribution- energy saving and energy efficiency with Transformers, reactive power correction and cable loss reduction- Energy saving in lighting systems -Specific Energy Consumption (SEC) - Load management - Demand Side Management (DSM). (9)

HEAT ENERGY CONSERVATION

Energy Audit - Losses in Boiler - Waste heat recovery - Sources of waste heat - High temperature heat recovery - Medium temperature heat recovery - Waste heat recovery applications- Cogeneration- Heating, ventilation and air conditioning systems (HVAC) :Types - energy conservation in cooling towers and Spray ponds. (9)

BUILDING, TRANSPORT AND UTILITY ENERGY CONSERVATION

Real buildings systems: Consumption - Cost versus lifecycle cost - Building design - Water supply systems Real Transportation Systems: Energy conservation in transportation - New technologies - Progress in clean diesel technology. Energy conservation in pumps, and fan and blowers - Energy efficient motors. (9)

ENERGY AUDIT PLANNING AND MONITORING

Energy Action Planning: Energy management system - Management commitment and Energy conservation policy - Energy performance assessment - Data collection and management - Analysis of data, baseline and benchmarking - Estimation of energy savings potential - Action planning and Training planning.

Monitoring and Targeting: Defining monitoring & targeting, Elements of monitoring & targeting - Data and information, various techniques - Energy consumption, Production and Cumulative sum of differences (CUSUM). (9)

TOTAL : 45

TEXT BOOKS

1. D. P. Sen Gupta, K. R. Padiyar, Indranil Sen, M.A, "Recent Advances in Control and Management of Energy Systems", Interline Publishers, Bangalore, 1993.

2. *AmlanChakrabarti, "Energy Engineering and Management", PHI Learning, New Delhi 2012.*
3. *YP.Abbi and Shashank Jain, "Handbook on Energy Audit and Environment Management", TERI, 2006.*
4. *Frank Krieth and D Yogi Goswami, "Energy Management and Conservation Handbook", CRC Press, 2007.*
5. *C.B. Smith, "Energy Management Principles", Pergamon Press, New York, 1981.*

REFERENCES

1. *"General Aspects of Energy Management and Energy Audit-Unit- 1,2,3,4", BEE Guide book, 2010.*
2. *Hamies, "Energy Auditing and Conservation: Methods, Measurements, Management & case study", Hemisphere, Washington, 1980.*
3. *Diamant R.M, "Total Energy", Pergamon Press, Oxford Press, 1970.*
4. *Albert Thumann, "Fundamentals of Energy Engineering", Prentice Hall, May 1984*
5. *Larry C Whit et.al, "Industrial Energy Management & Utilization", 1st Edition, Springer, 1988.*

19EEOE02 - SOLAR AND WIND ENERGY SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 : Summarize the solar radiation, measurements and characteristics of solar PV cell.

CO2 : Develop the model of a PV system and its applications.

CO3 : Illustrate the basic types, mechanical characteristics and model of wind turbine.

CO4 : Analyse the electrical characteristics and operation of various wind-driven electrical generators.

CO5 : Utilize 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 pyranometer - 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 by-pass 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 in the 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)

SYSTEM 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, 3rd Edition, 2015.

REFERENCES

1. Roger A. Messenger and Jerry Ventre, "Photovoltaic systems engineering", Taylor and Francis Group Publications, 2020.

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, 2015.*

19EEOE03 - ELECTRICAL SAFETY PROCEDURES AND MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 : Identify and analyze the precautions and protection of electrical hazards

CO2 : Select and use the suitable personal protective equipment according to the working environment

CO3 : Interpret the safety procedures for the specific work place

CO4 : Analyze and apply the various grounding techniques

CO5 : Infer the electrical safety against low voltage and high voltage and to manage the medical equipments

INTRODUCTION AND HAZARDS OF ELECTRICITY

Electrical Safety 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 - Tagout - 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 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 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 BOOK

1. John Cadick, Mary Capelli-Schellpfeffer, Dennis Neitzel and Al Winfield, "Electrical Safety Handbook", 4th edition, Mc Graw Hill, 2012

REFERENCE S

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. *Electrical Safety booklets issued by Government bodies*

19EEOE04 - ENERGY EFFICIENT ILLUMINATION SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

- CO1* : Understand the properties of light, importance of lighting in various fields, types of light sources and methods of lighting.
- CO2* : Perform the calculation of luminance parameters in various applications.
- CO3* : Identify the criteria for selection of lighting equipment's and control systems in various applications.
- CO4* : Impart design and technology for Interior lighting and Exterior lighting applications
- CO5* : Review the various technologies used in Smart lighting systems.

INTRODUCTION : BASICS OF LIGHTING

Lighting Physics - Optical Radiation - Concept of Color - Biological Factors : Human eye and brain response - Different entities of illuminating systems. Properties of Lighting - Natural and Artificial lighting - Good and Bad Lighting - Challenges in Lighting - Good Practices in Lighting - Types of Lighting. (7)

LIGHTING CALCULATIONS AND LIGHT SOURCES

Basic Terms in Lighting System - Luminance measurement - Laws of Illumination - Polar Curves - Rousseau's construction - Concept of Photometry - Introduction of lighting software.

Lamps: Incandescent Lamps: Halogen lamps - Discharge Lamps: MV and SV Lamps, Fluorescent Lamps: FTL, CFL - Arc lamps - Special Lamps: LED: Surface Mounted Devices (SMD-LEDs), Chip on Board (COB-LEDs) - Neon lamps - Lasers - Comparison of Lamps - Life Cycle Cost (LCC) Analysis - Efficacy. (12)

LIGHTING EQUIPMENTS AND STANDARDS

Luminaries, Wiring, Control gears, Switching boards, Reflectors and Control circuits - Heating, Harmonics and EMI Suppression techniques from lighting equipment - Switching and Dimming control algorithm - Recommendation of Illumination Levels for Various Tasks / Activities / Locations - Role of 3D printing technology for designing luminaries - International Standards and codes of lighting system. (9)

LIGHTING APPLICATIONS

Interior lighting: Industrial, Residential, Indoor stadium and Hospitals. Exterior lighting: Flood, Street, Aviation and Transport lighting - Sign and display Board Lighting - Lighting in Agriculture - Lighting in Automobiles. (8)

SMART LIGHTING SYSTEMS

Intelligent lighting system - Smart LED lighting systems - LED Smart Projector system - Solar Street Lighting Systems - Role of IoT in lighting system - Concept of Light Fidelity (Li-Fi) - Significance of UV-C lighting in medical - Concept of Artificial Moon for street lighting. (9)

TOTAL : 45

TEXT BOOKS

1. Joseph B. Murdoch, "Illumination Engineering from Edison's Lamp to the Laser", Visions Communications, Washington DC, USA, 2nd Edition, 1994.
2. Jack L. Lindsey, "Applied Illumination Engineering", Prentice Hall of India, New Delhi, 3rd Edition, 2008

3. Leon Gaster, John Stewart Dow, *"Modern Illuminants and Illuminating Engineering"*, Nabu Press, Washington DC, 1st Edition, 2010.
4. Philip Gordon., *"Principles and Practices of Lighting Design: The Art of Lighting Composition"*, Blue Matrix Productions, 2011.

REFERENCES

1. *Lighting Engineering: Practical Hand Book, INDALUX 2002*
2. *IES Lighting Handbook, 10th Edition, 2011.*
3. *NPTEL Course: Illumination Engineering*
4. *Lighting - Research paper reference from Philips - Lighting Academy and Signify Lighting University.*

19EEOE05 - ELECTRIC VEHICLE TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 : Apprehend the fundamentals and importance of electric vehicles and its components

CO2 : Select the suitable drive scheme based on the motor and topology for the given specification and applications

CO3 : Design and categorize the battery system for electric vehicles and hybrid electric vehicles

CO4 : Recognize the suitable battery charging scheme for different environments and applications.

CO5 : Describe the significance of E-mobility and its various business opportunities

ELECTRIC VEHICLES

An Overview of Conventional, Battery, Hybrid and Fuel Cell Electric Systems - Conventional IC Engine Vehicle - BEVs - HEVs - Series HEV - Parallel HEV - Series-Parallel HEV - FCEV - EV subsystems - Vehicle Dynamics: Vehicle Load Forces - Basic Power, Energy, and Speed Relationships - Aerodynamic Drag - Aerodynamic Drag and Fuel Consumption - Rolling Resistance - Gradability (9)

ELECTRIC PROPULSION

Electric Motors in EVs - Configuration and control of DC motor drives - Induction motor drives- Permanent Magnet motor drives - Switched reluctance motor drives - Transmission configuration, Components - gears, differential, clutch, brakes - regenerative braking - types - Motor sizing.- Matching the electric machine and the internal - combustion engine (ICE), Sizing the propulsion motor, sizing the power - electronics, selecting the energy storage technology, Communications- supporting subsystems (9)

BATTERIES

Introduction to Batteries - Energy Storage Requirements in Electric Vehicles: Batteries Types: Lead-Acid Battery - Nickel-Metal Hydride - Lithium-Ion - Battery Operation - Battery Parameters and Comparisons - Battery Packs - Battery Sizing - Battery based energy storage and its analysis - Fuel Cells - Fuel Cell based energy storage and its analysis - Super capacitors- Hybridization of different energy storage devices (9)

BATTERY CHARGING

Charging methods for battery- Fast charging - Battery Charging, Protection, and Management System - Termination methods - Charging from grid - Isolated and Non-isolated DC - DC Converters - Bidirectional DC-DC converter - High-frequency transformer based isolated charger topology - Transformer less topologies. (9)

E-MOBILITY

Energy Management Strategies - Automotive networking and communication, EV and EV charging standards, V2G, G2V, V2B, V2H - E-mobility business - Electrification challenges - Connected Mobility and Autonomous Mobility- Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV). (9)

TOTAL : 45

TEXT BOOKS

1. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, *Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, 2nd Edition* CRC Press, 2018.
2. Iqbal Hussein, *Electric and Hybrid Vehicles: Design Fundamentals, 3rd Edition*, CRC Press, 2021

REFERENCES

1. James Larminie, John Lowry, *Electric Vehicle Technology Explained, 2nd edition*, Wiley, 2012
2. Soylu "Electric Vehicles - The Benefits and Barriers", InTech Publishers, Croatia, 2011.
3. J.M. Miller, "Propulsion Systems for Hybrid Vehicles", Institution of Electrical Engineers (IEE), 2nd edition, London, UK, 2010.
4. R. Stone and J.K. Bell, "Automotive Engineering Fundamentals", SAE International, Warrendale, PA, 2004.
5. Viswanathan B. and Scibioh Aulice M, "Fuel cells: Principles and Applications", University Press, 2008.

19EEOE06 - ENERGY EFFICIENCY IN THERMAL AND ELECTRICAL UTILITIES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 : Preaudit the energy

CO2 : Analyse the possibility of energy savings

CO3 : Analyze the methods of energy savings

CO4 : Design the solutions

CO5 : Identify and perform appropriate energy management

ENERGY EFFICIENCY IN THERMAL UTILITIES - I

- Fuels and Combustion: Introduction to fuels, properties of fuel oil, coal and gas, storage, handling and preparation of fuels, principles of combustion, combustion of oil, coal, and gas.
- Boilers: Types, combustion in boilers, performance evaluation, analysis of losses, feedwater treatment, blowdown, energy conservation opportunities..
- Furnaces: Classification, general fuel economy measures in furnaces, excess air, heat distribution, temperature control, draft control, waste heat recovery.
- Insulation and Refractories: Insulation-types and application, the economic thickness of insulation, heat savings and application criteria, Refractory-types, selection and application of refractories, heat loss.
- FBC boilers: Introduction, mechanism of fluidized bed combustion, advantages, types of FBC boilers, operational features, Retrofitting FBC system to conventional boilers, saving potential. (9)

ENERGY EFFICIENCY IN THERMAL UTILITIES - II

- Steam System: Properties of steam, assessment of steam distribution losses, steam leakages, steam trapping, condensate, and flash steam recovery system, identifying opportunities for energy savings
- Cogeneration: Definition, need, application, advantages, classification and saving potentials.
- Waste Heat Recovery: Classification, advantages, and applications, commercially viable waste heat recovery devices, saving potential.
- Energy Management & Audit: Definition, need and types of an energy audit. Energy management (audit) approach- understanding energy costs, benchmarking, energy performance, matching energy use to the requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.
- Material and Energy balance: Facility as an energy system, methods for preparing process flow, material, and energy balance diagrams. (9)

ENERGY EFFICIENCY IN ELECTRICAL UTILITIES

- Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses.
- Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy-saving opportunities with energy- efficient motors.

- Energy-Efficient Technologies in Electrical Systems: Maximum demand controllers, automatic power factor controllers, energy-efficient motors, soft starters with energy savers, variable speed drives, energy-efficient transformers, electronic ballasts, occupancy sensors, energy-efficient lighting controls. (9)

ENERGY EFFICIENCY IN THERMO ELECTRIC UTILITIES - I

- Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities
- HVAC and Refrigeration System: Vapor compression refrigeration cycle, refrigerants, the coefficient of performance, capacity, and factors affecting Refrigeration and Air conditioning system performance and savings opportunities.
- Vapor absorption refrigeration system: Working principle, types and comparison with vapor compression system, saving potentially
- Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities.
- Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. (9)

ENERGY EFFICIENCY IN THERMO ELECTRIC UTILITIES - II

- Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy-saving opportunities assessment of cooling towers.
- Lighting System: Light source, choice of lighting, luminance requirements, and energy conservation avenues.
- Diesel Generating system: Factors affecting the selection, energy performance assessment of diesel conservation avenues (9)

TOTAL : 45

ENERGY PERFORMANCE ASSESSMENT FOR EQUIPMENT AND UTILITY SYSTEMS

Open Book examination on the following energy performance assessments for equipment and utility systems:

- Boilers, Furnaces
- Cogeneration, Turbines (gas, steam)
- Heat Exchangers
- Electric Motors, Variable Speed Drives
- Fans and Blowers, Water Pumps, Compressors
- HVAC systems
- Lighting Systems
- Performing Financial Analysis.
- Applications of Non-conventional & Renewable Energy Sources (NRES)
- Waste minimization and resource conservation

TEXT BOOKS

1. *Mehmet Kanolu, Yunus A. Çengel, "Energy efficiency and management for engineers", McGraw- Hill Education, 2020*
2. *Stephen A. Roosa, Steve Doty, Wayne C. Turner, "Energy Management Handbook", 9th edition, River Publishers, Taylore and Francis Group, 2020*
3. *Energy Efficiency in Thermal Utilities, Bureau of Energy Efficiency (BEE), Guide books*
4. *Energy Efficiency in Electrical Utilities, Bureau of Energy Efficiency (BEE), Guide books*

REFERENCES

1. *Rajiv Shankar, "Energy Auditing in Electrical Utilities", Viva Books, 2017*
2. *Wayne C. Turner, "Energy Management Handbook", Eighth Edition, 2012*
3. *Stephen A. Roosa, Steve Doty, "Energy Management Handbook", 2018*
4. *General Aspects of Energy Management and Energy Audit, Bureau of Energy Efficiency (BEE), Guide books*
5. *Energy Performance Assistance for Equipment and Utility Systems, Bureau of Energy Efficiency (BEE), Guide books*

19ECEOE01 - SIGNAL PROCESSING AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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 Blocks 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, 3rd Edition, 2011.
2. Simon Haykin, "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

19ECEOE02 - SMART SENSORS AND IoT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : Explain the classification ,types,packaging and testing of smart sensors

CO2 : Interpret the construction and working principles of Electronic sensors

CO3 : Exemplify the working of different types of light radiation sensors .

CO4 : Illustrate the key concepts of temperature ,gas and airquality sensors used to measure the parameters.

CO5 : Interpret the characteristics, functional blocks and architecture of IoT to develop an IoT based applications.

SMART SENSORS BASICS

Sensor Classification, Performance and Types, Error Analysis characteristics- Semiconductor Packaging- Hybrid Packaging- Packaging for Monolithic Sensors- Reliability Implications-Testing Smart Sensors- HVAC Sensor Chip- Amplification and Signal Conditioning- Integrated Signal Conditioning- Digital conversion- MCU Control-MCUs for Sensor Interface- Techniques and System Considerations- Sensor Integration. (9)

ELECTRONIC SENSORS

Resistance strain gauge - piezoelectric pressure gauge - characteristics- load cells-torque sensor- Piezo-resistive and capacitive pressure sensor- optoelectronic pressure sensors- vacuum sensors- Capacitor plate sensor, Inductive sensors, LVDT- Hall effect- Doppler detectors- liquid level detectors, flow sensors - ultrasonic sensor- flow sensors. (9)

GHT RADIATION SENSORS

Electronic and Optical properties of semiconductor as sensors - LED - Semiconductor lasers- Fiber optic sensors- Thermal detectors - Photo multipliers- photoconductive detectors- Photo diodes- Avalanche photodiodes - CCDs - Intensity sensor - Interferometers-Phase sensor: Phase detection, Polarization maintaining fibers. (9)

TEMPERATURE, GAS AND AIR QUALITY SENSORS

Bimetallic strip- Bourdon temperature gauge- thermocouples- Resistance thermometers- thermistors- bolometer- Pyroelectric detector-Engine combustion process- Catalytic exhaust after treatment, Emission limits- Exhaust sensors and Engine control - Exhaust sensors for OBD- Hydro-Carbon Sensors- NOx-Sensors-Oxygen Sensors- Measurement of oxides of sulphur,oxides of nitrogen unburnt hydrocarbons, carbonmonoxide, dust mist and fog- smoke sensors. (9)

IoT AND ITS APPLICATIONS

IoT Definition - Characteristics - IoT Functional Blocks -IoT Architecture -Physical design of IoT - Logical design of IoT- Sensing & Actuation -Basics of Networking - Communication Protocols- Machine-to-Machine - Communication models & APIs.

Domain specific applications of IoT: Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture, Smart Traffic Control and Smart water management. (9)

TOTAL : 45

TEXT BOOKS

1. Jacob Fraden, "Handbook of modern sensors: physics, designs, and applications", 5th Edition, Springer, 2016.
2. Randy Frank, "Understanding Smart Sensors", Artech House, 2nd Edition, Boston, 2011.

REFERENCES

1. Arshdeep Bahga, Vijay Madiseti, "Internet of Things - A hands-on approach", Universities Press, 2015.
2. Jon. S. Wilson, "Sensor Technology Hand Book", Elsevier, 1st Edition, Netherland, 2011.
3. John G Webster, "Measurement, Instrumentation and sensor Handbook", CRC Press, 2nd Edition, Florida, 2017.
4. John P. Bentley, "Principles of Measurement systems", 3rd Edition, Pearson Education Asia Pvt. Ltd, 2009.
5. D. Patranabis, "Sensors and Transducers", 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2006.
6. Ernest O Doebelin, Dhanesh N Manik, "Measurement Systems, Application and Design", McGraw Hill, 6th Edition, 2007.

19ECEOE03 - CONSUMER ELECTRONICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : Understand the various types of microphones and loudspeaker.

CO2 : Explain the principle and working of Monochrome TV.

CO3 : Describe the Colour TV scanning process and camera tube.

CO4 : Illustrate LCD, LED TV, working of cable TV and DTH.

CO5 : Interpret the significant technical considerations using a broad systems perspective.

AUDIO SYSTEMS

Microphones Carbon, moving coil, wireless microphone; Loudspeakers - Direct radiating Electrostatic and horn loudspeaker; Multi-speaker system; Sound Recording - Magnetic Recording, Digital Recording, Optical Recording (CD system and DVD). (9)

MONOCHROME TV

Elements of TV communication system, Scanning process, Scanning methods and Aspect Ratio, Need of synchronizing and blanking pulses, Composite Video Signal, Camera Tube: Vidicon. (9)

COLOUR TELEVISION

Primary, secondary colours, Concept of Mixing, Colour Triangle, Camera tube, PAL TV Receiver, Concept of Compatibility with Monochrome Receiver, NTSC, PAL, SECAM. (9)

LCD AND LED TELEVISION

Basic principle and working of LCD & LED TV, Cable Television: Working of Cable TV, DTH (9)

DOMESTIC & CONSUMER APPLIANCES

Operation of Microwave Oven, Automatic Washing Machine, Photostat Machine, Digital Camera, Vacuum cleaner, Food Processors, Scanner. (9)

TOTAL : 45

TEXT BOOKS

1. Bali S.P., "Consumer Electronics" Pearson Education, 2017.
2. Bali R and Bali S.P. "Audio video systems: principle practices & troubleshooting", Khanna Book Publishing Co. (P) Ltd., 2010.

REFERENCES

1. Gulati R.R., "Modern Television practices" New Age International Publication (P) Ltd.2011.
2. Gupta R.G, "Audio video systems" Tata Mc graw Hill, 2nd Edition, 2010.
3. Whitaker Jerry & Benson Blair, "Standard Handbook of Audio engineering" McGraw-Hill Professional, 3rd Edition, 2010.
4. Amit Dhir, "The Digital Consumer Technology Handbook", Elsevier Science, 2004.

19ECEOE04 - ROBOTICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

Upon completion of this course, students will be able to demonstrate an ability to

CO1 : Describe the concepts of robotics, safety measures and homogeneous transformation.

CO2 : Formulate the concepts of mechanical drives and sensors in robotics.

CO3 : Describe the types of sensors and Robotic Vision

CO4 : Develop robotics programming, classifications and its applications.

CO5 : Exemplify the concepts of artificial intelligence.

ROBOT KINEMATICS

Introduction - Robotics and programmable automation - Historical background - Laws of Robotics - Robot definitions - Robotics system and Robot anatomy - Specifications of Robots - Safety measures in Robotics. (10)

ROBOTIC DRIVERS AND CONTROLS

Robot drives, actuators and control - Functions of drive systems - General types of fluids - Pump classification - Pneumatic systems - Electrical drives - DC motors - Stepper motors - Drive mechanism. (9)

SENSORS AND MACHINE VISION

Need for sensing systems- Principles and Applications of the following types of sensors- Position and displacement sensors - Potentiometers, Encoders, Linear Variable Differential Transformer, Force and Torque sensors- Wrist sensor, Joint sensor, Tactile array sensor, Slip sensors- Proximity sensors- Range finders- Imaging sensors- Inductive Proximity switch- Acoustic sensors- Opto-electronic sensors- Lighting Techniques, Robot Vision- Sensing and Digitizing, Image Processing and analysis- Preprocessing, Segmentation, Description, Recognition, Interpretation and Applications of robot vision system (9)

ROBOTIC LANGUAGE AND PROGRAMMING

Robot language and programming. Robot language - Classification of Robot languages - Computer control and robot software - VAL system and language. Applications of Robots: Capabilities of Robots - Robotics applications - Obstacle avoidance. (8)

ARTIFICIAL INTELLIGENCE IN ROBOTICS

The history of Artificial Intelligence- Artificial and Natural Intelligence- Artificial Intelligence and Automated manufacturing- The application domains of Artificial Algorithms- Risks and Benefits of AI- Agents and Environments- Knowledge representation. (9)

TOTAL : 45

TEXT BOOKS

1. Satya Ranjan Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill, 2nd Edition, 2012.
2. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2014.

REFERENCES

1. Robin.R.Murphy, "Introduction to AI Robotics", The MIT Press, Cambridge, Massachusetts, London, England, Second Edition, 2019.
2. Jadran Lenarcic, Jean-Pierre Merlet, "Advances in Robot Kinematics 2016", Springer International Publishing AG, 2018.

3. *Peter McKinnon, "Robotics", CreateSpace Independent Publishing Platform, 2016.*
4. *Ritu Tiwari, Anupam Shukla, Rahul Kala, "Intelligent Planning for Mobile Robotics: Algorithmic Approaches", Information science reference, United states of America, 2013.*
5. *David. L. Pool and Alan. K. Mackworth, "Artificial Intelligence: Foundations of Computational agents", Cambridge University, 2011.*

19ECEOE05 - INFORMATION THEORY AND CODING TECHNIQUES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : Explain the information content in a discrete memoryless source through parameters such as entropy and mutual information.

CO2 : Estimate a channel's capacity based on Shannon's channel capacity theorem

CO3 : Analyze various channel encoding and decoding methods

CO4 : Design and develop an error control coding methods for random error and burst error detection and correction techniques

CO5 : Understand different applications in coding techniques

INFORMATION THEORY AND SCHEMES FOR SOURCE CODING

Uncertainty Information and Entropy - Basic Properties of entropy - Information rate - Conditional entropy - Joint Entropy - Mutual Information - Channel capacity of a Gaussian channel

SOURCE CODING : Prefix codes - Necessary conditions for source coding - Kraft Mcmillan Inequality- Huffman Coding- Shannon Fano Coding Efficiency calculations. (9)

MEMORYLESS FINITE SCHEMES FOR CHANNEL CODING

Discrete Memoryless Channel - Channel models - BSC and BEC channels - Cascaded channels - Channel capacity of discrete and analog channels - Channel capacity of a Gaussian channel-Bandwidth-S/N trade-off-Channel coding theorem - Information capacity theorem - Code rate and redundancy-Parity check codes - Rate Distortion Theory. (9)

LINEAR BLOCK CODES AND CYCLIC CODES

Rationale for coding - Types of codes - Matrix description of linear block codes - Syndrome decoding - Minimum distance considerations -Repetition codes - Dual codes- Cyclic codes :Generator polynomial - Parity check polynomial - Encoder of cyclic codes - Calculation of syndrome - Cyclic codes for error correction. (10)

CONVOLUTIONAL CODES

Convolutional codes : Tree codes- Trellis codes- Viterbi decoding of convolutional codes - Catastrophic Error Propagation in Convolutional Codes -Performance Bounds for Convolutional Codes - Coding Gain - Convolutional Code Trade off - Soft Decision Viterbi Decoding -Feedback Decoding - Sequential Decoding (8)

CODING TECHNIQUES IN DATA COMPRESSION

Static and Dynamic Huffman coding - Arithmetic coding - Run length encoding- Lempel-Ziv coding -Image compression techniques -JPEG standard for Lossy and Lossless compression- Video compression standards. (8)

TOTAL : 45

TEXT BOOKS

1. Roberto Togneri, Christopher J.S DeSilva, "Fundamentals of Information Theory and Coding Design", CRC press, 2003.
2. Ranjan Bose, "Information Theory Coding and Cryptography", Tata McGraw Hill, 3rd Edition 2016.

REFERENCES

1. *Richard B. Wells, "Applied Coding and Information Theory for Engineers", Pearson Education, 1st Edition Indian reprint, 2009.*
2. *Khalid Sayood, "Introduction to Data Compression", 4th Edition, Elsevier, 2012.*
3. *Bernard Sklar, "Digital Communications: Fundamentals and Applications", Pearson Education, 2nd Edition, 2009.*
4. *Thomas M. Cover and Joy A. Thomas, "Elements of Information Theory", John Wiley & Sons, 2nd Edition, 2006.*
5. *Reza F M, "An Introduction to Information theory", McGraw Hill, 2000.*
6. *Todd K Moon, "Error Correction Coding - Mathematical methods and Algorithms", John Wiley & Sons, 1st Edition, 2021.*

19ECEOE06 - WIRELESS SENSOR NETWORKS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

- CO1 : Outline the challenges & issues in the wireless sensor network and its subsystems and interpret network architecture and its components
- CO2 : Describe the essential principles of the MAC protocols for Wireless Sensor Networks
- CO3 : Elucidate the Routing & localization tracking in Wireless Sensor Networks
- CO4 : Discuss the features of WSN Operating systems
- CO5 : Illustrate the methodologies to provide WSN based solution for various critical issues.

SENSOR NETWORKS - INTRODUCTION & ARCHITECTURES

Challenges for Wireless Sensor Networks-Enabling Technologies for Wireless Sensor Networks- Characteristic requirements for WSN - WSN architecture - Commercially available sensor nodes -Imote, IRIS, Sunspot -Physical layer and transceiver design considerations in WSNs-Single Node Architecture -Energy Consumption of Sensor Nodes- Sensor Network Scenarios- Optimization Goals and Figures of Merit. (9)

DATA LINK LAYER

Fundamentals of MAC protocols- Issues in designing a MAC Protocol for WSN - Low duty cycle protocols and wakeup concepts - Contention based protocols:PAMAS - Schedule-based protocols:LEACH - Sensor MAC - Berkeley MAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4- Link Layer protocols - fundamentals task and requirements, error control, framing, link management, Address and Name Management, Assignment of MAC Addresses, Unique,Content-based and geographical addressing. (10)

ROUTING AND TRACKING

Routing Challenges and Design Issues in Wireless Sensor Networks- Taxonomy :Data-centric routing SPIN - Energy aware routing, Gradient-based routing -Hierarchical Routing LEACH -Location Based Routing GAF, Data aggregation - Various aggregation techniques

A Tracking Scenario - Problem formulation - Distributed representation and inference of states- Tracking multiple objects - Sensor models - Topology control - Clustering - Time synchronization - Localization and Localization Services (10)

EMBEDDED OPERATING SYSTEMS FOR WSNs

Embedded Operating Systems: Operating Systems for WSNs - Introduction - Operating System Design Issues- Introduction to Tiny OS - NesC - Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM. (7)

APPLICATIONS OF WSN

WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications - Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling (9)

TOTAL : 45

TEXT BOOKS

1. *Kazem Sohraby, Daniel Minoli and Taieb Znati, "Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, First Edition, 2007.*
2. *Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.*

REFERENCES

1. *Anna Hac, "Wireless Sensor Network Design", John Wiley & Sons, First Edition, 2003.*
2. *C.S.Raghavendra Krishna, M.Sivalingam and Taribznati, "Wireless Sensor Networks", Springer Publication, 2004.*
3. *Paolo Santi, "Topology Control in Wireless Adhoc and Sensor Networks", John Wiley & Sons, 2005.*
4. *Philip Levis, David Gay, "TinyOS Programming", Cambridge University Press, 2009 Contiki - Open Source Operating System for IoT - <http://www.contiki-os.org/>*

19ECEOE07 - AUTOMOTIVE EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : Design modules for hybrid vehicle using automotive system components.

CO2 : Design control system in automotives by appropriate choice of Microcontrollers, Sensors and actuators.

CO3 : Examine the communication protocols for real time applications

CO4 : Understand the safety and comfort in Automobiles as per the government test procedures.

CO5 : Understand the communication and diagnostic protocols

AUTOMOTIVE SYSTEMS

Overview of Automotive industry - Tools and Processes - Introduction to modern automotive systems -Spark and Compression Ignition Engines - Automotive Transmissions - Vehicle braking fundamentals -Steering Control - Overview of Hybrid Vehicles - Analog and Digital Systems - Basic measurements systems. (9)

SENSORS AND ACTUATORS

Sensors: Characteristics, response and modeling - Actuators - Microcontroller and Digital Signal Processors used for automotive applications. (9)

EMBEDDED COMMUNICATION

Embedded Automotive Protocols: CAN, LIN, FLEXRAY, MOST (9)

SAFETY SYSTEMS

Active Safety Systems: ABS, TCS, ESP, brake assist - Passive Safety Systems: Airbag systems, Advance Driver Assistance system (ADAS) -Computer vision techniques - Connected cars technology - Trends towards Autonomous vehicles. (9)

FUNDAMENTALS OF DIAGNOSTICS

Basic wiring system and Multiplex wiring system, Self-Diagnostic system - various On board and off board diagnostics in Automobiles - Diagnostics tools - Diagnostics Protocols: KWP20000 and UDS. (9)

TOTAL : 45

TEXT BOOK

Ronald K Jurgen, "Automotive Electronics Hand Book", McGraw- Hill, 2nd Edition 1999.

REFERENCES

1. William B. Ribbens, Ph.D, "Understanding Automotive Electronics", Elsevier Publications, 7th Edition, 2012.
2. Tom Denton, "Advance Automotive Diagnosis", 2nd Edition, Elsevier 2006.
3. BOSCH Automotive Handbook, 8th Edition.
4. Denton. T, "Automobile Electrical and Electronics Systems", SAE (Society for Automobile Engineers) International, 3rd Edition, 2004.
5. Jack Erjavec, "Automotive Technology: A Systems Approach", Delmar Cengage Learning, 5th Edition, 2009.

19ECEOE08 - 5G TECHNOLOGIES AND APPLICATIONS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : describe the evolution of cellular systems from 2G to 4G

CO2 : explain the motivation, targets of 5G technology and its standardization

CO3 : elaborate the 3GPP releases and 5G radio access network architecture

CO4 : discuss the services offered by 5G deployment and its design approaches

CO5 : understand the role between 5G and emerging next generation wireless technologies

EVOLUTION OF CELLULAR SYSTEMS

Evolution from 2G to 3G and 3G to 4G - Circuit Switch to Packet Switch - ITU Standardization Process- - Evolution of LTE and releases. (9)

INTRODUCTION TO 5G

Motivation for 5G - 5G targets - Technology components - Spectrum - capabilities - The role of 3GPP in standardization - use cases - 5GPPP (Public-Private Partnership) (9)

5G RADIO ACCESS NETWORK

Radio access - 3GPP Releases - 5G New Radio (NR) - Requirements - 3GPP phases for IMT-2020 - NR air interface - 5G RAN architecture (9)

5G SERVICES

Enhanced Mobile Broadband (eMBB) systems - Massive Machine Type Communication (MTC) system - Ultra Reliable and Low Latency Communication (URLLC) systems - Design approaches (9)

EMERGING TECHNOLOGIES IN 5G

Massive MIMO - Network Function Virtualization - Software Defined Networking - Cognitive radio - Millimetre Wave - Heterogeneous network - Internet of Things (9)

TOTAL : 45

TEXT BOOKS

1. Saad Asif, "5G mobile Communications Concepts and Technologies", CRC Press,2018
2. Biljana Badic, Christian Drewes, Ingolf karls, Markus Mueck, "Rolling out 5G Use cases, Applications and Technology Solutions", Apress, 2016

REFERENCES

1. Antti Toskala, Harri Holma, Takehiro Nakamura, "5G Technology 3GPP New Radio", Wiley & Sons Ltd. 2020.
2. Devaki Chandramouli, Juho Pirskanen, Rainer Liebhart, "5G for the Connected World", Wiley,2019
3. Haesik Kim, "Design and Optimization for 5G Wireless Communications", Wiley, 2020
4. Ramjee Prasad, "5G Outlook Innovations and Applications", River Publications, 2016
5. Anwer Al-Dulaimi, "5G Networks Fundamental Requirements, Enabling Technologies, and Operations Management", Wiley, 2018
6. Mauro Boldi, Olav Queseth, Patrick Marsch, Ömer Bulakci, "5G System Design Architectural and Functional Considerations and Long Term Research", Wiley,2018

19ECEOE09 - VEHICULAR COMMUNICATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : Understand basic principles, technologies, and system architecture of vehicular ad-hoc networks (VANET)

CO2 : Analyze Physical Layer and MAC Layer for signal propagation for vehicular communication

CO3 : Describe the various routing mechanisms and protocols to fulfill vehicular networking requirements.

CO4 : Explain the challenges and issues in establishing cellular V2X connection and mobility management.

CO5 : outline vehicular communication platforms for various emerging applications

INTRODUCTION TO VEHICULAR RADIO NETWORKS

Basic principles and challenges-Mobile Wireless Communications and Networks-Need for Vehicular Communications-VANET activities- Network Architecture for Vehicular Communications. (9)

PHYSICAL LAYER AND MAC LAYER

Signal Propagation-Doppler spread and its impact on OFDM Systems-Proposed MAC approaches and standards, Intelligent Transportation Systems: IEEE 802.11p-ITS-IVC (10)

VANET ROUTING PROTOCOLS

Opportunistic packet forwarding-topology based routing- geographic routing (8)

VEHICULAR MOBILITY MANAGEMENT

Connected Vehicles& Connected Autonomous Vehicles- Dedicated Short Range Communication-flow and traffic models-Standards and Regulations- DSRC Protocol Stack, Cellular V2X (9)

EMERGING VANET APPLICATIONS

Vehicle to Infrastructure Safety Applications-communication paradigms-message coding and composition-data aggregation-Security and Privacy (9)

TOTAL : 45

TEXT BOOKS

1. *H. Hartenstein and K. P. Laberteaux, VANET: Vehicular Applications and Inter-Networking Technologies, John Wiley & Sons Ltd., 1st Edition 2010.*
2. *Luca Delgrossi, Tao Zhang, "Vehicle Safety Communications: Protocols, Security, and Privacy", John Wiley & Sons Ltd 1st Edition 2012.*

REFERENCES

1. *P. H.-J. Chong, I. W.-H. Ho, Vehicular Networks: Applications, Performance Analysis and Challenges, Nova Science Publishers, 2019.*
2. *C. Sommer, F. Dressler, Vehicular Networking, Cambridge University Press, 2015.*
3. *Popescu-Zeletin R, Radusch I and Rigani M.A, "Vehicular-2-X Communication",Springer,2010.*
4. *M. Watfa, Advances in Vehicular Ad-Hoc Networks: Development and Challenges, Information Science Reference, 2010.*
5. *H. Moustafa, Y. Zhang, Vehicular Networks: Techniques, Standards, and Applications, CRC Press, 2009.*
6. *Xiang W, "Wireless Access in Vehicular Environments Technology", Springer, 2015*

19ECEOE10 - SENSING FOR AUTOMOTIVE SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : Acquaint with the basic automotive system components and need for automotive sensors.

CO2 : Discuss the fundamentals of various Power train sensors in automotive systems.

CO3 : Comprehend various sensors for chassis management.

CO4 : Understand the sensors for vehicle management & security systems in Automobiles.

CO5 : Examine the vehicle communication protocols standards in automotive applications.

AUTOMOTIVE SYSTEMS

Introduction to Modern Automotive Systems- Electronics in Automobiles - Combustion Engines- Power-train- braking systems - Transmission- Applications and Challenges in the automotive. (9)

POWERTRAIN AUTOMOTIVE SENSORS

Exhaust temperature sensor - λ sensors - PM sensor - NOx sensor - fuel quality sensor- level sensor- torque sensor-speed sensor- manifold pressure sensor - mass flow sensor. (9)

CHASSIS SENSORS

Wheel speed sensors/direction sensors- steering position sensor (multi turn)- acceleration sensor (inertia measurement)- brake pneumatic pressure sensor- ABS sensor- electronic stability sensor. (9)

SENSORS FOR VEHICLE MANAGEMENT & SECURITY SYSTEMS

Gas sensors (CO₂)- Temperature/humidity sensor- air bag sensor- key less entering sensor- radar sensors. Tire pressure monitoring systems- Two wheeler and Four wheeler security systems. (9)

VEHICLE COMMUNICATION STANDARDS

Automotive Protocols : CAN, LIN, FLEXRAY, MOST (9)

TOTAL : 45

TEXT BOOK

John Turner, Automotive Sensors, 2010, Momentum Press, 1st Edition, New York.

REFERENCES

1. *Automotive Electrics, Automotive Electronics: Systems & Components, 2014, 5th Edition, BOSCH.*
2. *Ronald K Jurgen, "Automotive Electronics Hand Book", McGraw- Hill, 2nd Edition 1999.*
3. *Automotive Sensors Handbook, 8th Edition, 2011, BOSCH*
4. *Jiri Marek, Hans-Peter Trah, Yasutoshi Suzuki, Iwao Yokomori, "Sensors for Automotive Technology", 4th Edition, Wiley, New York, 2010.*
5. *Jack Erjavec, "Automotive Technology: A Systems Approach", Delmar Cengage Learning, 5th Edition, 2009.*

19CSOE01 - CUSTOMER RELATIONSHIP MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

- 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.*
- CO3 : Understand the type of collecting and connecting the customer data with proper guidelines for privacy.*
- CO4 : Demonstrate the scoring process and apply the various CRM optimization techniques to optimize the CRM process in order to improve customer profitability.*
- CO5 : 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 -Data mining tool: WEKA -CRM tools - Next generation for CRM. (10)

TOTAL : 45

TEXT BOOKS

- Alex Berson, Stephen Smith, Kurt Thearling, "Building Data mining Applications for CRM", Tata McGraw Hill, Fifteenth Reprint, 2008.*
- Ian H. Witten ,Eibe Frank, Mark A.Hall, "Data Mining Practical Machine Learning Tools and Techniques", Morgan Kaufmann, Fourth Edition, 2016*

REFERENCES

1. Francis Buttle, Stan Maklan *"Customer Relationship Management: Concepts and Technologies"*, Routledge, Fourth Edition, 2019.
2. Roger J. Baran, Robert J. Galka, *"CRM: The Foundation of Contemporary Marketing Strategy"*, S.Chand (G/L) & Company Ltd, Second Edition, 2017.

19CSOE02 - FUNDAMENTALS OF SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

- 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 BOOKS

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)

REFERENCES

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

19CSOE03 - INTERNET PROGRAMMING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

- CO1* : Gain knowledge in overview of www and web based applications.
- CO2* : Design and develop dynamic and Interactive web page 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.

REFERENCES

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.

19CSOE04 - INTRODUCTION TO DATA WAREHOUSING AND DATA MINING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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.

REFERENCES

1. Arun K Pujari, "Data Mining Techniques" Universities Press India Ltd., Third Edition, 2012.
2. Dunham, "Data Mining- Introductory and Advanced Topics", Pearson Education, New Delhi, First Edition, 2006.
3. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World ", Pearson Education, Seventh Indian Reprint New Delhi, 2003.
4. George M. Marakas, "Modern Data Warehousing, Mining, & Visualization Core concepts", Pearson Education, First Edition, 2003
5. Paulraj Ponnaiah, "Data Warehousing Fundamentals", Wiley Publishers, Singapore, First Edition, 2001.

19CSOE05 - INTRODUCTION TO EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

- 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

REFERENCES

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.

19ITOE01 - DIGITAL COMPUTER BASICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

- 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 (9)

COMBINATIONAL CIRCUITS

Adder : Half Adder - Full Adder - Binary Parallel Adder - BCD Adder. Subtractor : Half Subtractor - Full Subtractor. Code Conversion. Decoders - De-Multiplexer - Encoders - Multiplexers. (10)

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 - Up down 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. Cieti, "Digital Design with an Introduction to the Verilog HDL, Pearson Education, Fifth Edition, 2013.*

REFERENCES

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.*

19ITOE02 - PROGRAMMING IN JAVA

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

- 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 references ", Tata McGraw Hill, fifth Edition, McGraw Hill Education, 2014.

REFERENCE

1. Deitel H.M and Deitel P.J, "Java - How to Program", Prentice Hall of India, Ninth Edition, 2012.

19ITOE03 - FUNDAMENTALS OF DATABASE SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

- 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 Serializability-Deadlocks-Database Recovery Management-RAID. (9)

TOTAL : 45

TEXT BOOK

1. Peter Rob, Coras M.Colonel, "Database Systems: Design, Implementation and Management", Thompson Learning Course Technology, Tenth Edition, 2012.

REFERENCES

1. Abraham Silberschatz, Henry F.Korth,S.Sudharshan,"Database System Concepts", McGraw-Hill, Sixth Edition, 2013.
2. Ramez Elmasri, Shamkant B. Uvathe, "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, 2004.

19ITOE04 - CLOUD COMPUTING FUNDAMENTALS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

- 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 / 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 tool (9)

CLOUD SECURITY

Security Overview - Cloud SecurityChallenges - 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

1. *Toby Velt, Anthony Velt, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.*
2. *Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2002.*
3. *Kai Hwang, Geoffrey C Fox, Jack GDongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2002.*

19ITOE05 - INFORMATION SECURITY FUNDAMENTALS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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 - NISTISSC 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. (9)

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. (9)

POLICIES, STANDARDS, PRACTICES AND BUSINESS CONTINUITY

Introduction - Information Security Policy, Standards and Practices -The Information Security Blueprint: ISO 17799/BS 7799, ISO 27001and itscontrols, NIST SecurityModels, 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 (6)

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 ITAct - 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)*

REFERENCES

1. *Thomas R.Pettier, "Information Security Fundamentals", Auerbach Publications, Second Edition, 2013.*
2. *Vicki 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.*

19ITOE06 - INTRODUCTION TO HUMAN COMPUTER INTERACTION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

- 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. (9)

WINDOWS & COMPONENTS

Windows: New Navigation Schemes - Selection of Window - Selection of DevicesBased on Screen Based Controls. Components: Text and Messages - Icons and Increases - Multimedia - Colors - Uses -Problems - Choosing colors. (11)

SOFTWARE TOOLS AND INTERACTION DEVICES

Specification Methods - Interface Building Tools - Keyboard and Function Keys - Pointing Devices Speech Recognition. (7)

TOTAL : 45

TEXT BOOKS

- Wilbert O Galitz, "The Essential Guide to User Interface Design", Third Edition, Wiley India Pvt., Ltd., 2007.*
- Ben Shneidermann, "Designing the User Interface", Fifth edition, Pearson Education Asia, 2013. (Software Tools and Interaction Devices)*

REFERENCE

- Alan Dix, Janet Finlay, G D Abowd and Russel Beale, "Human Computer Interaction", Pearson Education, Third Edition*

19ITOE07 - ENTERPRISE RESOURCE PLANNING CONCEPTS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

- 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 in order to define the functionality of various departments in a company.*
- CO4 : Analyze the ERP market place 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)

REFERENCES

1. Ellen F.Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Course Technology Ptr, Fourth Edition, 2011.
2. Vinod Kumar Garg and Venkitakrishnan N.K., "Enterprise Resource Planning - Concepts and Practice", Prentice Hall of India, New Delhi, Second Edition, 2012.

19CHOE01 - INDUSTRIAL SAFETY ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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 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 protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening. Selection and suitability: lathe - drilling - boring - milling - grinding - shaping - sawing- shearing presses - forge hammer - flywheels - shafts - couplings -gears - sprockets wheels and chains pulleys and belts - authorized entry to 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 equipment and instruments - safety in generation, distribution and handling of industrial 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-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes. Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills - hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production 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 leak test, 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.

19CHOE02 - RISK ANALYSIS AND HAZOP

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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 - Evaluation 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.*

19CHOE03 - GREEN TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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 initiative by UNEP, etc.

CO5 : Analyse 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.*

19CHOE04 - CORROSION SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completion of the course, students are 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 : Analyse 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-H₂O 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, New York, 2005.*
3. *Uhling H. H., Revie R.W., Corrosion and Corrosion Control, John Wiley and Sons, Inc, 1985.*

REFERENCE

1. *Banarjee.S.N., An introduction to corrosion and corrosion inhibitors, Oxonian Press Ltd., New Delhi, 1985.*

19CHOE05 - INTRODUCTION TO CHEMICAL ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completion of the course, students are 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 equipment for transport and separation processes.

CO4 : Apply material and Energy balance to precisely calculate material required for a process.

CO5 : Apply steady state balances to develop process flow sheets.

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.*

19CHOE06 - NANOMATERIAL SYNTHESIS AND CHARACTERIZATION LABORATORY

L	T	P	C
0	0	6	3

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

After completion of the course, students are able to

CO1 : To synthesize several nanomaterials in different methods in lab scale.

CO2 : To understand and operate the instruments for material characterization.

CO3 : To interpret the properties of synthesized nanomaterials by analyzing the results

EXPERIMENTS

1. Chemical synthesis of Ag nanoparticles; UV-Visible absorption of the colloidal sol.
2. Chemical synthesis of CdS nanoparticles; Optical absorption spectra; Band gap estimation from the band edge.
3. Synthesis of ceria nanofibres by Solvothermal method.
4. Synthesis of silica nanoparticles using Stober method.
5. Synthesis of Au nanoparticles by simple chemical method.
6. Synthesis of Fe₃O₄ nanoparticles by simple reduction method.
7. Effect of reducing agent on the synthesis of metal nanoparticles.
8. Aqueous to organic phase transfer of Ag and CdS nanoparticles; Confirmation by UV-Visible absorption.
9. Effect of concentration on the synthesis of silver nanoparticles.
10. Effect of reducing agent on gold nanoparticles.
11. Fabrication of silver nanofilms.
12. Synthesis of polyvinyl alcohol fibres by electrospinning method.
13. Synthesis of Au and Ag nanoparticles at aqueous-organic liquid interface; UV-visible spectroscopy of the colloidal film; comparison with the corresponding colloidal sol.
14. Sol gel synthesis of ZnO/TiO₂/CdO nanoparticles.
15. A bioroute to Au nanoparticles.
16. Sol-gel spin coating route to SnO₂ nanorods: surface roughness measurement by AFM.
17. Hydrothermal synthesis of ZnS Nanorods: Nanorods formation by SEM analysis.
18. Fabrication and wettability characterization of nanostructured soft polymer surfaces.
19. Preparation of nanofluids.
20. Determination of viscosity of nanofluids.
21. Evaporation studies of nanofluids.
22. Measurement of stability of nanofluids.
23. Optical properties of nanofluids.
24. Measurement of onset of natural convection in nanofluids.
25. Thermal conductivity measurement of nanofluids.

TOTAL : 60

REFERENCES

1. Sarit K. Das, Stephen U. Choi, Wenhua Yu, T. Pradeep, *Nanofluids: Science and Technology*, Wiley, 2007.
2. Vincenzo Bianco, Oronzio Manca, Sergio Nardini, Kambiz Vafai, *Heat Transfer Enhancement with Nanofluids*, CRC Press, 2017.
3. Amy S., *Thermal Energy Storage Using Phase Change Materials: Fundamentals and Applications* Fleischer, Springer, 2015.
4. Mohsen Sheikholeslami and Davood Domairry Ganji, *Applications of Nanofluid for Heat Transfer Enhancement*, Elsevier, 2017.
5. S.M. Sohel Murshed, Carlos Nieto de Castro, *Nanofluids: Synthesis, Properties and Applications*, Nova Science Publishers, 2014.
6. T. Pradeep, *A Textbook of Nanoscience and Nanotechnology*. Tata McGraw-Hill Education, 2003.
7. P.R. Chandran, M. Naseer, N. Udupa, N. Sandhyarani. Size controlled synthesis of biocompatible gold nanoparticles and their activity in the oxidation of NADH. *Nanotechnology*. 8, 23(1), 2011.
8. I.A. Ibrahim, A.A. Zikry, M.A. Sharaf. Preparation of spherical silica nanoparticles: Stober silica. *J. Am. Sci.* 6(11), 985-9, 2010.
9. X. Chen, S.S. Mao. Titanium dioxide nanomaterials: synthesis, properties, modifications, and applications. *Chemical reviews*. 11, 107(7), 2891-959, 2007.
10. Sarit K. Das, Stephen U. Choi, Wenhua Yu, T. Pradeep, *Nanofluids: Science and Technology*, Wiley, 2007.

19CHOE07 - MULTIVARIATE STATISTICS LABORATORY

L	T	P	C
0	0	6	3

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

After completion of the course, students are able to

CO1 : Design experiments to obtain statistical principles of Univariate examples.

CO2 : Apply the concepts of statistics to draw conclusions from data

CO3 : Assess practical knowledge to carry out meaningful interpretation of data from real life

CO4 : Conduct experiments to solve complex engineering problems effectively as an individual or team work.

CO5 : Perform as a leader with good ethical principles to meet societal needs in the field of chemical engineering.

LIST OF EXPERIMENTS

1. Point and Interval Estimation for Normal and Chi-Square Distribution using Excel and R.
2. Point and Interval Estimation for T-Distribution and F-Distribution using Excel and R.
3. K-means Clustering.
4. One-way ANOVA Model in Excel and R.
5. Linear Regression
6. Logistic Regression
7. Naive Bayesian Classifier
8. Decision Trees
9. Simulation of Principal component analysis using Excel and R.
10. Simulation of Fischer Discriminant Analysis using Excel and R.
11. Modeling the Change by Differential Equations using R and Excel.
12. Modeling the Change by Difference Equations using R and Excel.
13. Multivariate Normal & Hotelling's T₂ Distribution.
14. Multivariate Analysis of Variance (MANOVA).
15. Correspondence Analysis using R.

TOTAL : 60

REFERENCES

1. *Apostol T.M. (1985) Mathematical Analysis, Narosa, Indian Ed.*
2. *Courant R. And John F. (1965) Introduction to Calculus and Analysis, Wiley.*
3. *Miller K.S. (1957) Advanced Real Calculus, Harper, New York.*
4. *Rudin, Walter (1976) Principles of Mathematical Analysis, McGraw Hill.*
5. *Malik S.C. (2005) Principles of Real Analysis, New Age International (p) Ltd.*
6. *Bartle R.G. (1976) Elements of Real Analysis*

19MOE01 - GRAPH THEORY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE 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 the irrespective mainstream.
- 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 SUB GRAPHS

Graph-Standard Concepts in Graphs - Sub graphs - Complete Graph - Bipartite Graph - Isomorphism - Adjacency Matrix and Incidence Matrix-Walk, Trail and Path - Bipartite Graph - Connectedness - The Shortest Path Problem - Dijkstra'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)

TOTAL : 45

TEXT BOOKS

1. Gary Chartrand and Ping Zhang, *Introduction to Graph Theory*, Mc Graw Hill Education (India), 2017.
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"* Second Edition, Prentice Hall of India Private Limited, 2001.
2. Balakrishnan. R, Ranganathan. K , *"A Text book of Graph Theory"*, Second Edition, Springer Newyork, 2012.
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.

19MOE02 - METHODS OF APPLIED MATHEMATICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE 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. Fredholm's equation with separable Kernels Hilbert Schmidt theory, interactive methods for solving equations of second kind. (9)

SECOND ORDER ORDINARY DIFFERENTIAL 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 Bei functions. (9)

BOUNDARY PROBLEMS AND CHARACTERISTIC FUNCTION REPRESENTATIONS

Sturm - Liouville problems. Orthogonal functions and expansions in series of Orthogonal functions. Stodola and Vianello method for Sturm - Liouville problems, Fourier - Bessel and Legendre Series (9)

PARTIAL DIFFERENTIAL EQUATIONS

Linear and quasi - linear equations of the first and second order. Characteristics of first and second order linear equations. Heat flow equations. Problems in one, two and three dimensions - Fourier method. (9)

INTEGRAL TRANSFORM METHODS

Calculus of variations - Variational notation, Constraints and Lagrangian multipliers, variable and points, Rayleigh - Ritz method. (9)

TOTAL : 45

TEXT BOOKS

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 Edition (EEE).Prentice Hall of India P.Ltd., 2014.*

REFERENCES

1. *F.B. Hildebrand - Methods of Applied Mathematics, Second Edition. Prentice Hall of India P.Ltd., 2012.*
2. *David Borthwick : An introduction to partial differential equation Springer International Publishing 2017.*
3. *Mattias Blennow: Mathematical methods in Physics and Engineering, CRC Press, 2018.*

19MOE03 - LINEAR AND NON - LINEAR PROGRAMMING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE 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 - Vogel'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 Sales man 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 $n \times n$ games - Dominance Property - Graphical Method of $2 \times n$ or $m \times 2$ 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 2016, New Delhi.*
2. *Resource management techniques by V.Sundaresan, Tenth Edition, 2016, A.R Publications, Chennai.*

REFERENCES

1. *Kanti Swarup, P.K. Gupta and Man Mohan, " Operations Research", Sultan Chand & Sons, Educational publishers, New Delhi. 20th Edition, 2019.*
2. *Frederick S. Hillier, Gerald J. Lieberman, "Introduction to Operations Research", Mc Graw Hill, (India) Private Limited, India, 11th Edition, 2021.*

19MOE04 - PROBABILITY AND RANDOM PROCESSES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

- CO1* : The students will be able to understand the basic 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

Discrete distributions : Binomial, Poisson and Geometric - Properties and Simple problems

Continuous distributions : Normal, Uniform Exponential - Properties and Simple problems. (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)

RANDOM PROCESSES

Classification - Stationary process - Markov process - Poisson process - Random telegraph process. (9)

CORRELATION FUNCTIONS AND POWER 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, 2020.*
2. T. Veerarajan, *Probability, Statistics and Random Processes, Second Edition, Tata Mc Graw - Hill 2017.*

REFERENCES

1. Robert Hogg & Joseph McKean: *Introduction to Mathematical Statistics, Pearson 8th Edition 2018.*
2. Bhat, B. R.: *Modern Probability Theory - An Introductory Text Book, Third Edition, New Age International 2015.*

3. Cochran, W.G: *Sampling Techniques*, Wiley Eastern Private Limited, 2007.
4. Sukhatme, P.V. and Sukhatme, B.V.(1977) : *Sampling Theory of Survey with Applications*, Asia publishing House.
5. Rakesh Dube, "Higher mathematics for Engineering and Science" Manakin Press, 2018.
6. Ibe, O.C., "Fundamentals of Applied Probability and Random processes", 2nd Edition, Elsevier, 2019.
7. Peyton Peebles, "Probability Random Variables and Random Signal Principles", Tata Mc Graw Hill, 4th Edition, NewDelhi, 2017.

19POE01 - INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

- 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 (buckyballs, 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. *Nano technology: Basic Science and Emerging technologies, Mick Wilson, Kamali Kannargare., Geoff Smith Overseas Press (2005)*
2. *A Text book of Nanoscience and Nanotechnology, Pradeep T., Tata McGraw Hill Education Pvt. Ltd., 2012.*
3. *Nanostructured Materials and Nanotechnology, Hari Singh Nalwa, Academic Press, 2002.*
4. *Introduction to Nanotechnology, Charles P.Poole, Frank J.Owens, Wiley Interscience (2003)*

5. *Textbook of Nanoscience and Nanotechnology*, B.S. Murty, P. Shankar, Baldev Raj, B B Rath, 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 nanostructured 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

19POE02 - PHYSICS AND TECHNOLOGY OF THIN FILMS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

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 abalation 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. Kiyotaka Wasa, Makoto Kitabatake, Hideaki Adachi, *Thin Films Material Technology*, Springer-Verlag Berlin Heidelberg, 2004.

19POE03 - SOLAR CELL FUNDAMENTALS AND MATERIALS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

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

EVOLUTION 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.

19POE04 - ADVANCED MATERIAL PROCESSING TECHNOLOGIES

L	T	P	C
3	0	0	3

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

- 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

INTRODUCTION AND 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, 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. (10)

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. (8)

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. Betzalel Avitzu, "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", Mc Graw Hill Publishing Co., INC, 1997*
2. *Gowariker V R, Viswanathan N V, Jayadev Sreedhar, "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.*

19COE01 - 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-TiO₂ 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. George W. 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

REFERENCES

1. Mithin.V, Kochelap.V and Stroschio.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.

19COE02 - ADVANCED DRUG DELIVERY SYSTEMS

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

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)

POLYMERS Dendrimers- Synthesis -Nanoscale containers- Dendritic Nanoscaffold systems Biocompatibility of Dendrimers, Gene transfection. pH based targeted delivery- chitosan and alginate. Copolymers in targeted drug delivery- PCL,PLA, PLGA. (8)

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 antibodybioconjugates. (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.*

19COE03 - BIOSENSORS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

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 microporous 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 - Fluorescence - 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.

19COE04 - 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 Veprek (Review Article) *JVSTA*, 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

19COE05 - 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; trichoderma 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. CO₂, H₂S and H₂) 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, H₂, H₂O, CO₂) 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 Resources: 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.

REFERENCES

1. Martin Kaltschmitt; Hermann Hofbauer. "Biomass Conversion and Biorefinery", Springer Publishing, 2008.

19HOE01 - PRINCIPLES OF MANAGEMENT

COURSE OUTCOMES

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

Unit I - Introduction to Management: Meaning, Definition and Significance of Management-Basic functions of Management-Development of Management Thought (9)

Unit II - Management Concepts: Planning, Organizing, Staffing, Directing and Controlling- MBO-Six sigma (9)

Unit III - Organizational Behavior: Significance of OB, Role of Leadership, Personality and Motivation, Stress, Attitudes, Values and Perceptions at work (9)

Unit IV - Business Process Reengineering: Need for BPR, Various phases of BPR, Production and Productivity-Factors influencing Productivity (8)

Unit V - 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 BOOKS

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.

REFERENCES

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.

19HOE02 : CURRENT TRENDS IN INDIAN ECONOMY

L	T	P	C
3	0	0	3

COURSE OUTCOMES

- 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

Unit - 1 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)

Unit - II 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)

Unit - III 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)

Unit - IV Service sector: Service sector in India-Banking-Insurance-Telecommunication-IT sector-Software exports-BPO-Contribution to GDP (9)

Unit - V 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 BOOKS

1. Ruddar Datt and Sundaram, *KPM, Indian Economy, S.Chand and company, New Delhi-2015*
2. Ramesh Singh *Indian Economy, McGraw hill Education 7th edition, 2015*

References: www.jagranjosh.com

19H0E03 - MONETARY ECONOMICS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

Unit I 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)

Unit II 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)

Unit III 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)

Unit IV 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)

Unit V 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.*

REFERENCES

1. *Sethi TT, "Monetary Economic Theory", S Chand & Co, New Delhi, 1996.*

2. *Mithani DN, "Money Banking and International Trade", Himalaya, Mumbai, 2013.*

19HOE04 - ENGLISH FOR ACADEMIC PURPOSE

L	T	P	C
3	0	0	3

COURSE OUTCOMES

- CO1 : Write a description and apply grammatical rules.*
CO2 : Analyse a passage and enhance vocabulary.
CO3 : Formulate a research paper
CO4 : Listen to a lecture and prepare a summary.
CO5 : Construct dialogues using appropriate expressions.

FOCUS ON LANGUAGE

Sentence construction- types of clauses- sequence- co ordination- subordination- paragraphing information - describing a system & procedure (9)

READING

Understand a writer's purpose - Use strategies to ascertain meaning from unfamiliar vocabulary encountered in context - Recall and use vocabulary regarding urbanization and megacities - 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. (13)

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 - 6. The Methodology - The Results - The Discussion - The Conclusion - Citing Sources - Proofreading.

LISTENING

Listening to conversation - lectures - topics - discussions - listening comprehension on specific topics - listening to recognize formal and informal spoken English (11)

SPEAKING

Seminar skills - Engage in verbal role playing in Formal and Informal situation. - 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 (12)

TOTAL : 45

REFERENCES

1. *Wisniewska, I., Riggerbach, H., & Samuda, V. (2007). Grammar dimensions*
2. *Form, meaning, and use (4th Ed.). Boston, MA: Heinle Cengage Learning Longman Introductory Course for the TOFEL Test*
3. *Original publications and web- based resources will be reviewed as necessary.*

19HOE05 - ENGLISH FOR COMPETITIVE EXAMS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

CO1 : Listen to TOEFL 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 question.

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 a 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

REFERENCES

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.*
2. Sharpe J.Pamela. *Barron's TOEFL iBT Internet- Based Test. 12th Edition, Galgotia publications Pvt.Ltd: New Delhi, 2009.*

19HOE06 - LIFE AND LITERATURE

L	T	P	C
3	0	0	3

COURSE OUTCOMES

- 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 the fiction

Unit - 1 : 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)

Unit - 2 : Poems

- Stopping By Woods on a Snowy Evening by Robert Frost
The Ballad of Father Gilligan by W.B. Yeats (9)

Unit - 3 : 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
Albert Einstein and Steve Jobs (11)

Unit - 4 : 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

REFERENCES

1. *Xavier. ed. An Anthology of Popular Essays and Poems. Macmillan: New Delhi, 2009.*
2. *Kumara Pillai. ed. A Book of Modern Short Stories. Macmillan: New Delhi, 2009.*
3. *Colleen and Darius Krishnaraj. ed. Convergence , A Book of Short Stories. Macmillan: New Delhi, 2009.*
4. *Ernest Hemmingway. The Old Man and the Sea. Arrow: Warwickshire, 2000.*
5. *Baroness Emma Orczy, The Scarlet Pimpernel. Hutchinson : 1995.*

COIMBATORE INSTITUTE OF TECHNOLOGY

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DEPARTMENT OF CIVIL ENGINEERING

B.E. CIVIL ENGINEERING - FULL TIME

(III TO VIII SEMESTER)

Under Choice Based Credit System

(For the students admitted during the academic year 2019 - 2020 and onwards)

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