RAJALAKSHMI ENGINEERING COLLEGE

(An Autonomous Institution Affiliated to Anna University Chennai)

DEPARTMENT OF CIVIL ENGINEERING
CURRICULUM AND SYLLABUS REGULATIONS – 2017
B.E. CIVIL ENGINEERING

VISION:

To be a department imparting knowledge in civil engineering education, research, entrepreneurship and industry outreach services for creating sustainable infrastructure and enhancing quality of life with professional and ethical values.

MISSION:

- To provide an effective teaching – learning environment enabling students to be a competent civil engineer.
- To motivate research and entrepreneurial initiatives in the field of civil engineering.
- To inculcate ethical values to serve the society with high order professionalism.

Programme Educational Objectives: (PEO)

1. Graduates will possess fundamental knowledge in all fields of civil engineering to apply them towards planning, analysis, design and execution of civil projects.
2. Graduates will exhibit effective interpersonal skills in teams and at work place.
3. Graduates will be able to assess the impact of civil engineering activities and recommend appropriate remedies to societal needs and environmental issues
4. Graduates will exhibit interest for life-long learning, research and entrepreneurial practice in civil engineering
5. Graduates will hold strong professional, moral and ethical values with a concern to society and technology

Programme Outcomes: (PO)

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.

PROGRAM SPECIFIC OUTCOMES (PSOs)

The graduate will be able to:

PSO 1: Identify the requirements of a specific civil Engineering project, plan and devise strategies to execute the project.

PSO 2: Analyse, design and prepare estimates for various civil engineering structures.

PSO 3: Assess the materials and technology that is required for delivering quality in design and execution.

CURRICULUM AND SYLLABUS

SEMESTER I

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS17151	Communicative English	HS	3	3	0	0	3
2.	MA17151	Engineering Mathematics I	BS	5	3	2	0	4
3.	PH17151	Engineering Physics	BS	3	3	0	0	3
4.	CY17151	Engineering Chemistry	BS	3	3	0	0	3
5.	GE17151	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	GE17152	Engineering Graphics	ES	6	2	0	4	4
PRACTICAL								
7.	GE17161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	GE17162	Physics and Chemistry Laboratory	BS	4	0	0	4	2
TOTAL				**31**	**17**	**2**	**12**	**24**

SEMESTER II

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS17251	Technical English	HS	3	3	0	0	3
	HS17252	Professional English Communication						
2.	MA17251	Engineering Mathematics II	BS	5	3	2	0	4
3.	PH17257	Physics for Civil Engineering	BS	3	3	0	0	3
4.	EE17251	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3
5.	CY17251	Environmental Science and Engineering	HS	3	3	0	0	3
6.	GE17251	Engineering Mechanics	ES	4	2	2	0	3
PRACTICAL								
7.	GE17261	Engineering Practices Laboratory	ES	4	0	0	4	2
8.	CE17211	Computer Aided Building Drawing	PC	4	0	0	4	2
TOTAL				**29**	**17**	**4**	**8**	**23**

SEMESTER III

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA17351	Transforms and Partial Differential Equations	BS	5	3	2	0	4
2.	CE17301	Engineering Geology	ES	3	3	0	0	3
3.	CE17302	Construction Materials	PC	3	3	0	0	3
4.	CE17303	Strength of Materials I	PC	4	2	2	0	3
5.	CE17304	Fluid Mechanics	PC	4	2	2	0	3
6.	CE17305	Surveying	PC	4	2	2	0	3
PRACTICAL								
7.	CE17311	Surveying Laboratory	PC	4	0	0	4	2
8.	CE17312	Strength of Materials Laboratory	PC	4	0	0	4	2
9.	HS17361	HS17361 - Interpersonal Skills / Listening and Speaking	EEC	2	0	0	2	1
TOTAL				**33**	**15**	**8**	**10**	**24**

SEMESTER IV

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA17451	Numerical Methods	BS	5	3	2	0	4
2.	CE17401	Construction Techniques, Equipment and Practice	PC	3	3	0	0	3
3.	CE17402	Strength of Materials II	PC	4	2	2	0	3
4.	CE17403	Applied Hydraulic Engineering	PC	4	2	2	0	3
5.	CE17404	Concrete Technology	PC	3	3	0	0	3
6.	CE17405	Soil Mechanics	PC	4	2	2	0	3
PRACTICAL								
7.	CE17411	Soil Mechanics Laboratory	PC	4	0	0	4	2
8.	CE17412	Hydraulic Engineering Laboratory	PC	4	0	0	4	2
9.	HS17461	Advanced Reading and Writing	EEC	2	0	0	2	1
TOTAL				**33**	**15**	**8**	**10**	**24**

SEMESTER V

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	CE17501	Design of Reinforced Concrete Elements	PC	5	3	2	0	4
2.	CE17502	Foundation Engineering	PC	4	2	2	0	3
3.	CE17503	Structural Analysis I	PC	4	2	2	0	3
4.	CE17504	Highway Engineering	PC	4	2	2	0	3
5.		Professional Elective I	PE	3	3	0	0	3
6.		Open Elective I	OE	3	3	0	0	3
PRACTICAL								
7.	CE17511	Construction Materials Laboratory	PC	4	0	0	4	2
8.	CE17512	Survey Camp (2 weeks – During IV Semester Vacation)	EEC	0	0	0	0	2
9.	CE17513	Highway Engineering Laboratory	PC	4	0	0	4	2
TOTAL				**31**	**15**	**8**	**8**	**25**

SEMESTER VI

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	CE17601	Design of Steel Structural Elements	PC	5	3	2	0	4
2.	CE17602	Structural Analysis II	PC	4	2	2	0	3
3.	CE17603	Irrigation Engineering	PC	3	3	0	0	3
4.	CE17604	Water Supply Engineering	PC	4	2	2	0	3
5.	CE17605	Waste Water Engineering	PC	4	2	2	0	3
6.		Open Elective II	OE	3	3	0	0	3
PRACTICAL								
7.	CE17611	Water and Waste Water Analysis Laboratory	PC	4	0	0	4	2
8.	CE17612	Irrigation and Environmental Engineering Drawing	PC	4	0	0	4	2
TOTAL				**31**	**15**	**8**	**8**	**23**

SEMESTER VII

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	CE17701	Estimation, Costing and Valuation Engineering	PC	4	2	2	0	3
2.	CE17702	Railways, Airports, Docks and Harbour Engineering	PC	3	3	0	0	3
3.	CE17703	Structural Design and Drawing	PC	5	3	2	0	4
4.		Professional Elective II	PE	3	3	0	0	3
5.		Professional Elective III	PE	3	3	0	0	3
PRACTICAL								
6.	CE17711	Creative and Innovative Project (Activity Based – Subject Related)	EEC	4	0	0	4	2
7.	CE17712	Industrial Training (4 weeks During VI Semester – Summer)	EEC	0	0	0	0	2
8.	CE17713	Computer Aided Design and Drafting Laboratory	PC	4	0	0	4	2
TOTAL				**26**	**14**	**4**	**8**	**22**

SEMESTER VIII

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.		Professional Elective IV	PE	3	3	0	0	3
2.		Professional Elective V	PE	3	3	0	0	3
PRACTICAL								
3.	CE17811	Project Work	EEC	20	0	0	20	10
TOTAL				**26**	**6**	**0**	**20**	**16**

PROFESSIONAL ELECTIVES

SEMESTER V

ELECTIVE - I

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CE17E51	Advanced Surveying	PE	3	3	0	0	3
2.	CE17E52	Geographic Information System	PE	3	3	0	0	3
3.	CE17E53	Geoinformatics Applications for Civil Engineers	PE	3	3	0	0	3
4.	GE17E51	Human Values and Professional Ethics	PE	3	3	0	0	3
5.	GE17E54	Intellectual Property Rights	PE	3	3	0	0	3

SEMESTER VII
ELECTIVE - II

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CE17E71	Ground Improvement Techniques	PE	3	3	0	0	3
2.	CE17E72	Comprehension in Civil Engineering	PE	3	3	0	0	3
3.	CE17E73	Air Pollution and Control Engineering	PE	3	3	0	0	3
4.	CE17E74	Construction Planning and Scheduling	PE	3	3	0	0	3

SEMESTER VII
ELECTIVE – III

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CE17E75	Pavement Engineering	PE	3	3	0	0	3
2.	CE17E76	Transport and Environment	PE	3	3	0	0	3
3.	CE17E77	Traffic Engineering and Management	PE	3	3	0	0	3
4.	CE17E78	Environmental and Social Impact Assessment	PE	3	3	0	0	3
5.	CE17E79	Municipal Solid Waste Management	PE	3	3	0	0	3

SEMESTER VIII
ELECTIVE – IV

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CE17E81	Water Resources Engineering	PE	3	3	0	0	3
2.	CE17E82	Participatory Water Resources Management	PE	3	3	0	0	3
3.	CE17E83	Ground Water Engineering	PE	3	3	0	0	3
4.	CE17E84	Applied Hydrology	PE	3	3	0	0	3
5.	GE17451	Total Quality Management	PE	3	3	0	0	3

SEMESTER VIII

ELECTIVE – V

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CE17E85	Computer Aided Design of Structures	PE	3	3	0	0	3
2.	CE17E86	Design of Prestressed Concrete Structures	PE	3	3	0	0	3
3.	CE17E87	Maintenance, Repair and Rehabilitation of Structures	PE	3	3	0	0	3
4.	CE17E88	Structural Dynamics and Earthquake Engineering	PE	3	3	0	0	3
5.	CE17E89	Prefabricated Structures	PE	3	3	0	0	3

OPEN ELECTIVES OFFERED TO CIVIL DEPARTMENT

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	OAE1701	Introduction to Aeronautical Engineering	OE	3	3	0	0	3
2.	OAE1702	Fundamentals of Jet Propulsion	OE	3	3	0	0	3
3.	OAE1703	Introduction to space flight	OE	3	3	0	0	3
4.	OAE1704	Industrial Aerodynamics	OE	3	3	0	0	3
5.	OAT1701	Automotive Systems	OE	3	3	0	0	3
6.	OAT1702	Automotive Sensors and Actuators	OE	3	3	0	0	3
7.	OAT1703	Elements of Electric and Hybrid vehicles	OE	3	3	0	0	3
8.	OAT1704	Fundamentals of Automotive Electronics	OE	3	3	0	0	3
9.	OBM1701	Anatomy and Physiology for Engineers	OE	3	3	0	0	3
10.	OBM1702	Biomaterials and Artificial Organs	OE	3	3	0	0	3
11.	OBM1705	Basics of Biosensors and Biophotonics	OE	3	3	0	0	3
12.	OBT1702	Biotechnology in Product Development	OE	3	3	0	0	3
13.	OBT1703	Food and Nutrition	OE	3	3	0	0	3
14.	OBT1704	Medical Sciences for Engineers	OE	3	3	0	0	3
15.	OBT1705	Applications of Biotechnology for Environmental protection	OE	3	3	0	0	3
16.	OCH1701	Introduction to Fertilizer Technology	OE	3	3	0	0	3
17.	OCH1702	Introduction to Petroleum Technology	OE	3	3	0	0	3

18.	OCH1704	Process Technology	OE	3	3	0	0	3
19.	OCH1705	Petrochemical Processing	OE	3	3	0	0	3
20.	OCS1701	Web Design and Management	OE	3	3	0	0	3
21.	OCS1702	Mobile Application Development	OE	3	3	0	0	3
22.	OCS1705	IoT and its Applications	OE	3	3	0	0	3
23.	OCS1706	Programming in C	OE	4	2	0	2	3
24.	OCS1707	Programming in C++	OE	4	2	0	2	3
25.	OCS1708	Java Programming	OE	4	2	0	2	3
26.	OCS1709	Computer Programming	OE	4	2	0	2	3
27.	OEE1701	Renewable Power Generation Systems	OE	3	3	0	0	3
28.	OEE1702	Electrical Safety and Quality Assurance	OE	3	3	0	0	3
29.	OEE1703	Sensors and Transducers	OE	3	3	0	0	3
30.	OEE1704	Electric Power Utilization	OE	3	3	0	0	3
31.	OEE1705	Electrical Machines	OE	3	3	0	0	3
32.	OEC1702	Consumer Electronics	OE	3	3	0	0	3
33.	OEC1703	Digital Image Processing and its Applications	OE	3	3	0	0	3
34.	OEC1704	Pattern Recognition and Artificial Intelligence	OE	3	3	0	0	3
35.	OIT1702	Advanced Python Programming	OE	3	3	0	0	3
36.	OIT1703	Business Intelligence	OE	3	3	0	0	3
37.	OIT1704	Computer Vision	OE	3	3	0	0	3
38.	OIT1705	Cyber Security	OE	3	3	0	0	3
39.	OMT1701	Industrial Robotics	OE	3	3	0	0	3
40.	OMT1702	Elements of Automation	OE	3	3	0	0	3
41.	OMT1705	Mobile Robotics	OE	3	3	0	0	3
42.	OME1702	Industrial Safety	OE	3	3	0	0	3
43.	OME1703	Quality Concept	OE	3	3	0	0	3
44.	OME1704	Fundamentals of Production Engineering	OE	3	3	0	0	3
45.	OME1705	Supply chain and Logistics Management	OE	3	3	0	0	3
46.	OMA1701	Computer based Numerical methods	OE	4	2	0	2	3
47.	OMA1702	Number theory and applications	OE	3	3	0	0	3
48.	OPH1701	Materials Synthesis and Characterization Techniques	OE	3	3	0	0	3

49.	OPH1702	Nanophysics	OE	3	3	0	0	3
50.	OCY1701	Green Chemistry in Energy and Environment	OE	3	3	0	0	3
51.	OCY1702	Interface Chemistry and Engineering	OE	3	3	0	0	3
52.	OGE1701	Human Rights	OE	3	3	0	0	3
53.	OGE1702	Foreign Language - Japanese	OE	3	3	0	0	3
54.	OGE1703	Foreign Language - German	OE	3	3	0	0	3
55.	OGE1704	Foreign Language - French	OE	3	3	0	0	3

SUMMARY

Sl. No.	SUBJECT AREA	CREDITS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1	HS	3	6	-	-	-	-	-	-	9
2	BS	12	7	4	4	-	-	-	-	27
3	ES	9	8	3	-	-	-	-	-	20
4	PC	-	2	16	19	17	20	12	-	86
5	PE	-	-	-	-	3	-	6	6	15
6	OE	-	-	-	-	3	3	-	-	06
7	EEC	-	-	1	1	2	-	4	10	18
	Total	24	23	24	24	25	23	22	16	181

HS17151 COMMUNICATIVE ENGLISH L T P C

(Common to all branches of B.E. / B.Tech. programmes) 3 0 0 3

OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 9

Reading- short comprehension passages, practice in skimming-scanning and predicting. Writing- completing sentences- developing hints. Listening- short texts- short formal and informal conversations. Speaking- introducing oneself - exchanging personal information- Language development- Wh Questions- asking and answering yes or no questions. Subject-Verb agreement – regular and irregular verbs. Vocabulary development- prefixes- suffixes- articles.

UNIT II GENERAL READING AND FREE WRITING 9

Reading – comprehension - pre-reading-post reading - comprehension questions (multiple choice questions and /or short questions/ open-ended questions) - inductive reading - short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts) - register. Writing – paragraph writing - topic sentence - main ideas - free writing, short narrative descriptions using some suggested vocabulary and structures. Listening - telephonic conversations. Speaking – sharing information of a personal kind - greeting – taking leave. Language development – prepositions, conjunctions. Vocabulary development - guessing meanings of words in context.

UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 9

Reading - short texts and longer passages (close reading). Writing - understanding text structure - use of reference words and discourse markers – coherence - jumbled sentences. Listening – listening to longer texts and filling up the table - product description - narratives from different sources. Speaking - asking about routine actions and expressing opinions. Language development - degrees of comparison – pronouns - direct vs indirect questions. Vocabulary development – single word substitutes - adverbs.

UNIT IV READING AND LANGUAGE DEVELOPMENT 9

Reading - comprehension-reading longer texts - reading different types of texts - magazines. Writing - letter writing, informal or personal letters-emails - conventions of personal email. Listening - listening to dialogues or conversations and completing exercises based on them. Speaking- speaking about oneself- speaking about one's friend. Language development- Tenses- simple present-simple past- present continuous and past continuous. Vocabulary development- synonyms-antonyms- phrasal verbs

UNIT V EXTENDED WRITING 9

Reading- longer texts- close reading. Writing- brainstorming - writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing. Listening – listening to talks- conversations. Speaking – participating in conversations- short group conversations. Language development-modal verbs- present/ past perfect tense. Vocabulary development-functional uses of tenses.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions.
- Comprehend conversations and short talks delivered in English
- Express ideas about oneself freely
- Write short essays of a general kind and personal letters and emails in English.

TEXT BOOKS:

1. Board of Editors. Using English A Coursebook for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015.
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

REFERENCES:

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge,2011.
2. Means,L. Thomas and Elaine Langlois. English & Communication For Colleges. Cengage Learning ,USA: 2007
3. Redston, Chris &Gillies Cunningham Face2Face (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005
4. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
5. Dutt P. Kiranmai and RajeevanGeeta. Basic Communication Skills, Foundation Books: 2013

MA17151	ENGINEERING MATHEMATICS I	L	T	P	C
	Common to all branches of B.E. / B.Tech. Programmes	**3**	**2**	**0**	**4**

OBJECTIVES:

- To learn the basics and concepts of traditional calculus.
- To provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions.
- To understand the concepts of single variable and multivariable calculus that plays an important role in the field of science, engineering & technology.

UNIT I MATRICES 15

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II DIFFERENTIAL CALCULUS 15

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 15

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV INTEGRAL CALCULUS 15

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts – Bernoulli's formula, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT V MULTIPLE INTEGRALS 15

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

TOTAL : 75 PERIODS

OUTCOMES:

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

- Apply the concept of Eigen values and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices for solving problems
- Use the techniques of differentiation to differentiate functions and to apply the concept of differentiation to solve maxima and minima problems.
- To apply the concept of Partial differentiation for functions two or more variables and use different techniques for solving problems.
- Solve problems involving integration using different methods such as substitution, partial fractions, by parts .
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.

REFERENCES:

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016.
6. Veerarajan T, Engineering Mathematics I & II, McGraw Hill Education, 3rd Edition, 2012.

PH 17151	ENGINEERING PHYSICS	L	T	P	C
	Common to all branches of B.E. / B.Tech. Programmes	**3**	**0**	**0**	**3**

OBJECTIVE:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER 9

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams –area moment of inertia - bending moment – cantilever - applications – uniform and non-uniform bending- I-shaped girders - stress due to bending in beams.

UNIT II WAVES AND OPTICS 9

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers: population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) –CO_2 laser - Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibers (material, refractive index and mode) – losses associated with optical fibers - fiber optic sensors: pressure and displacement.

UNIT III THERMAL PHYSICS 9

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation –rectilinear heat flow – thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

UNIT IV QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunnelling (qualitative) – electron microscope – scanning tunnelling microscope.

UNIT V CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances -reciprocal lattice - coordination number and packing factor for SC, BCC, FCC, and HCP –Polymorphism and allotropy: diamond and graphite structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

TOTAL :45 PERIODS

OUTCOMES:

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

- Apply the knowledge of basic properties of matter and its applications in Engineering and Technology.
- Use the concepts of waves and optical devices and their applications in fiber optics.
- Use the concepts of thermal properties of materials and their applications in heat exchangers.
- Use the advanced physics concepts of quantum theory and its applications in electron microscope and material sciences.
- Apply the basic knowledge of crystallography in materials preparation and device fabrication.

TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. &Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.

REFERENCES:

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. "Physics for Scientists and Engineers with Modern Physics'. W.H. Freeman, 2007.
4. Arthur Besier and S. RaiChoudhury,Concepts of Modern Physics (SIE), 7th edition, McGraw-Hill Education, 1994.

5. Murugeshan R and KiruthigaSivaprasath, Modern Physics, S.Chand, 2015.

CY17151	ENGINEERING CHEMISTRY	L	T	P	C
	Common to all branches of B.E. / B.Tech. Programmes	**3**	**0**	**0**	**3**

OBJECTIVES:

- To acquire knowledge on characteristics of boiler feed water and water treatment techniques.
- To develop an understanding on surface chemistry and its applications.
- To develop an understanding of the basic concepts of phase rule and its applications towards alloying.
- To acquire knowledge on different types of fuels and its characteristics.
- To obtain knowledge on batteries and fuel cell.

UNIT I WATER AND ITS TREATMENT 9

Hardness of water – types – expression of hardness – units– boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) - External treatment – ion exchange process, zeolite process – potable water treatment – break point chlorination - desalination of brackish water - Reverse Osmosis – UASB process (Upflow Anaerobic Sludge Blanket).

UNIT II SURFACE CHEMISTRY AND CATALYSIS 9

Adsorption - types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – Preparation and applications of activated carbon (up flow and down flow process) -applications of adsorption on pollution abatement.

Catalysis – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis – Michaelis – Menten equation.

UNIT III PHASE RULE, ALLOYS AND COMPOSITES 9

Phase rule - introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

Alloys - definition- properties of alloys- significance of alloying- functions and effect of alloying elements- nichrome and stainless steel (18/8) – heat treatment of steel.

Composites- polymer matrix composites -metal matrix composites-ceramic matrix composites.

UNIT IV FUELS AND COMBUSTION 9

Fuels - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gas (LPG) - power alcohol and biodiesel.

Combustion of fuels - introduction - calorific value - higher and lower calorific values- theoretical Calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range.

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9

Batteries - components – Characteristics – voltage , current , capacity, electrical storage density, energy density, discharge rate – types of batteries – primary battery (dry cell)- secondary battery (lead acid battery,

Ni- Cd battery, lithium-ion-battery) .Fuel cells – H_2-O_2 fuel cell, methanol oxygen fuel cell, Proton exchange membrane fuel cell – SOFC and Biofuel cells.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, students will be able to

- Get familiarized on water treatment techniques.
- Apply adsorption phenomena on various fields.
- Analyse alloying composition based on phase rule concept.
- Apply the role of fuels in day today applications.
- Design batteries and fuel cells.

TEXT BOOKS:

1. Jain P C and Monika Jain, "Engineering Chemistry" 17th edition,DhanpatRai Publishing Company (P) LTD, New Delhi, 2015
2. Vairam S, Kalyani P and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.
4. Dara S S and Umare S S, "A Textbook of Engineering Chemistry", 12th edition, S. Chand & Company LTD, New Delhi, 2015.

GE17151	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the basics of algorithmic problem solving.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING 9

Introduction to computers - characteristics - basic organization of a computer – algorithms - building blocks of algorithms (instructions/statements, state, control flow, functions) - notation (pseudo code, flow chart, programming language) - algorithmic problem solving - simple strategies for developing algorithms (iteration, recursion).

UNIT II DATA, EXPRESSIONS, STATEMENTS AND CONTROL FLOW 9

Python interpreter and interactive mode - values and types - data types – variables – keywords - expressions and statements - python I/O - operators - precedence of operators – comments. Conditionals: conditional (if) - alternative (if-else) - chained conditional (if-elif-else) – nested conditional. Iteration: while – for - break – continue – pass. Illustrative programs: exchange the values of two variables - circulate the values of n variables - test for leap year.

UNIT III FUNCTIONS 9

Function calls – type conversion – math function – composition - definition and use - flow of execution - parameters and arguments. Fruitful functions: return values – parameters - scope: local and global - recursion. Strings: string slices – immutability - string functions and methods - string comparison. Illustrative programs: square root – GCD – exponentiation - sum the array of numbers - linear search - binary search.

UNIT IV COMPOUND DATA: LISTS, TUPLES AND DICTIONARIES 9

Lists - list operations - list slices - list methods - list loop – mutability – aliasing - cloning lists - list parameters. Tuples – immutable - tuple assignment - tuple as return value. Dictionaries: operations and methods – dictionaries and tuples – dictionaries and lists. Advanced list processing - list comprehension. Illustrative programs: Sorting.

UNIT V FILES, MODULES AND PACKAGES 9

Files and exception: file operation - text files - reading and writing files - format operator- command line arguments - errors and exceptions - handling exceptions – writing modules – packages. Illustrative programs: word count - copy file – case studies.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Develop algorithmic solutions to simple computational problems.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples and dictionaries.
- Read and write data from/to files in Python programs.

TEXT BOOK:

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)

REFERENCES:

1. Anita Goel, Ajay Mittal, Computer Fundamentals and programming in C, Pearson India Publisher, First edition, 2013.
2. John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd. 2015.
5. Kenneth A. Lambert, Fundamentals of Python: First Programs, CENGAGE Learning, 2012.
6. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.

The Python Tutorial, https://docs.python.org/2.7/tutorial/

GE17152	ENGINEERING GRAPHICS	L	T	P	C
	Common to all B.E and B.Tech Programmes	**2**	**0**	**4**	**4**

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.

- To expose them to existing national standards related to technical drawings.
- To study different type of projections and practice him on free hand sketching.

CONCEPTS AND CONVENTIONS (Not for Examination) 1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves- Construction of helical curve.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5 +12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6 + 12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL: 90 PERIODS

OUTCOMES:

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

- Drawbasic geometrical constructions of plane curves and freehand sketching of multiple views of objects.
- Draw the orthographic projection of lines and plane surfaces.
- Draw the projections solids.
- Draw the true shape of the sectioned solid and development of surfaces.
- Draw the isometric and perspective sections of simple solids.

TEXT BOOKS:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.

REFERENCES:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
3. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
5. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

SPECIAL POINTS APPLICABLE TO END SEMESTER EXAMINATIONS ON ENGINEERING GRAPHICS:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

GE17161	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To be familiar with the use of office package exposed to presentation and visualization tools.
- To implement Python programs with conditionals and loops.
- To use functions for structuring Python programs.
- To represent compound data using Python lists, tuples and dictionaries.
- To read and write data from/to files in Python.

LIST OF PROGRAMS

1. Search, generate, manipulate data using Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem Solving using Algorithms and Flowcharts

4. Compute the GCD of two numbers.
5. Find the square root of a number (Newton's method)
6. Exponentiation (power of a number)
7. Linear search and Binary search
8. First n prime numbers
9. Find the maximum of a list of numbers
10. Sorting
11. Removing all the duplicate elements in a list
12. Multiply matrices
13. Programs that take command line arguments (word count)
14. Find the most frequent words in a text read from a file
15. Mini Project

TOTAL: 60 PERIODS

PLATFORM NEEDED:

Hardware: PC with 2 GB RAM, i3 Processor

Software: Python 3 interpreter for Windows/Linux

OUTCOMES:

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

- Develop documentation, presentation and visualization charts.
- Implement Python programs with conditionals and loops.
- Develop Python programs stepwise by defining functions and calling them.
- Use Python lists, tuples and dictionaries for representing compound data.
- Read and write data from/to files in Python

GE17162	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
	Common to all branches of B.E/B.Tech programmes	**0**	**0**	**4**	**2**

OBJECTIVE:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, and properties of matter.
- To impart practical skills in water quality parameter analysis, spectrophotometry, flame photometry and corrosion rate determination.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

LIST OF EXPERIMENTS: CHEMISTRY LABORATORY (Any 7 Experiments)

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.

2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Determination of strength of given hydrochloric acid using pH meter.
6. Estimation of iron content of the given solution using potentiometer.
7. Conductometric titration of strong acid vs strong base.
8. Determination of strength of acids in a mixture of acids using conductivity meter.
9. Estimation of copper content of the given solution by Iodometry.
10. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
11. Estimation of sodium and potassium present in water using flame photometer.
12. Corrosion experiment-weight loss method.

OUTCOMES:

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

- Calculate elastic properties of materials, such as Young's modulus & Rigidity modulus (of solids) and Bulk modulus (through compressibility of liquids).
- Measure various optical and thermal properties of materials (such as wavelengths of spectral lines & Laser source, acceptance angle &numerical aperture of fiber optical cable and thermal conductivity of media).
- Analyse water quality parameters.
- Be familiar in the use of instruments for chemical analysis.
- Measure the corrosion rate in metals.

TOTAL: 30 PERIODS

TEXTBOOKS:

- Vogel's Textbook of Quantitative Chemical Analysis (8^{TH} edition, 2014)

HS17251	TECHNICAL ENGLISH	L	T	P	C
	Common to all branches of B.E/B.Tech programmes	**3**	**0**	**0**	**3**

OBJECTIVES:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

UNIT I INTRODUCTION TO TECHNICAL ENGLISH 9

Listening- listening to talks mostly of a scientific/technical nature and completing information-gap exercises. Speaking – asking for and giving directions. Reading – reading short technical texts from journals-newspapers. Writing- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations. Vocabulary Development- technical vocabulary. Language Development –subject verb agreement - compound words.

UNIT II READING AND STUDY SKILLS 9

Listening- listening to longer technical talks and completing exercises based on them. Speaking – describing a process. Reading – reading longer technical texts- identifying the various transitions in a text- paragraphing. Writing- interpreting charts, graphs. Vocabulary Development-vocabularyused in formal letters/emails and reports. Language Development- impersonal passive voice, numerical adjectives.

UNIT III TECHNICAL WRITING AND GRAMMAR 9

Listening- listening to classroom lectures/ talks on engineering/technology. Speaking – introduction to technical presentations. Reading – longer texts both general and technical, practice in speed reading. Writing- Describing a process, use of sequence words. Vocabulary Development- sequence words. Misspelled words. Language Development- embedded sentences

UNIT IV REPORT WRITING 9

Listening- listening to documentaries and making notes. Speaking – mechanics of presentations. Reading – reading for detailed comprehension. Writing- email etiquette- job application – cover letter. Résumé preparation(via email and hard copy)- analytical essays and issue based essays. Vocabulary Development- finding suitable synonyms-paraphrasing. Language Development- clauses- if conditionals.

UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 9

Listening- TED talks; Speaking –participating in a group discussion. Reading– reading and understanding technical articles. Writing– writing reports- minutes of a meeting- accident and survey. Vocabulary Development- verbal analogies, foreign words and phrases Language Development- reported speech, common errors in English.

TOTAL : 45 PERIODS

OUTCOMES:

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

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.
- Write error free language.

TEXT BOOKS:

1. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

REFERENCES:

1. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice.Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007
6. Students can be asked to read Tagore and Chetan Bhagat for supplementary reading.

HS17252	PROFESSIONAL ENGLISH COMMUNICATION Common to all branches of B.E/ B.Tech programmes	L	T	P	C
		3	0	0	3

OBJECTIVES

- To prepare students to be competent in a global business environment.
- To think accurately, clearly and deeply in communicative contexts.
- To improve career opportunities – get English language skills that are needed to be successful.

UNIT-I CRITICAL / INFORMATIONAL LISTENING 9

Short conversations or Monologues – Listening for specific information- Conversations or Monologues with factual information- listen to fill up missing information- business related discussions or interview (two or more speakers).

UNIT-II CONVERSATIONAL/ PRESENTATION SKILLS 9

Speak about oneself - Face-to-face speaking for real-life context – pick and talk - personal opinion on business related topics- mini presentations on a business theme- discussion with another candidate on business related topics.

UNIT-III INTENSIVE/ EXTENSIVE READING AND INTERPRETING 9

Short texts (signs, messages, emails, labels and notes) -Short descriptions-graph or chart. Reading to find factual information- decision making from a written text- a leaflet or a newspaper- magazine or article- reading to understand correct grammar, contextually- reading to understand the structure of a text-read and transfer information from memos, advertisements, notices.

UNIT-IV FORMAL COMMUNICATION 9

Business Correspondence - writing business letters to people outside the company. Internal Company Communication- a note, a message, a memo or an email.

UNIT – V VERBAL ABILITY/ FUNCTIONAL GRAMMAR 9

Grammar – tenses – concord- prepositions – articles- punctuations. Vocabulary – advanced vocabulary – synonyms and antonyms. Sentence correction – sentence completion - cloze passage - verbal reasoning: analogies, meaning-usage match.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Listen to, understand and give opinions in meetings.
- Apply for new jobs and develop their career.
- Write short business messages and reports.
- Use language in both official and unofficial contexts.
- Speak effectively in business communication

TEXT BOOK:

1. Board of Editors. Sure Outcomes. A Communication Skills Course for Undergraduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad, 2013.

REFERENCE BOOKS:

1. Hartley, Mary. “The Power of Listening,” Jaico Publishing House; First Edition (2015).

2. Chambers, Harry. "Effective Communication Skills for Scientific and Technical Professionals," Persues Publishing, Cambridge, Massachusetts, 2000.
Lesikar V. Raymond, Flatley E. Marie, Rentz, Kathryn and Pande, Neerja. "Business Communication," Eleventh Edition, Tata McGraw Hill Education Private Limited.

MA17251	ENGINEERING MATHEMATICS II Common to all branches of B.E, B.Tech programmes	L	T	P	C
		3	2	0	4

OBJECTIVES:

- To handle practical problems arising in the field of engineering and technology.
- To solve problems using the concept of Differential Equation, Vectors calculus, Complex analysis, Laplace transforms.

UNIT I DIFFERENTIAL EQUATIONS 15

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

UNIT II VECTOR CALCULUS 15

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals (cubes and parallelepipeds).

UNIT III ANALYTIC FUNCTIONS 15

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w = z + c, cz, \frac{1}{z}, z^2$ - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 15

Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

UNIT V LAPLACE TRANSFORMS 15

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

TOTAL: 75 PERIODS

OUTCOMES:

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

- Apply various techniques in solving differential equations.

- Use the concept of Gradient, divergence and curl of a vector point function and related identities in different areas of Engineering.
- Evaluate line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Use the concept of Analytic functions, conformal mapping and complex integration for solving problems.
- Use Laplace transform and inverse transform techniques in solving differential equations.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3rd Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
6. Veerarajan T, Engineering Mathematics I & II, McGraw Hill Education, 3rd Edition, 2012.

PH17257	PHYSICS FOR CIVIL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To introduce the principles of thermal, acoustics, optics and new materials for civil engineering applications

UNIT I THERMAL PERFORMANCE OF BUILDINGS 9

Heat transfer through fenestrations, thermal insulation and its benefits - heat gain and heat loss estimation - factors affecting the thermal performance of buildings, thermal measurements, thermal comfort, indices of thermal comfort, climate and design of solar radiation, shading devices - central heating. Principles of natural ventilation - ventilation measurements, design for natural ventilation - Window types and packaged air conditioners - chilled water plant - fan coil systems - water piping - cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C. Systems.

UNIT II ACOUSTICS 9

Classification of sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination – factors affecting acoustics of buildings and their remedies. Methods of sound absorption - absorbing materials - noise and its measurements, sound insulation and its measurements, impact of noise in multi - storeyed buildings.

UNIT III LIGHTING DESIGNS 9

Radiation quantities – spectral quantities – relationship between luminescence and radiant quantities – hemispherical reflectance and transmittance – photometry: cosines law, inverse square law. Vision – photopic, mesopic, scotopic visions. Colour – luminous efficiency function - Visual field glare, colour - day light calculations - day light design of windows, measurement of day-light and use of models and artificial skies, principles of artificial lighting, supplementary artificial lighting.

UNIT IV NEW ENGINEERING MATERIALS 9

Composites - definition and classification - Fibre reinforced plastics (FRP) and fiber reinforced metals (FRM) - Metallic glasses - Shape memory alloys - Ceramics - Classification - Crystalline - Non Crystalline - Bonded ceramics, Manufacturing methods - Slip casting - Isostatic pressing - Gas pressure bonding - Properties - thermal, mechanical, electrical and chemical. Ceramic fibres - ferroelectric and ferromagnetic ceramics - High Aluminium ceramics.

UNIT V HAZARDS 9

Seismology and Seismic waves - Earth quake ground motion - Basic concepts and estimation techniques - site effects - Probabilistic and deterministic Seismic hazard analysis - Cyclone and flood hazards - Fire hazards and fire protection, fire-proofing of materials, fire safety regulations and firefighting equipment - Prevention and safety measures.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, students will be able to

- Apply the knowledge of the thermal performance of buildings.
- Apply the knowledge of acoustic properties for construction of buildings.
- Get knowledge on various lighting designs for buildings.
- Use of properties and performance of engineering materials.
- Analyze the hazards occur in buildings.

TEXT BOOKS:

1. Alexander D. “Natural disaster”, Springer (1993).
2. Budinski K.G. & Budinski M.K. “Engineering Materials Properties and Selection”, Prentice Hall, 2009.
3. Severns W.H. & Fellows J.R. “Air conditioning and Refrigeration”, John Wiley and Sons, London, 1988.
4. Stevens W.R., “Building Physics: Lighting: Seeing in the Artificial Environment, Pergaman Press, 2013.

REFERENCES:

1. Gaur R.K. and Gupta S.L., Engineering Physics. Dhanpat Rai publishers, 2012.
2. Reiter L., “Earthquake hazard analysis - Issues and insights”, Columbia University Press, 1991.
3. Shearer P.M., “Introduction to Seismology”, Cambridge University Press, 1999.

		L	T	P	C
EE17251	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To impart knowledge on Electrical Circuits, and measuring instruments.
- To study the working principle of Electrical Machines.
- To expose to the construction and operation of various electronic devices.
- To provide knowledge on digital electronics.
- To impart knowledge on working of various communication systems.

UNIT I ELECTRICAL CIRCUITS & MEASURMENTS 9

Fundamental laws of electric circuits– Steady State Solution of DC Circuits – Introduction to AC Circuits – Sinusoidal steady state analysis– Power and Power factor – Single Phase and Three Phase Balanced Circuits. Classification of instruments – Operating Principles of indicating Instruments

UNIT II ELECTRICAL MACHINES 9

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 9

Introduction - Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV DIGITAL ELECTRONICS 9

Binary Number System – boolean algebra theorems– Digital circuits - Introduction to sequential Circuits– Flip-Flops – Registers and Counters – A/D and D/A Conversion –digital processing architecture.

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 9

Introduction – Elements of Communication Systems– Modulation and Demodulation: Principles of Amplitude and Frequency Modulations. Digital Communication - Communication Systems: Radio, Antenna, TV, Fax, ISDN, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 45 PERIODS

OUTCOMES:

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

- Realize the working principles of electrical circuits and measuring instruments.
- Realize the working principle of electrical machines
- Realize the working principle and operation of various electronic devices.
- Understand and verify the truth table of Logic gates, Adders, Flip-Flops, Registers and Counters.
- Analyze the working principles of various communication systems.

TEXT BOOKS:

1. D P Kothari and I.J Nagarath, ”Electrical Machines “Basic Electrical and Electronics Engineering”, McGraw Hill Education(India) Private Limited, Third Reprint ,2016
2. S.K.Bhattacharya “Basic Electrical and Electronics Engineering”, Pearson India, 2011
3. Sedha R.S., “Applied Electronics”, S. Chand & Co., 2006

REFERENCES:

1. A.E.Fitzgerald, David E Higginbotham and Arvin Grabel, “Basic Electrical Engineering”, McGraw Hill Education(India) Private Limited, 2009
2. Del Toro, “Electrical Engineering Fundamentals”, Pearson Education, New Delhi, 2007

3. Leonard S Bobrow, " Foundations of Electrical Engineering", Oxford University Press, 2013
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
5. Mehta V K, "Principles of Electronics", S.Chand& Company Ltd, 1994.
6. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.
7. A.E.Fitzgerald, David E Higginbotham and Arvin Grabel, "Basic Electrical Engineering", McGraw Hill Education(India) Private Limited, 2009
8. N K De, Dipu Sarkar, "Basic Electrical Engineering", Universities Press (India)Private Limited 2016
9. Thereja .B.L., "Fundamentals of Electrical Engineering and Electronics", S. Chand & Co. Ltd., 2008

CY17251	ENVIRONMENTAL SCIENCE AND ENGINEERING Common to B.E. (Aero, Auto, Mech, Civil, BME & MCT) B.Tech (B.T, IT, Chemical and FT)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To find the scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To study the importance of environment by assessing its impact on the human world.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 12

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the forest ecosystem - grassland ecosystem - desert ecosystem - aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – Significance of medicinal plants – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT II ENVIRONMENTAL POLLUTION 10

Definition - causes, effects and control measures of Air pollution (Atmospheric chemistry - Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry- Mitigation procedures - Control of particulate and gaseous emission, Control of SO_2, NO_X, CO and HC) - Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance - Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – Marine pollution - Noise pollution - Thermal pollution - Nuclear hazards– e-Waste – toxic substances in e-waste – risks related to toxic substances – role of an individual in prevention of pollution – pollution case studies.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources - energy production from waste materials. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization environmental ethics: Issues and possible solutions – Principles of green chemistry - nuclear accidents and holocaust, case studies – wasteland reclamation – consumerism and waste products – environment protection act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labelling of environmentally friendly products (Eco-mark). Enforcement machinery involved in environmental legislation- central and state pollution control boards - disaster management: floods, earthquake, cyclone and landslides. Public awareness and case studies.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – Dengue fever- Swine flu – women and child welfare – Environmental impact analysis (EIA)- GIS-remote sensing - role of information technology in environment and human health – Case studies. Effect of Radiation from computing devices.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Solve problems that cannot be solved by mere laws.
- Get familiarized with ecological balance.
- Get public awareness of environment at infant stage.
- Find ways to protect the environment and play proactive roles.
- Develop and improve the standard of better living.

TEXTBOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', 2nd edition, Tata McGraw-Hill, New Delhi,2008.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

REFERENCES:

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, 2007.
2. ErachBharucha, "Textbook of Environmental Studies", 3rd edition, Universities Press(I) Pvt, Ltd, Hydrabad, 2015.

3. Tyler G Miller and Scott E. Spoolman, "Environmental Science", 15th edition, Cengage Learning India PVT, LTD, Delhi, 2014.
4. Rajagopalan R, 'Environmental Studies-From Crisis to Cure', 3rdedition,Oxford University Press,2015.

GE17251 ENGINEERING MECHANICS L T P C
(Common to Mech, Aero, Auto, Civil and MCT) 2 2 0 3

OBJECTIVES:

- To understand the basics of mechanics and apply the concept of equilibrium to solve problems of concurrent forces
- To understand the concept of equilibrium and to solve problems of rigid bodies
- To learn about the center of gravity and moment of inertia of surfaces and solids
- To learn the basic concepts of friction
- To learn the concepts in kinematics and kinetics of rigid bodies in plane motion.

UNIT I STATICS OF PARTICLES 12

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

Centroids and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 12

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND RIGID BODY DYNAMICS 12

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction - Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Understand the basics of Mechanics.
- Solve problems in engineering systems using the concept of static equilibrium
- Determine the centroid of objects such as areas and volumes, center of mass of body and moment of inertia of composite areas
- Solve problems involving kinematics and kinetics of rigid bodies in plane motion
- Solve problems involving frictional phenomena in machines

TEXT BOOKS:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.

REFERENCES:

1. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
2. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
3. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.
4. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
5. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

GE17261	**ENGINEERING PRACTICES LABORATORY**	**L T P C**
	(Common to all Branches of B.E/B.Tech)	**0 0 4 2**

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE **15**

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.

(b) Study of pipe connections requirements for pumps and turbines.

(c) Preparation of plumbing line sketches for water supply and sewage works.

(d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.

(b) Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 15

Welding:

(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.

(b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning

(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:

(b) Model making – Trays and funnels.

(c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump

(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.

(b) Foundry operations like mould preparation for gear and step cone pulley.

(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 15

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of earth resistance.

IV ELECTRONICS ENGINEERING PRACTICE 15

1. Study of Electronic components and equipments – Resistance measurement using colour coding, Study of Function Generator and CRO. Measurement of AC signal parameters (peak-peak, RMS, Time period & frequency).
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL= 60 PERIODS

OUTCOMES:

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

- Fabricate carpentry components
- Fit pipe connections including plumbing works.
- Use welding equipment's to join the structures.
- Construct different types of wiring circuits.
- Construct electrical and electronic circuits.

CE17211	COMPUTER AIDED BUILDING DRAWING	L	T	P	C
		0	0	4	2

OBJECTIVE:

- To introduce the students to draft the plan, elevation and sectional views of buildings in accordance with development and control rules satisfying orientation and functional requirements as per National Building Code.

LIST OF EXPERIMENTS

1. Principles of planning, orientation and complete joinery details (Paneled and Glazed Doors and Windows)
2. Buildings with load bearing walls
3. Buildings with sloping roof
4. R.C.C. framed structures.
5. Industrial buildings – North light roof structures
6. BIM

TOTAL: 60 PERIODS

OUTCOME:

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

- Draft the plan, elevation and sectional views of the buildings, industrial structures and framed buildings using computer software.

TEXTBOOKS:

- Sikka V.B., A Course in Civil Engineering Drawing, 4th Edition, S.K.Kataria and Sons, 2015.
- George Omura, Mastering in AutoCAD 2005 and AutoCAD LT 2005– BPB Publications.

REFERENCES:

1. Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston, BIM Hand book: A Guide to building information modeling for Owners, Managers, Designers, Engineers, and Contractors, John Wiley and Sons. Inc., 2011.
2. Marimuthu V.M., Murugesan R. and Padmini S., Civil Engineering Drawing-I, Pratheeba Publishers, 2008.
3. Shah M.G, Kale. C.M. and Patki.S.Y., Building Drawing with an Integrated Approach to Built Environment, Tata McGraw Hill Publishers Limited, 2007.
4. Verma B.P., Civil Engineering Drawing and House Planning, Khanna Publishers, 2010

MA 17351	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	2	0	4

OBJECTIVES

- To introduce Fourier series which is central to many applications in engineering apart from its use in solving boundary value problems.

- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 15

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order PDE:$f(p,q)=0, f(z,p,q)=0, z=px+qy+f(p,q), f(x,p)=f(y,q)$ - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of homogeneous type.

UNIT II FOURIER SERIES 15

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series –Half range cosine series – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 15

Classification of PDE – Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT IV FOURIER TRANSFORMS 15

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity - Application to boundary value problems.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 15

Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z-transform.

TOTAL: 75 PERIODS

OUTCOMES:

On completion of the course, students will be able to

- Develop skills to solve different types of partial differential equations
- Develop skills to construct Fourier series for different periodic functions and to evaluate infinite series.
- Classify different types of PDE and solve boundary value problems.
- Develop skills to solve differential equations using Fourier transform techniques.
- Solve difference equations using Z – transforms that arise in discrete time systems.

TEXT BOOKS:

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt.Ltd.,New Delhi, Second reprint, 2012.
2. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2014.

REFERENCES:

1. Bali N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, LaxmiPublications Pvt Ltd, 2007.

2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.
5. Ray Wylie C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
6. Datta K.B., "Mathematical Methods of Science and Engineering", Cengage Learning IndiaPvt Ltd, Delhi, 2013.

CE17301 ENGINEERING GEOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To acquire geological knowledge on structure of earth, weathering phenomena & plate tectonics.
- To gain an understanding on the physical properties of minerals.
- To develop an ability to classify the rocks, distinguish between Igneous, Sedimentary and Metamorphic rocks and gain knowledge in engineering properties of rocks.
- To acquire knowledge on structural geology and various geophysical methods.
- To develop an understanding on the importance of geological aspects in projects such as dams, tunnels, bridges, roads, airport and harbour.

UNIT I PHYSICAL GEOLOGY 9

Geology in civil engineering – branches of geology – structure of earth and its composition - weathering of rocks – scale of weathering – soils - landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering. Plate tectonics – Earth quakes – Seismic zones in India.

UNIT II MINEROLOGY 9

Physical properties of minerals – Quartz group, Feldspar group, Pyroxene - hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals.

UNIT III PETROLOGY 9

Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

UNIT IV STRUCTURAL GEOLOGY AND GEOPHYSICAL METHODS 9

Geological maps – attitude of beds, study of structures – folds, faults and joints – relevance to civil engineering. Geophysical methods – Seismic and electrical methods for subsurface investigations.

UNIT V APPLICATION OF GEOLOGICAL INVESTIGATIONS 9

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings - Hydrogeological investigations and mining - Coastal protection structures. Investigation of Landslides, causes and mitigation.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Get familiarized with the structure of earth, process of weathering &the phenomena of plate tectonics.

- Assess the physical properties of minerals and identify the various minerals.
- Classify the rocks, able to distinguish between Igneous, Sedimentary and Metamorphic rocks.
- Know the effects of fold, fault plane & joints and use of various geophysical methods.
- Use of geological aspects in projects such as dams, tunnels, bridges, roads, airport and harbour.

TEXT BOOKS:

1. Varghese, P.C., Engineering Geology for Civil Engineering Prentice Hall of India Learning Private Limited, New Delhi, 2012.
2. Venkat Reddy. D. Engineering Geology, Vikas Publishing House Pvt. Lt, 2010.
3. Gokhale KVGK, "Principles of Engineering Geology", B.S. Publications, Hyderabad 2011.
4. Chenna Kesavulu N. "Textbook of Engineering Geology", Macmillan India Ltd., 2009.
5. Parbin Singh. A "Text book of Engineering and General Geology", Katson publishing house, Ludhiana 2009.

REFERENCES:

1. Muthiayya, V.D. " A Text of Geology", Oxford IBH Publications, Calcutta, 1969
2. Blyth F.G.H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2010.
3. Bell .F.G.. "Fundamentals of Engineering Geology", B.S. Publications. Hyderabad 2011.
4. Dobrin, M.B "An introduction to geophysical prospecting", McGraw Hill, New Delhi, 1988.

CE17302	CONSTRUCTION MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge on masonry elements, their properties and applications in construction.
- To gain knowledge on lime, cement and aggregates and their properties.
- To provide students knowledge on basic properties of concrete and its mix design concepts.
- To acquire knowledge on timber and its forms, steel, aluminium, paints and bitumen.
- To know the applications of modern construction materials.

UNIT I STONES – BRICKS – CONCRETE BLOCKS 9

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Cement, Concrete blocks – Light weight concrete blocks.

UNIT II LIME – CEMENT – MORTAR - AGGREGATES 9

Lime – Preparation of lime mortar – Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Compressive strength – Tensile strength – Fineness– Soundness and consistency – Setting time – Industrial by-products – Fly ash – Aggregates – Natural stone aggregates – Crushing strength – Impact strength – Flakiness Index– Elongation Index – Abrasion Resistance – Grading – Sand Bulking.

UNIT III CONCRETE 9

Concrete – Ingredients – Manufacturing Process – Batching plants – mixing – transporting – placing – compaction of concrete – curing and finishing – Ready mix Concrete – Properties of fresh concrete – Slump

– Flow and compaction Factor – Properties of hardened concrete – Compressive, Tensile and shear strength – Modulus of rupture – Tests – Mix specification – Mix proportioning – BIS method - High Strength Concrete – Extreme Weather Concreting.

UNIT IV TIMBER AND OTHER MATERIALS 9

Timber – Market forms – Industrial timber – Plywood – Veneer – Thermocole – Panels of laminates – Steel – Aluminium and Other Metallic Materials – Composition – Aluminium composite panel – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Bitumens.

UNIT V MODERN MATERIALS 9

Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement – Introduction to Sustainable construction materials.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Get familiarized with stone, brick and concrete blocks, their properties and applications.
- Assess the properties of lime, cement and aggregates, their properties and usage.
- Get familiarized with concrete, its manufacturing, application and testing.
- Asses the properties of timber, steel, aluminium, paints and bitumen and their applications.
- Get familiarized with the modern construction materials and their applications in the construction.

TEXT BOOKS:

1. Varghese.P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2015.
2. Rajput. R.K., "Engineering Materials", S. Chand and Company Ltd., 2008.
3. Shetty.M.S., "Concrete Technology (Theory and Practice)", S. Chand and Company Ltd.,2013.
4. Gambhir.M.L., "Concrete Technology", 3rd Edition, Tata McGraw Hill Education, 2004.
5. Duggal.S.K., "Building Materials", 4th Edition, New Age International, 2008.

REFERENCES:

1. Jagadish.K.S, "Alternative Building Materials Technology", New Age International, 2007.
2. Gambhir. M.L., &NehaJamwal., "Building Materials, products, properties and systems",Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012.
3. IS456 - 2000: Indian Standard specification for plain and reinforced concrete, 2011.
4. IS4926 - 2003: Indian Standard specification for ready–mixed concrete, 2012.
5. IS383 - 1970: Indian Standard specification for coarse and fine aggregate from natural sources for concrete, 2011.
6. IS1542-1992: Indian standard specification for sand for plaster, 2009.
7. IS 10262-2009: Indian Standard Concrete Mix Proportioning –Guidelines, 2009.

CE17303	**STRENGTH OF MATERIALS I**	**L**	**T**	**P**	**C**
		2	**2**	**0**	**3**

OBJECTIVES:

- To gain knowledge on various concepts of stresses and strains, deformation of solids and stresses in thin cylinders.

- To acquire knowledge on the various mechanism of load transfer on beams.
- To learn the slope and deflection of beams.
- To know the effect of torsion on shafts and springs.
- To obtain knowledge on concepts of two dimensional state of stress and plane trusses.

UNIT I STRESS AND STRAIN 9+3

Stress and strain at a point – Tension, Compression, Shear Stress – Hooke's Law – Relationship among elastic constants – Stress Strain Diagram for Mild Steel, TOR steel, Concrete – Ultimate Stress – Yield Stress – Factor of Safety – Thermal Stresses – Thin Cylinders and Shells – Strain Energy due to Axial Force – Resilience – Stresses due to impact and Suddenly Applied Load – Compound Bars.

UNIT II SHEAR AND BENDING IN BEAMS 9+3

Beams and Bending- Types of loads, supports – Shear Force and Bending Moment Diagrams for statically determinate beam with concentrated load, UDL, uniformly varying load. Theory of Simple Bending – Analysis of Beams for Stresses – Stress Distribution at a cross Section due to bending moment and shear force for Cantilever, simply supported and overhanging beams with different loading conditions - Flitched Beams.

UNIT III DEFLECTION 9+3

Double integration method - Macaulay's methods – Moment area method - conjugate beam method for computation of slopes and deflections of determinant beams.

UNIT IV TORSION 9+3

Torsion of Circular and Hollow Shafts – Elastic Theory of Torsion – Stresses and Deflection in Circular Solid and Hollow Shafts – combined bending moment and torsion of shafts - strain energy due to torsion - Modulus of Rupture – Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – Leaf Springs – Springs in series and parallel – Design of buffer springs.

UNIT V COMPLEX STRESSES AND PLANE TRUSSES 9+3

2 D State of Stress – 2 D Normal and Shear Stresses on any plane – Principal Stresses and Principal Planes – Mohr's circle - Plane trusses: Analysis of plane trusses - method of joints - method of sections.

TOTAL: 45 PERIODS+ 15 TUTORIALS

OUTCOMES:

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

- Get familiarized with the concepts of stress and strain subjected to axial load, direct shear and bending.
- Analyse the shear force and bending moment of beams due to different types of loads.
- Get familiarized with the slope and deflection of beams.
- Get familiarized with torsion of shafts, power transmitted to shafts and the energy stored in springs.
- Acquire knowledge on principal stresses and principal planes and analysis of plane trusses.

TEXTBOOKS:

1. Rajput R.K. "Strength of Materials", S.Chand and Co, New Delhi, 2007.
2. Bhavikatti S., "Solid Mechanics", Vikas publishing house Pvt. Ltd, New Delhi, 2010.

REFERENCES:

1. Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2009.

2. Timoshenko.S.B. and Gere.J.M, “Mechanics of Materials”, Van NosReinbhold, New Delhi 1995.
3. Vazirani.V.N and Ratwani.M.M, “Analysis of Structures”, Vol I Khanna Publishers, New Delhi, 1995.
4. Junnarkar.S.B. and Shah.H.J, “Mechanics of Structures”, Vol I, Charotar Publishing House, New Delhi, 1997.
5. Ugural. A.C., "Mechanics of Materials", Wiley India Pvt. Ltd., New Delhi, 2013.

CE17304 FLUID MECHANICS

L	T	P	C
2	2	0	3

OBJECTIVES:

- To develop an understanding of various fluid properties and its behavior under static condition.
- To acquire the knowledge of fluid forces at static and dynamic equilibrium conditions.
- To obtain the knowledge in dimensional analysis and model studies in real time.
- To analyze and perform the problems related to pipe flow and its losses.
- To understand the boundary layer thickness concepts and its separation during different types of fluid flow.

UNIT I FLUID PROPERTIES AND FLUID STATICS 9+3

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers-forces on planes – centre of pressure – buoyancy and floatation.

UNIT II FLUID KINEMATICS AND DYNAMICS 9+3

Fluid Kinematics – Classification and types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms) - stream line-streak line-path line - stream function - velocity potential function - flow net. Fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli’s equation – application - Venturimeter, orifice meter and Pitot tube - linear momentum equation and its application to pipe bend.

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES 9+3

Fundamental dimensions - dimensional homogeneity - Rayleigh’s method and Buckingham Pi-theorem - dimensionless parameters - similitudes and model studies - distorted models.

UNIT IV FLOW THROUGH PIPES 9+3

Reynold’s experiment - laminar flow through circular pipe (Hagen Poiseulle's) - hydraulic and energy gradient – flow through pipes - Darcy - Weisbach's equation - pipe roughness - friction factor - Moody's diagram - major and minor losses of flow in pipes - pipes in series and in parallel.

UNIT V BOUNDARY LAYER 9+3

Boundary layer – definition - boundary layer on a flat plate – laminar and turbulent boundary layer - displacement, energy and momentum thickness – Momentum integral equation - Boundary layer separation and control – drag on flat plate.

TOTAL: 45 PERIODS+15 TUTORIALS

OUTCOMES:

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

- Apply the basic knowledge of fluid properties in designing of hydraulic structures.
- Get familiarized with the knowledge of fluid forces at static and dynamic equilibrium conditions.
- Employ the knowledge in dimensional analysis and model studies in real time.

- Perform the problems related to pipe flow and its losses.
- Apply the boundary layer thickness and its separation during different types of fluid flow.

TEXT BOOKS:

1. Dr.Modi P.N and Seth "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2009.
2. Dr.A.K.Jain "Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, Twelfth Edition, 2016.
3. K. Subramanya "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.

REFERENCES:

1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw Hill, 2000.
2. Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 2013.
3. Roberson J.A and Crowe C.T., "Engineering Fluid Mechanics", Jaico Books Mumbai, 2000.
4. White, F.M., "Fluid Mechanics", Tata McGraw Hill, 5th Edition, New Delhi, 2017.
5. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press, New Delhi, 2015.

CE17305	SURVEYING	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To conduct survey in the field using linear measurement equipments, compass and also to evaluate the reduced level of points using different methods of levelling.
- To apply the concepts of tacheometric surveying and trigonometric levelling in the field.
- To understand the concepts of control surveying.
- To understand advanced surveying topics like hydrographic surveying and astronomical surveying.
- To utilize modern surveying equipments like total station and GPS in the field.

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING AND LEVELLING 9+3

Classifications and basic principles of surveying - Equipment and accessories for ranging and chaining - Methods of ranging - Chain traversing - Obstacles - Tape corrections - Compass - Types of Compass- Basic Principles - Bearing – Types - True Bearing - Magnetic Bearing - Local Attraction – Magnetic declination – Dip – Levelling - Principles and theory of Levelling – Datum - Bench Marks – Temporary and Permanent Adjustments - Methods of Levelling - Booking – Reduction - Sources of errors in Levelling - Curvature and refraction - Contouring - Digital Planimeter - Uses.

UNIT II THEODOLITE AND TACHEOMETRIC SURVEYING 9+3

Horizontal and vertical angle measurements - Temporary and permanent adjustments - Heights and distances - Tacheometer - Stadia Constants - Anallactic Lens -Tangential and Stadia, Tacheometry surveying - Trigonometric levelling.

UNIT III CONTROL SURVEYING AND ADJUSTMENT 9+3

Horizontal and vertical control – Methods – specifications – triangulation - baseline – satellite stations – reduction to centre - trigonometrical levelling – single and reciprocal observations – traversing – Gale's table - Errors Sources - precautions and corrections – classification of errors – true and most probable values - weighed observations – method of equal shifts – principle of least squares - normal equation – correlates - level nets - adjustment of simple triangulation networks.

UNIT IV ADVANCED TOPICS IN SURVEYING 9+3

Hydrographic Surveying – Tides – MSL – Sounding methods – Three point problem – Strength of fix – Sextants and station pointer – astronomical Surveying – Field observations and determination of Azimuth by altitude and hour angle methods – Fundamentals of Photogrammetry and Remote sensing - Astronomical terms and definitions - Motion of sun and stars - Celestial coordinate systems - different time systems - Nautical Almanac - Apparent altitude and corrections - Field observations and determination of time, longitude, latitude and azimuth by altitude and hour angle method.

UNIT V MODERN SURVEYING 9+3

Total Station : Advantages - Fundamental quantities measured - Parts and accessories - working principle - On board calculations - Field procedure - Errors and Good practices in using Total Station.

GPS Surveying : Different segments - space, control and user segments - satellite configuration - signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - Hand Held and Geodetic receivers - data processing - Traversing and triangulation.

TOTAL: 45 PERIODS+ 15 TUTORIALS

OUTCOMES:

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

- Use linear measurement equipments, compass to conduct survey in the field and also evaluate the reduced level of points using different methods of levelling.
- Apply the concepts of tacheometric surveying and trignometric levelling in the field.
- Use the concepts of control surveying in the field.
- Get familiarized with advanced surveying topics like hydrographic surveying and astronomical surveying.
- Use modern surveying equipments like total station and GPS in the field.

TEXTBOOKS:

1. T.P.Kanetkar and S.V.Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008.
2. Dr.B.C.Punmia, Ashok K.Jain and Arun K Jain , Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005.
3. James M. Anderson and Edward M. Mikhail, "Surveying, Theory and Practice", 7th Edition, McGraw Hill, 2001.
4. Bannister and S. Raymond, "Surveying", 7th Edition, Longman 2004. 3. Laurila, S.H. "Electronic Surveying in Practice", John Wiley and Sons Inc, 1993.

REFERENCES:

1. Alfred Leick, “GPS satellite surveying”, John Wiley & Sons Inc., 3rd Edition, 2004.
2. GuochengXu, “GPS Theory, Algorithms and Applications”, Springer – Berlin, 2003.
3. SatheeshGopi, rasathishkumar, N. Madhu, “Advanced Surveying, Total Station GPS and Remote Sensing” Pearson education, 2007.
4. Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2004.
5. Arora K.R.,"SurveyingVol I & II", Standard Book house, 10th Edition 2008.

CE17311	SURVEYING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To ensure that the student understands the concepts of Chain and Compass Surveying.

- To gain the knowledge and implementation of Levelling concepts in the field.
- To learn the practical implementations using Theodolite in various fields.
- To understand the usage of a tacheometer.
- To acquire the knowledge of modern survey techniques using Total Station equipment and GPS.

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.

Compass Survey

3. Compass Traversing – Measuring Bearings & arriving included angles.

Levelling - Study of levels and levelling staff

4. Fly levelling using Dumpy level &Tilting level.
5. Check levelling.

Theodolite - Study of Theodolite

6. Measurements of horizontal angles by reiteration and repetition and vertical angles.
7. Determination of elevation of an object using single plane method when base is accessible /inaccessible.

Tacheometry – Tangential system – Stadia system

8. Determination of Tacheometric Constants.
9. Heights and distances by stadia Tacheometry.
10. Heights and distances by Tangential Tacheometry.

Total Station - Study of Total Station, Measuring Horizontal and vertical angles.

11. Traverse using Total station and Area of Traverse.
12. Determination of distance and difference in elevation between two inaccessible points using Total station.

Azimuth and GPS

13. Field observation of Sun Rise and Calculation of azimuth using Total Station.
14. GPS- Explore GPS unit - Mark a position-view your position- Simple Exercise using GPS.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Implement the procedure of Chain and Compass Survey to find different areas and bearings.
- Implement the concepts and procedure of Levelling in different construction fields.
- Get familiarized with the practical implementation of Theodolite instrument.
- Apply the use of tacheometer in surveying.
- Implement the modern survey techniques using Total Station equipment and GPS.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No.	Description of Equipment	Quantity
1.	Total Station	6 No's
2.	Theodolites	At least 1 for every 5 students
3.	Dumpy level / Filling level	At least 1 for every 5 students
4.	Pocket stereoscope	1 No
5.	Ranging rods	
6.	Levelling staff	

7.	Cross staff	1 for a set of 5 students
8.	Chains	
9.	Tapes	
10.	Arrows	
11.	Prismatic Compass	10 no's
12.	Surveyor Compass	2 no's
13.	GPS	5 no's

CE17312 STRENGTH OF MATERIALS LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To provide students an exposure to the methodology of tensile testing on mild steel rod.
- To conduct double shear test & torsion test on mild steel specimens and compute its modulus of rigidity.
- To conduct hardness test on metals (copper, brass, aluminium, cast iron and mild steel) by Rockwell Test and Brinell Test & Determine the impact strength of steel by Izod and Charpy impact test.
- To compute Young's modulus of simply supported and cantilever beams with loads at centre and free end respectively, through deflection test.
- To determine the stiffness of helical springs and carriage springs.
- To compute the compressive strengths of wood and cement mortar cube specimens.

LIST OF EXPERIMENTS

1. Tension test on mild steel rod
2. Compression test on wood
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell HardnessTests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring
10. Test on Cement

TOTAL: 60 PERIODS

OUTCOMES:

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

- Perform tensile testing on mild steel rod.
- Conduct double shear test & torsion test on mild steel specimens and compute its modulus of rigidity.
- Perform hardness test on metals (copper, brass, aluminium, cast iron and mild steel) by Rockwell Test and Brinell Test & Determine the impact strength of steel by Izod and Charpy impact test.
- Compute Young's modulus of simply supported and cantilever beams with loads at centre and free end respectively, through deflection test.
- Determine the stiffness of helical springs and carriage springs.
- Compute the compressive strength of wood and cement mortar cube specimens.

REFERENCES:

1. Strength of Materials Laboratory Manual, Anna University, Chennai - 600 025.

2. IS1786-2008 (Fourth Revision, Reaffirmed 2013), 'High strength deformed bars and wires for concrete reinforcement – Specification', 2008.
3. IS : 1598 – 1977 (First Revision, Reaffirmed 2003), 'Method for Izod impact test of Metals', 1978.
4. IS : 1499 – 1977 (First Revision, Reaffirmed 2003), 'Method for Charpy impact test (U-Notch) for Metals', 1978.
5. IS : 4031 – 1988 Parts 1 - 15 (First Revision, Reaffirmed 2003), 'Methods of Physical tests for Hydraulic Cement', 1988.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No.	Description of Equipment	Quantity
1.	UTM of minimum 400 kN capacity	1
2.	Torsion testing machine for steel rods	1
3.	Izod impact testing machine	1
4.	Hardness testing machine Rockwell Vicker's (any 2) Brinnel	1 each
5.	Beam deflection test apparatus	1
6.	Extensometer	1
7.	Compressometer	1
8.	Dial gauges	Few
9.	Le Chatelier's apparatus	2
10.	Vicat's apparatus	2
11.	Mortar cube moulds	10

HS17361 HS17361 - Interpersonal Skills / Listening and Speaking L T P C
0 0 2 1

OBJECTIVES

- To upgrade the learners' listening and speaking skills for educational purposes.
- To enhance the employability skills of the learners with a special focus on listening and speaking skills.

UNIT I INTRODUCTION 6

Importance of listening and Types of Listening – listening to TED Talks, lectures, etc. **Speaking**: group discussions on general topics like how to grow organic potted plants, to furnish an apartment inexpensively, etc. – **Phonetics.**

UNIT II APPRECIATIVE LISTENING AND IMPROMPTU 6

Listening - Listening to motivational speeches, music and poetry. **Speaking** – pick and talk, short talks on any event on topics- a trip to remember, a job I'd love to have, etc. – **Vocabulary**: Collocation.

UNIT III INFORMATIVE LISTENING AND PERSUASIVE SPEAKING 6

Listening – Listening- to gather information such as facts, directions, news or instructions. **Speaking –** Persuasive speaking- convincing the audience with the speaker's view on the topics- food additives and unhealthiness, financial education is important in today's world, etc. – **Vocabulary**: Idioms and Phrases.

UNIT IV CRITICAL LISTENING AND SPEAKING ON SPECIAL OCCASION 6

Listening – Critical Listening- listening to examine and evaluate the message for logic and truth - televised debate, election campaign. **Speaking** – speech to commemorate a person or an event- speech of Introduction, etc. – **Vocabulary**: Foreign Words and Phrases.

UNIT V EMPATHETIC LISTENING AND DEMONSTRATIVE SPEAKING 6

Listening– Empathetic Listening – paying attention to another person with empathy – listening to problems and issues (videos). **Speaking –** Demonstrative speaking – Demonstrate a process using visual aids (charts, graphs, maps, pictures, etc.) – **Grammar**: Different types of Questions.

TOTAL: 30 PERIODS

OUTCOMES

On completion of the course, students will be able to

- Identify the different types of listening and speaking for effective interpersonal communication.
- Discuss and respond to content of a listening passage.
- Understand facts and directions and convince the listeners.
- Understand different genres of communication and comprehend the materials to improve their vocabulary and get familiarized with new words, phrases, sentence structures and ideas.
- Make inferences and predictions about spoken discourse.

REFERENCES

1. "Technical Communication – Principles and Practice," Second Edition – Meenakshi Raman and Sangeetha Sharma, Oxford University Press, December, 2011.
2. "Interpersonal Skills: How to develop Interpersonal Skills for work and home," Henry Lee (Kindle Edition)
3. "Teaching the Core Skills of Listening and Speaking," Erik Palmer (Kindle Edition)

MA17451 NUMERICAL METHODS L T P C

3 2 0 4

OBJECTIVES:

- To provide the necessary basic concepts of a few numerical methods.
- To provide procedures for solving numerically different kinds of problems occurring in the field of Engineering and Technology.

UNIT I SOLUTION OF EQUATIONS 15

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel.

UNIT II INTERPOLATION 15

Interpolation with equal intervals - Newton's forward and backward difference formulae - Interpolation with unequal intervals – Newton's divided difference interpolation - Lagrange's interpolation – Cubic Splines

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 15

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule and Simpson's 3/8 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal rule.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 15

Single Step methods - Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge - Kutta method for solving first order equations - Multi step methods - Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 15

Finite difference method for solving second order differential equations - Finite difference techniques for the solution of two dimensional Laplace and Poisson equations on rectangular domain – One dimensional heat flow equation by implicit and explicit methods – One Dimensional Wave Equation by Explicit method.

TOTAL : 75 PERIODS

OUTCOMES

On completion of the course, students will be able to

- Solve algebraic equations and eigen value problems that arise during the study of Engineering problems.
- use various interpolation techniques for solving problems in Engineering.
- use numerical methods to solve problems involving numerical differentiation and integration.
- solve initial value problems numerically that arise in Science and Engineering.
- Solve boundary value problems that encounter in different fields of Engineering study.

TEXT BOOKS:

1. Kandasamy P., Thilagavathy K., and Gunavathy,S., 'Numerical Methods', Chand and Co., 2007.
2. Grewal B.S., and Grewal. J.S.,"Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi, 2007.
3. Sastry S.S, "Introductory Methods of Numerical Analysis", Prentice- Hall of India PVT. LTD., 4th edition, New Delhi, 2006

REFERENCES:

1. Veerarajan T., Ramachandran T., 'Numerical Methods with Programs in C and C++' Tata McGraw Hill., 2007.
2. Jain M.K., Iyengar, S.R., and Jain, R.K., 'Numerical Methods for Scientific and Engineering Computation', New Age Publishers. 6th edition, 2007.
3. Chapra S.C., and Canale. R.P, "Numerical Methods for Engineers", 7th Edition, McGrawHill, New Delhi, 2015.
4. Brian Bradie "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2007.
5. Sankara Rao K., "Numerical methods for Scientists and Engineers", Prentice Hall of IndiaPrivate, 3rd Edition, New Delhi, 2007.
6. Gerald C. F. and Wheatley, P.O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.
7. Rajaraman V., Computer-Oriented Numerical Methods, Third Edition, Published by PHI Learning Private Limited (2013).

CE17401	CONSTRUCTION TECHNIQUES, EQUUIPMENT AND PRACTICE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge of building materials, process of concreting and testing methods

- To learn the construction practices and various stages involved during construction of building and materials.
- To acquire knowledge on various techniques involved in the construction of foundation for complicated structures.
- To acquire the knowledge of construction of super structures construction practices and the equipments used for their implementation
- To gain knowledge of equipments used in the construction of various buildings.

UNIT I CONCRETE TECHNOLOGY 9

Cements – Grade of cements - concrete chemicals and Applications – Grade of concrete - manufacturing of concrete – Batching – mixing – transporting – placing – compaction of concrete – curing and finishing - Testing of fresh and hardened concrete – quality of concrete – Extreme Weather Concreting - Ready Mix Concrete - Non-destructive testing.

UNIT II CONSTRUCTION PRACTICES 9

Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick — weather and water proof – roof finishes – acoustic and fire protection – Advanced formwork techniques.

UNIT III SUB STRUCTURE CONSTRUCTION 9

Techniques of Box jacking – Pipe Jacking - under water construction of diaphragm walls and basement - Tunnelling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting - driving diaphragm walls, sheet piles - shoring for deep cutting - well points - Dewatering and stand by Plant equipment for underground open excavation.

UNIT IV SUPER STRUCTURE CONSTRUCTION 9

Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space decks.

UNIT V CONSTRUCTION EQUIPMENT 9

Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers – Equipment for foundation and pile driving. Equipment for compaction, batching, mixing and concreting - Equipment for material handling and erection of structures – Types of Cranes - Equipment for dredging, trenching, tunneling.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Use the basics of concrete manufacturing methods and their implementation in the construction.
- Assess with different forms of construction practices and their application.
- Get familiarized with the substructure construction and its implementation.
- Get familiarized with the superstructure construction and its implementation.
- Assess the various equipments used for construction and the advantages of using it.

TEXTBOOKS:

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 5th Edition, McGraw Hill, Singapore, 1995.
2. Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", DhanpatRai and Sons, 1997.
3. Varghese, P.C. "Building construction", Prentice Hall of India Pvt. Ltd, New Delhi, 2007.
4. Shetty, M.S, "Concrete Technology, Theory and Practice", S. Chand and Company Ltd, New Delhi, 2008.

REFERENCES:

1. Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publishers, 1999.
2. Sharma S.C. “Construction Equipment and Management”, Khanna Publishers New Delhi, 2002.
3. Deodhar S.V. “Construction Equipment and Job Planning”, Khanna Publishers, New Delhi, 2012.
4. Dr. Mahesh Varma, “Construction Equipment and its Planning and Application”, Metropolitan Book Company, New Delhi, 1983.
5. Gambhir M.L, "Concrete Technology", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2004.

CE17402	STRENGTH OF MATERIALS II	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To know the slope and deflection of beams using Energy theorems.
- To acquire knowledge to determine shear force and bending moments of indeterminate beams.
- To know the behavior and failure of columns.
- To gain knowledge on the principal stresses and principal planes.
- To obtain knowledge on the unsymmetrical sections of beams and curved beams.

UNIT I ENERGY PRINCIPLES 9+3

Strain energy and strain energy density – strain energy due to axial load, shear, flexure and torsion – Castigliano’s theorems – Maxwell’s reciprocal theorems - Principle of virtual work – application of energy theorems for computing deflections in beams and trusses - Williot Mohr's Diagram.

UNIT II INDETERMINATE BEAMS 9+3

Concept of Analysis - Propped cantilever and fixed beams-fixed end moments and reactions – Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

UNIT III COLUMNS AND CYLINDER 9+3

Euler’s theory of long columns – critical loads for prismatic columns with different end conditions; Rankine - Gordon formula for eccentrically loaded columns – Eccentrically loaded short columns – middle third rule – core section – Thick cylinders – Compound cylinders.

UNIT IV STATE OF STRESS IN THREE DIMENSIONS 9+3

Determination of principal stresses and principal planes – Volumetric strain – Theories of failure – Principal stress - Principal strain – shear stress – Strain energy and distortion energy theories – application in analysis of stress, load carrying capacity.

UNIT V ADVANCED TOPICS 9+3

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – Shear Centre - curved beams – Winkler Bach formula**.**

TOTAL: 45 PERIODS + 15 TUTORIALS

OUTCOMES:

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

- Get familiarized to compute slope and deflection of beams and trusses using Energy theorems and strain energy due to axial load, shear, flexure and torsion.
- Analyse the indeterminate beams to determine shear force and bending moments.
- Get familiarized with the behavior of columns and its failures with different end conditions and thick cylinders.
- Analyze the principal stresses, principal planes and theories of failure.
- Design unsymmetrical bending of beams, shear center and curved beams.

TEXT BOOKS:

1. Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 2010.
2. Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2012.

REFERENCES:

1. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. William A .Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, Tata McGraw Hill Publishing Company, 2007.
3. PunmiaB.C."Theory of Structures" (SMTS) Vol I&II, Laxmi Publishing Pvt Ltd, New Delhi 2004.
4. Rattan.S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.

CE17403	**APPLIED HYDRAULIC ENGINEERING**	**L**	**T**	**P**	**C**
		2	**2**	**0**	**3**

OBJECTIVES:

- To understand the concepts of fluid mechanics in addressing problems on open channels and uniform flow.
- To formulate the different types of flow profiles and its computation.
- To gain knowledge on RVF, its types and surges in flow.
- To enhance the knowledge of working principles of turbine and its classifications.
- To learn the principles behind the working of pumps and its classifications.

UNIT I UNIFORM FLOW 9+3

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Velocity distribution in open channel - Steady uniform flow: Chezy equation, Manning equation - Best hydraulic sections for uniform flow – Wide open channel - Specific energy and specific force – Critical flow.

UNIT II GRADUALLY VARIED FLOW 9+3

Dynamic equations of gradually varied flows – Types of flow profiles - Classifications: Computation by Direct step method and Standard step method – Control section – Break in Grade – Computation.

UNIT III RAPIDLY VARIED FLOW 9+3

Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation – Celerity – Rapidly varied unsteady flows (positive and negative surges)

UNIT IV TURBINES 9+3

Impact of Jet on flat, curved plates, Stationary and Moving – Classification of Turbines – Pelton wheel – Francis turbine – Kaplan turbine - Draft tube and cavitation - Specific speed – Characteristic Curves of Turbines

UNIT V PUMPS 9+3

Classification of Pumps - Centrifugal pumps – Work done - Minimum speed to start the pump - NPSH - Multistage pumps – Characteristics curve - Reciprocating pumps - Negative slip - Indicator diagrams and its variations – Air vessels - Savings in work done.

TOTAL: 45 PERIODS + 15 TUTORIALS

OUTCOMES:

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

- Apply the knowledge of fluid mechanics in addressing problems on open channels and uniform flow.
- Carry out problems in gradually varied flows in steady state conditions and water surface profile determination by various methods.
- Evaluate problems in rapidly varied flows in steady state conditions and applications of energy and momentum equations in RVF.
- Distinguish different types of turbines and their practical applications.
- Infer the knowledge of different types of pumps and their practical applications.

TEXTBOOKS:

1. K. Subramanya, "Flow in open channels", Tata McGraw Hill, New Delhi, 2000.
2. P. N. Chandramouli, " Applied Hydraulic Engineering", Yes Dee Publishing, Chennai, 2017
3. Dr.Modi P.N and Dr. S.M. Seth "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2009.
4. K. Subramanya "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.

REFERENCES:

1. VenTe Chow, "Open Channel Hydraulics", McGraw Hill, New York, 2009.
2. M. Hanif Chaudhry, "Open Channel Flow", Second Edition, Springer, 2007.
3. Rajesh Srivastava, "Flow through open channels", Oxford University Press, New Delhi, 2008.
4. Dr.A.K.Jain “Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, Twelfth Edition, 2016.

CE17404	CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge on properties and tests of constituent materials in concrete.
- To know the different types of admixtures and their effects on concrete properties.
- To design the concrete mix ratio for various design strength as per BIS.
- To evaluate the strength and properties of fresh and hardened concrete.
- To become familiar with different types of special concretes.

UNIT I CONSTITUENT MATERIALS 9

Cement-Different types - Chemical composition and Properties - Tests on cement - IS Specifications – Aggregates – Classification - Mechanical properties and tests as per BIS grading requirements – Water - Quality of water for use in concrete.

UNIT II CHEMICAL AND MINERAL ADMIXTURES 9

Accelerators – Retarders – Plasticizers - Super plasticizers - Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline - Their effects on concrete properties.

UNIT III PROPORTIONING OF CONCRETE MIX 9

Principles of Mix Proportioning - Properties of concrete related to Mix Design - Physical properties of materials required for Mix Design - Design Mix and Nominal Mix-BIS Method of Mix Design - Mix Design Examples.

UNIT IV FRESH AND HARDENED PROPERTIES OF CONCRETE 9

Workability - Tests for workability of concrete - Slump Test and Compacting factor Test - Segregation and Bleeding - Determination of Compressive and Flexural strength as per BIS - Properties of Hardened concrete - Determination of Compressive and Flexural strength - Stress-strain curve for concrete - Determination of Young's Modulus – Accelerated curing methods.

UNIT V SPECIAL CONCRETES 9

Light weight concretes - High strength concrete - Fiber reinforced concrete – Ferro cement - Ready mix concrete - SIFCON- Shotcrete – Polymer concrete - High performance concrete- Geopolymer Concrete – Self Compacting concrete – Vacuum concreting – Mix design for HPC (ACI method) and SCC (Okamura method).

TOTAL: 45 PERIODS

OUTCOMES:

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

- Get familiarized the properties of the constituent materials in concrete.
- Get familiarized with the usage of the admixtures and their effects in concrete.
- Design the concrete mix ratio for various design strength.
- Know the properties of fresh and hardened concrete.
- Get familiarized with the special types of concrete and their usage.

TEXT BOOKS:

1. Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2. ShettyM.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003.

REFERENCES:

1. Santhakumar,A.R; "Concrete Technology" , Oxford University Press, New Delhi, 2007
2. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London, 1995.
3. Gambir, M.L; "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2007
4. IS10262-1982 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998.

CE17405	**SOIL MECHANICS**	**L**	**T**	**P**	**C**
		2	**2**	**0**	**3**

OBJECTIVES:

- To classify the soil based on the soil index properties.
- To understand the soil characteristics due to the presence of water in soil.

- To estimate the stress distribution in soil and also know its behavior under compression.
- To estimate the shear strength parameters of soil using different laboratory tests.
- To analyze the stability of slopes using different methods and also to know the different slope protection measures.

UNIT I SOIL CLASSIFICATION AND COMPACTION 9+3

History – formation and types of soil – composition - Soil properties – clay mineralogy structural arrangement of grains – description – Classification – BIS – USCS – phase relationship – Compaction – theory – laboratory and field technology – field Compaction method – factors influencing compaction.

UNIT II EFFECTIVE STRESS AND PERMEABILITY 9+3

Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena – Permeability – Darcy's law – Determination of Permeability – Laboratory Determination (Constant head and falling head methods) and field measurement pumping out in unconfined and confined aquifer – Factors influencing permeability of soils – Seepage - Two dimensional flow – Laplace equation – Introduction to flow nets – Simple problems on Sheet pile and weir.

UNIT III STRESS DISTRIBUTION AND SETTLEMENT 9+3

Stress distribution in homogeneous and isotropic medium – Boussinesq's theory – (Point load, Line load and udl) Use of Newmarks influence chart –Components of settlement — Immediate and consolidation settlement – Factors influencing settlement – Terzaghi's one dimensional consolidation theory – Computation of rate of settlement. –- √t and log t methods, e-log p relationship - Computation of consolidation settlement - N.C clays and O.C clays.

UNIT IV SHEAR STRENGTH 9+3

Shear strength of cohesive and cohesionless soils – Mohr-Coulomb failure theory – shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Factors influences shear strength of soil – Cyclic mobility – Flow Liquefaction.

UNIT V SLOPE STABILITY 9+3

Infinite slopes and finite slopes – Total stress analysis for saturated clay – Friction circle method – Use of stability number – Fellenius method of slices – Guidelines for location of critical slope surface in cohesive and c - φoil – Slope protection measures.

TOTAL: 45 PERIODS + 15 TUTORIALS

OUTCOMES:

Upon completion of this course, the students will able to

- Classify the soil based on the index properties of soil.
- Get familiarized with the soil characteristics due to the presence of water in soil.
- Estimate the stress distribution in soil and also know its behavior under compression.
- Estimate the shear strength parameters of soil using different laboratory tests.
- Analyze the slope stability using different methods and will also know the different slope protection measures.

TEXTBOOKS:

1. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2014.

2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 7th Edition, 2017(Reprint).
3. GopalRanjan, A S R Rao, "Basic and Applied Soil Mechanics" New Age International Publication, 3rd Edition, 2016.
4. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition, 2017.

REFERENCES:

1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations: Basic Geotechnics". Prentice-Hall, 2006.
2. Coduto, D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of India
3. Pvt. Ltd. New Delhi, 2010.
4. Braja M Das, "Principles of Geotechnical Engineering", Cengage Learning India Private Limited, 8th Edition, 2014.
5. Palanikumar.M, "Soil Mechanics", Prentice Hall of India Pvt. Ltd, Learning Private Limited Delhi, 2013.
6. Craig.R.F, "Soil Mechanics", E & FN Spon, London and New York, 2012.
7. Purushothama Raj. P., "Soil Mechanics and Foundations Engineering", 2nd Edition, Pearson Education, 2013.

CE17411	**SOIL MECHANICS LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

OBJECTIVES:

- To ensure that the student understands soil classification based on the index properties of soil.
- To acquire knowledge about in situ density & compaction characteristics of soil.
- To learn about the principles of permeability of soil.
- To acquire knowledge on shear strength parameters of soil.
- To study about the strength of soil based on CBR test.

EXERCISES:

1. DETERMINATION OF INDEX PROPERTIES **20**

a. Specific gravity of soil solids.
b. Grain size distribution – Sieve analysis.
c. Grain size distribution - Hydrometer analysis.
d. Liquid limit and Plastic limit tests.
e. Shrinkage limit and Differential free swell tests.

2. DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS **8**

a. Field density Test (Sand replacement method and core cutter method).
b. Determination of moisture – density relationship using standard Proctor compaction test.
c. Determination of relative density (Demonstration only).

3. DETERMINATION OF ENGINEERING PROPERTIES **28**

a. Permeability determination (constant head and falling head methods).
b. One dimensional consolidation test (Determination of Co-efficient of consolidation only).
c. Direct shear test in cohesionless soil.
d. Unconfined compression test on cohesive soil.
e. Laboratory vane shear test in cohesive soil.
f. Tri-axial compression test in cohesionless soil (Demonstration only).
g. California Bearing Ratio Test.

4. TEST ON GEOSYNTHETICS (Demonstration only) **4**

a. Determination of tensile strength and interfacial friction angle.
b. Determination of apparent opening sizes and permeability.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Classify the soil based on the index properties of soil.
- Determine the in-situ density & compaction characteristics of soil.
- Determine the permeability of soil.
- Determine the shear strength parameters of soil.
- Determine the strength of soil based on the CBR test.

REFERENCES:

1. "Soil Engineering Laboratory Instruction Manual" published by Engineering College Cooperative Society, Anna University, Chennai, 2010.
2. Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1951. Digitized2008.
3. Saibaba Reddy, E.Ramasastri, K. "Measurement of Engineering Properties of Soils" New Age International (P) Limited Publishers, New Delhi, 2002.
4. IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of Indian Standards, New Delhi.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No.	Description of Equipment	Quantity
1.	Sieves	2 sets
2.	Hydrometer	2 sets
3.	Liquid and Plastic limit apparatus	2 sets
4.	Shrinkage limit apparatus	3 sets
5.	Proctor Compaction apparatus	2 sets
6.	UTM of minimum of 20kN capacity	1
7.	Direct Shear apparatus	1
8.	Thermometer	2
9.	Sand replacement method accessories and core cutter method	2
10.	Tri-axial Shear apparatus	1
11.	Three Gang Consolidation test device	1
12.	Relative Density apparatus	1
13.	Van Shear apparatus	1
14.	Weighing machine – 20kg capacity	1 No
15.	Weighing machine – 1kg capacity	3 No's

CE17412 HYDRAULIC ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To acquire knowledge on the calibration of flow measurement apparatus.
- To understand the losses in flow through pipes.

- To learn the principles behind the pump operation and its real time application.
- To enhance the knowledge of working principles of turbine and its classifications.
- To understand the principle of buoyancy and Meta-centric height determination.

LIST OF EXPERIMENTS

A. Flow Measurement

1. Calibration of Rotameter.
2. Calibration of Venturimeter/Orificemeter.
3. Bernoulli's Experiment.

B. Losses in Pipes

4. Determination of friction factor in pipes.
5. Determination of min or losses.

C. Pumps

6. Characteristics of Centrifugal pumps.
7. Characteristics of Gear pump.
8. Characteristics of Submersible pump.
9. Characteristics of Reciprocating pump.

D. Turbines

10. Characteristics of Pelton wheel turbine.
11. Characteristics of Francis turbine.

E. Determination of Metacentric height

12. Determination of Metacentric height of floating bodies.

TOTAL: 60 PERIODS

OUTCOMES:

Upon completion of this course, students will be able to

- Implement the calibration procedure in flow measurement.
- Demonstrate the behavior of losses in pipe flow.
- Apply the principles of pump operation and its real time application.
- Get familiarized with the working principles of turbine.
- Implement the principle of buoyancy in floating objects.

REFERENCES:

1. Sarbjit Singh."Experiments in Fluid Mechanics", Prentice Hall of India Pvt. Ltd, Learning Private Limited, Delhi, 2009.
2. "Hydraulic Laboratory Manual", Centre for Water Resources, Anna University, 2004.
3. Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2000.
4. Subramanya K. "Flow in open channels", Tata McGraw Hill Publishing.Company, 2001.

HS17461	ADVANCED READING AND WRITING	L	T	P	C
	(Common to B.E - CSE, MECH & CIVIL and B.Tech – IT , BT& FT)	**0**	**0**	**2**	**1**

OBJECTIVES:

- To enhance the employability skills of the learners with a special focus on critical thing , reading and writing.

- To enhance proficiency in the language and the ability to write compare and contrast essays effectively.

UNIT I PRIMITIVE READING AND FREE WRITING 6

Reading – Primitive Reading: Reading stories. Skimming: browse through a book or a long passage, understand the gist of a text. **Writing**: Free writing – writing about oneself/ family/ native/ hobbies/ festivals, etc. **Grammar:** Sentence Structure.

UNIT II SCANNING AND EXPOSITORY WRITING 6

Reading - Scanning: Guessing meaning from the context, surveying the text. **Writing** – Narrative Writing: Narrating a story, incident or past events. **Grammar** – Imperative Sentences.

UNIT III INTENSIVE READING AND DESCRIPTIVE WRITING 6

Reading – Intensive Reading: Drawing inferences from the text, responding critically to the text. **Writing** – Descriptive Writing: an incident, place, person, process, etc. **Grammar** – Different kinds of adjectives.

UNIT IV EXTENSIVE READING AND COMPARATIVE WRITING 6

Reading – Extensive Reading: Reading wide range of articles for better understanding, etc. **Writing** – Compare and Contrast: two things/ places/ persons/ ideas, etc. **Grammar** – Connectives.

UNIT V INFERENTIAL WRITING AND ARGUMENTATIVE/ PERSUASIVE WRITING 6

Reading – Inferential Reading: draw upon prior knowledge, draw conclusions and make inferences. **Writing** – Argumentative and Persuasive Writing: establishing facts, forming and stating conclusions. **Grammar** – Conjunctions, Cohesive Devices.

TOTAL: 30 PERIODS

OUTCOMES

On completion of the course, students will be able to

- Skim through columns and magazines and write on simple topics with proper sentence structures.
- Read comprehensively and understand the thoughts of the writer and report clearly in detail about the happenings around.
- Comprehend and answer questions based on the texts/passages given and write descriptive essays.
- Read different genres of texts and comprehend the materials to improve their vocabulary and are familiar with new words, phrases, sentence structures and ideas.
- Read between lines, draw conclusions with their prior knowledge on the subject and persuade their readers with their flawless writing skills.

REFERENCES

1. "Bridge to College Success – Intensive Academic Preparation for Advanced Students" – Robertson.
2. "Source Work – Academic Writing from Sources" Second Edition - Dellahite, Haun, Heinle / Cengage Learning, 2012.
3. Aebersold, Jo Ann and Field M. L. 1997, "From Reader to Reading teacher," Cambridge, Cambridge University Press, Anderson, R. C. 1996.
4. Bamford, Julian and Day, R. R. 1997, "Extensive Reading: What is it? Why Bother?" Language Teacher Online.

CE17501 DESIGN OF REINFORCED CONCRETE ELEMENTS L T P C
3 2 0 4

OBJECTIVES:

- To understand the design philosophies of various methods used for the design of RC structures and to know the design concepts of beam members by working stress method and limit state method.
- To know the design procedure for flanged beams and for beams subjected to bending, shear and torsion as per limit state method.
- To understand the design of all types of slabs for different boundary conditions and design of staircase as per IS 456-2000.
- To understand the design of columns at different location as per the IS Code and SP 16.
- To know the design concepts for isolated and combined footings subjected to axial and eccentric loading.

UNIT I INTRODUCTION 9+6

Objective of structural design - Steps in RCC Structural Design Process - Type of Loads on Structures and Load combinations - Code of practices and Specifications - Concept of Working Stress Method, Ultimate Load Design and Limit State Design Methods for RCC – Properties of Concrete and Reinforcing Steel - Analysis and Design of Singly reinforced Rectangular beams by working stress method - Limit State philosophy as detailed in IS code - Advantages of Limit State Method over other methods - Analysis and design of singly and doubly reinforced rectangular beams by Limit State Method.

UNIT II DESIGN OF BEAMS 9+6

Analysis and design of Flanged beams for – Use of design aids for Flexure - Behaviour of RC members in Shear, Bond and Anchorage - Design requirements as per current code - Behaviour of rectangular RC beams in shear and torsion - Design of RC members for combined Bending, Shear and Torsion.

UNIT III DESIGN OF SLABS AND STAIRCASE 9+6

Analysis and design of cantilever, one way simply supported and continuous slabs and supporting beams - Two way slab - Design of simply supported and continuous slabs using IS code coefficients - Types of Staircases – Design of dog-legged Staircase.

UNIT IV DESIGN OF COLUMNS 9+6

Types of columns – Axially Loaded columns – Design of short Rectangular, Square and circular columns – Design of Slender columns - Design for Uniaxial and Biaxial bending using Column Curves

UNIT V DESIGN OF FOOTINGS 9+6

Concepts of Proportioning footings and foundations based on soil properties-Design of wall footing – Design of axially and eccentrically loaded Square, Rectangular pad and sloped footings – Design of Combined Rectangular footing for two columns only.

TOTAL: 45 PERIODS + 30 TUTORIALS

OUTCOMES:

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

- Get familiarized with the design concepts and will be able to analyze and design singly reinforced and doubly reinforced beams by working stress method and limit state method.

- Analyze and design flanged beams and beams subjected to bending, shear and torsion as per limit state method.
- Design all types of slabs for different boundary conditions and design doglegged staircase as per IS 456-2000.
- Design columns for different types of location as per the IS Code and SP 16.
- Design isolated and combined footings for axial and eccentric loading.

TEXT BOOKS:

1. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd., New Delhi, 2002.
2. Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.
3. Subramanian,N.,"Design of Reinforced Concrete Structures",Oxford University Press, New Delhi, 2013.
4. Krishnaraju.N "Design of Reinforced Concrete Structures ", CBS Publishers & Distributors Pvt. Ltd., New Delhi.
5. Dr.Ramachandra, " Limit state Design of Concrete Structures " Standard Book House, New Delhi

REFERENCES:

1. Jain, A.K., "Limit State Design of RC Structures", Nemchand Publications, Roorkee, 1998.
2. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002 .
3. Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., 2009.
4. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete",Laxmi Publication Pvt. Ltd., New Delhi, 2007.
5. Bandyopadhyay. J.N., "Design of Concrete Structures". Prentice Hall of India Pvt. Ltd., New Delhi, 2008.
6. IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000.
7. SP16, IS456:1978 "Design Aids for Reinforced Concrete to Bureau of Indian Standards, New Delhi, 1999.
8. Shah V L Karve S R., "Limit State Theory and Design of Reinforced Concrete", Structures Publilcations, Pune, 2013.

CE17502	FOUNDATION ENGINEERING	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To decide the foundation based on the soil condition inferred from different methods of subsoil exploration.
- To estimate the bearing capacity of soil and also the settlement of foundation.
- To proportionate different types of footings.
- To design pile foundation and also calculate the settlement of pile group.
- To analyze the stability of retaining walls using different methods.

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9+3

Scope and objectives – Methods of exploration – Auguring and boring – Wash boring and rotary drilling – Depth and spacing of bore holes – Soil samples – Representative and undisturbed – Sampling methods – Split spoon sampler, thin wall sampler, Stationary piston sampler – Penetration tests (SPT and SCPT) – Data interpretation - Strength parameters and Evaluation of Liquefaction potential - Bore log report and Selection of foundation.

UNIT II SHALLOW FOUNDATION 9+3

Location and depth of foundation – Codal provisions – Bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – Factors affecting bearing capacity – Bearing capacity from in-situ tests (SPT, SCPT and Plate Load) – Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements – Codal provision – Methods of minimizing total and differential settlements.

UNIT III FOOTINGS AND RAFTS 9+3

Types of Isolated footing, Combined footing, Mat foundation – Contact pressure and settlement distribution – Proportioning of foundations for conventional rigid behavior – Minimum thickness for rigid behavior – Applications – Compensated foundation – Seismic force consideration – Codal provision

UNIT IV PILE FOUNDATION 9+3

Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – Static formula – Dynamic formulae (Engineering news and Hileys) – Capacity from in-situ tests (SPT and SCPT) – Negative skin friction – Uplift capacity - Group capacity by different methods (Feld's rule, Converse – Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test (routine test only), Under reamed piles – Capacity under compression and uplift – Cohesive – expansive – non expansive – Cohesionless soils – Codal provisions.

UNIT V RETAINING WALLS 9+3

Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesionless and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann's Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls – Codal provisions.

TOTAL: 45 PERIODS + 15 TUTORIALS

OUTCOMES:

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

- Get familiarized with different subsoil exploration methods and decide the foundation based on the soil condition.
- Estimate the bearing capacity of soil and also the settlement of foundation.
- Proportionate the different types of footings.
- Estimate load carrying capacity of pile and also calculate the settlement of pile group.
- Analyze the stability of retaining walls using different methods.

TEXTBOOKS:

1. Murthy V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2014.
2. Gopal Ranjan, A.S.R Rao, "Basic and Applied Soil Mechanics", New Age International Publication, 3rd Edition, 2016.

3. Arora K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 7th Edition, 2017 (Reprint).
4. Punmia B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th edition 2017.

REFERENCES:

1. Braja M Das, "Principles of Foundation Engineering" (Eighth edition), Cengage Learning 2014.
2. Kaniraj S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill publishing company Ltd., New Delhi, 2014.
3. Venkatramaiah C., "Geotechnical Engineering", New Age International Publishers, New Delhi, 5th Edition, 2017.
4. Joseph E Bowles, "Foundation Analysis and design", McGraw Hill Education, 5th Edition, 28th August 2015.
5. IS Code 6403: 1981 (Reaffirmed 1997) "Bearing capacity of shallow foundation", Bureau of Indian Standards, New Delhi.
6. IS Code 8009 (Part 1):1976 (Reaffirmed 1998) "Shallow foundations subjected to symmetrical static vertical loads", Bureau of Indian Standards, New Delhi.
7. IS Code 8009 (Part 2):1980 (Reaffirmed 1995) "Deep foundations subjected to symmetrical static vertical loading", Bureau of Indian Standards, New Delhi.
8. IS Code 2911 (Part 1): 1979 (Reaffirmed 1997) "Concrete Piles" Bureau of Indian Standards, New Delhi.
9. IS Code 2911 (Part 2): 1979 (Reaffirmed 1997) "Timber Piles", Bureau of Indian Standards, New Delhi.
10. IS Code 2911 (Part 3): 1979 (Reaffirmed 1997) "Under Reamed Piles", Bureau of Indian Standards, New Delhi.
11. IS Code 2911 (Part 4): 1979 (Reaffirmed 1997) "Load Test on Piles", Bureau of Indian Standards, New Delhi.
12. IS Code 1904: 1986 (Reaffirmed 1995) "Design and Construction of Foundations in Soils", Bureau of Indian Standards, New Delhi.
13. IS Code 2131: 1981 (Reaffirmed 1997) "Method for Standard Penetration test for Soils", Bureau of Indian Standards, New Delhi.
14. IS Code 2132: 1986 (Reaffirmed 1997) "Code of Practice for thin – walled tube sampling for soils", Bureau of Indian Standards, New Delhi.
15. IS Code 1892 (1979): Code of Practice for subsurface Investigation for Foundations, Bureau of Indian Standards, New Delhi.
16. IS Code 14458 (Part 1): 1998 "Retaining Wall for Hill Area – Guidelines, Selection of Type of Wall", Bureau of Indian Standards, New Delhi.
17. IS Code 14458 (Part 2): 1998 "Retaining Wall for Hill Area – Guidelines, Design of Retaining/Breast Walls", Bureau of Indian Standards, New Delhi.
18. IS Code 14458 (Part 3): 1998 "Retaining Wall for Hill Area – Guidelines, Construction of Dry Stone Walls", Bureau of Indian Standards, New Delhi.

CE17503	STRUCTURAL ANALYSIS I	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To introduce students the basic concept of differentiating Statically Determinate and Indeterminate Structures and to understand the deflection in determinate frames.

- To analyze statically indeterminate beams and frames using slope deflection method.
- To analyze statically indeterminate beams and frames using Moment Distribution Method.
- To analyze statically indeterminate beams and frames using Matrix flexibility Method.
- To analyze statically indeterminate beams and frames using Matrix Stiffness Method.

UNIT I STRAIN ENERGY METHOD 9+3

Determination of Static and Kinematic Indeterminacies – Analysis of continuous beams, plane frames and indeterminate plane trusses by strain energy method (up to two degree of redundancy).

UNIT II SLOPE DEFLECTION METHOD 9+3

Slope deflection equations – Equilibrium conditions - Analysis of continuous beams and rigid frames – Rigid frames with inclined members - Support settlements - symmetric frames with symmetric and skew - symmetric loadings.

UNIT III MOMENT DISTRIBUTION METHOD 9+3

Stiffness and carry over factors – Distribution and carryover of moments - Analysis of continuous Beams - Plane rigid frames with and without sway – Support settlement - symmetric frames with symmetric and skew - symmetric loadings.

UNIT IV FLEXIBLITY METHOD 9+3

Primary structures - Compatibility conditions – Formation of flexibility matrices - Analysis of indeterminate pin-jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach.

UNIT V STIFFNESS METHOD 9+3

Restrained structure – Formation of stiffness matrices - equilibrium conditions - Analysis of Continuous Beams, Pin-jointed plane frames and rigid frames by direct stiffness method.

TOTAL: 45 PERIODS + 15 TUTORIALS

OUTCOMES:

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

- Draw Shear force and Bending moment diagram for both statically determinate and indeterminate structures
- Adopt any method to analyze a statically indeterminate frame or beam.
- Get familiarized in finding deflection and behavior of determinate frames.
- Get familiarized in sway mechanism of a portal frame and analyzing it using a suitable method.
- Analyze the member forces, deflection for a pin jointed or rigid jointed frames using suitable matrix method.

TEXTBOOKS:

1. Bhavikatti, S.S, StructuralAnalysis, Vol.1, Vikas Publishing House Pvt.Ltd., NewDelhi 4, 2010.
2. Bhavikatti,S.S,Structural Analysis,Vol.2,VikasPublishing House Pvt.Ltd., NewDelhi-4, 2013.
3. Punmia.B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications, NewDelhi, 2004.
4. Hibbeler, R.C.,Structural Analysis, VII Edition, Prentice Hall, 2012.

REFERENCES:

1. William Weaver, Jrand James M.Gere, Matrix analysis of framed structures, CBS Publishers & Distributors,Delhi,1995

2. Vaidyanathan,R & Perumal P, Structural Analysis,Vol.1&2,Laxmi Publications, NewDelhi,2004
3. Pandit G.S.and Gupta S.P., Structural Analysis – A Matrix Approach, Tata McGraw Hill Publishing Company Ltd.,2006
4. Reddy.C.S, "Basic Structural Analysis", Tata McGraw Hill Publishing Company,2005.
5. Negi L.S.and Jangid R.S.,Structural Analysis, Tata McGraw Hill PublishingCo.Ltd.2004.

CE17504 HIGHWAY ENGINEERING

L	T	P	C
2	2	0	3

OBJECTIVES:

- To understand the importance of planning, history of road development in India, classification and design of highways according to IRC standards and specifications.
- To know the Cross sectional elements of urban and rural road, Sight distances, Horizontal curves, vertical curves and Hairpin bends.
- To acquire knowledge on pavement components and their role and design practice for flexible and rigid Pavements (IRC methods only)
- To obtain knowledge on the highway construction materials, testing methods, Construction practice including modern materials, methods and equipments.
- To learn the pavement distress in flexible and rigid pavements, pavement management systems, pavement evaluation, and highway project formulation.

UNIT I HIGHWAY PLANNING AND ALIGNMENT 8+3

Significance of highway planning – Modal limitations towards sustainability - History of road development in India – Classification of highways – Locations and functions – Factors influencing highway alignment – Soil suitability analysis - Road ecology - Engineering surveys for alignment, objectives, conventional and modern methods - Typical cross sections of Urban and Rural roads.

UNIT II GEOMETRIC DESIGN OF HIGHWAYS 12+3

Cross sectional elements - Sight distances – Horizontal curves, Super elevation, transition curves, widening at curves – Vertical curves - Gradients, Special consideration for hill roads - Hairpin bends – Lateral and vertical clearance at underpasses.

UNIT III DESIGN OF FLEXIBLE AND RIGID PAVEMENTS 9+3

Design principles – pavement components and their role - Design practice for flexible and rigid Pavements (IRC methods only) – Embankments - Problems in Flexible pavement design.

UNIT IV HIGHWAY CONSTRUCTION MATERIALS AND PRACTICE 8+3

Highway construction materials, properties, testing methods – CBR Test for subgrade - tests on aggregate & bitumen – Test on Bituminous mixes - Construction practice including modern materials and methods, Bituminous and Concrete road construction, Polymer modified bitumen, Recycling, Different materials – Glass, Fibre, Plastic, Geo-Textiles, Geo-Membrane (problem not included) – Quality control measures - Highway drainage - Construction machineries.

UNIT V EVALUATION AND MAINTENANCE OF PAVEMENTS 8+3

Pavement distress in flexible and rigid pavements – Pavement Management Systems - Pavement evaluation, roughness, present serviceability index, skid resistance, structural evaluation, evaluation by deflection measurements – Strengthening of pavements – Types of maintenance – Highway Project formulation.

TOTAL: 45 PERIODS + 15 TUTORAILS

OUTCOMES:

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

- Get familiarized with significance of highway planning, road development plan in India, engineering survey and factor influencing alignment.
- Evaluate the cross sectional elements, Sight distances, Horizontal curves, Super elevation, transition curves, widening at curves and the Vertical curves.
- Design the flexible and rigid Pavements (IRC methods only).
- Get familiarized with the properties, testing methods for aggregate, soil, bitumen and Construction practice including modern materials and design of highway drainage.
- Identify the pavement distress in flexible and rigid pavements, pavement management systems, pavement evaluation, and highway project formulation.

TEXTBOOKS:

1. Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", Nemchand Publishers, 2014.
2. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai, 2010
3. Indian Road Congress (IRC), Guidelines and Special Publications of Planning and Design.

REFERENCES:

1. Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications, 8th edition Delhi, 2013.
2. Yang H. Huang, "Pavement Analysis and Design", Pearson Education Inc, Ninth Impression, South Asia, 2012
3. Ian D. Walsh, "ICE manual of highway design and management", ICE Publishers, 1st Edition, USA, 2011
4. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, "Principles of Highway Engineering and Traffic Analysis", Wiley India Pvt. Ltd., New Delhi, 2011
5. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
6. O'Flaherty.C.A "Highways, Butterworth – Heinemann, Oxford, 2006.

CE17511 CONSTRUCTION MATERIALS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To determine the quality of cement through various laboratory tests on cement.
- To acquire knowledge on the quality of fine aggregates through various tests on fine aggregates.
- To know the quality of bricks through various tests on bricks.
- To acquire knowledge on the quality of coarse aggregates through various tests on coarse aggregates.
- To know the quality of concrete and the materials used in the construction.

I. TESTS ON CEMENT **12**

1. Determination of fineness
2. Determination of consistency
3. Determination of initial and final setting time
4. Determination of specific gravity

II. TESTS ON FINE AGGREGATE **12**

5. Grading of fine aggregates
6. Test for specific gravity and test for bulk density
7. Compacted and loose bulk density of fine aggregate

III. TESTS ON BRICK **12**

8. Test for compressive strength
9. Test for Water absorption
10. Determination of Efflorescence

IV. TESTS ON COARSE AGGREGATE **12**

11. Determination of impact value of coarse aggregate
12. Determination of elongation index
13. Determination of flakiness index
14. Determination of aggregate crushing value of coarse aggregate

V. TESTS ON CONCRETE **12**

15. Test for Slump
16. Test for Compaction factor
17. Test for Compressive strength - Cube & Cylinder
18. Test for Flexural strength

TOTAL: 60 PERIODS

OUTCOMES:

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

- Get familiarized with the quality of cement through various laboratory tests on cement.
- Get familiarized with the quality of fine aggregates through various tests on fine aggregates.
- Get familiarized with the quality of bricks through various tests on aggregates
- Assess the quality of coarse aggregates through various tests on coarse aggregates.
- Assess the quality of concrete and the materials used in the construction

REFERENCES:

1. Construction Materials Laboratory Manual, Anna University, Chennai-600 025.
2. IS 4031 (Part 1) – 1996: – Indian Standard Method for determination of fineness by dry sieving.
3. IS 4031 (Part 3) – 1988 – Indian Standard methods for Determination of soundness
4. IS 4031 (Part 5) – 1988 – Indian Standard methods for Determination of initial and final setting times
5. IS 2386 (Part 1 to Part 6) – 1963 – Indian Standard methods for test for aggregate for concrete
6. IS 383– 1970: Indian Standard specification for coarse and fine aggregates from natural sources for concrete.

CE17512	SURVEY CAMP (2 WEEKS – DURING IV SEMESTER VACATION)	L	T	P	C
		0	0	0	2

OBJECTIVES:

- To acquire knowledge on the concepts of Traversing and Contour Survey.
- To gain the knowledge and implementation of building marking and location.
- To learn the concepts of determining the Azimuth of Sun/Star and implementing the same.
- To understand the method of calculating latitude and longitude of a place and traversing using GPS.
- To implement the procedure of setting a curve in the field using various methods.

Groups of not more than six members in a group will carry out each exercise in survey camp. The camp must involve work on a large area of not less than 40 acres outside the campus (Survey camp should not be conducted inside the campus). At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

Two weeks Survey Camp will be conducted during summer vacation in the following activities:

1. Traverse - using Total station
2. Contouring
   (i). Radial tachometric contouring - Radial Line at Every 45 degree and Length not less than 60 Meter on each Radial Line
   (ii). Block Level/ by squares of size at least 100 Meter x 100 Meter at least 20 Meter interval
   (III). L.S & C.S - Road and canal alignment for a Length of not less than 1 Kilo Meter at least L.S at Every 30M and C.S at every 90 M
3. Offset of Buildings and Plotting the Location
4. Sun / Star observation to determine azimuth
5. Use of GPS to determine latitude and longitude and locate the survey camp location
6. Traversing using GPS
7. Curve setting by deflection angle

Apart from above students may be given survey exercises in other area also based on site condition to give good exposure on survey.

OUTCOMES:

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

- Implement the concepts behind Traversing and Contour Survey in the field.
- Get familiarized with the implementation of building marking and location.
- Determine the Azimuth of Sun/Star and implementing the same in the field.
- Do the method of calculating latitude and longitude of a place and traversing using GPS.
- Implement the procedure of setting a curve in the field using various methods.

CE17513	**HIGHWAY ENGINEERING LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

OBJECTIVES:

- To perform several laboratory experiments including designing an experiment in highway engineering.
- To describe the principles and procedures of conducting tests on Aggregates.
- To conduct tests on bitumen as engineering materials.
- To develop an understanding on the Determination of Binder Content in bituminous mixes.
- To gain knowledge about various materials for road construction.

EXCERCISES:

I TEST ON AGGREGATES

a) Specific Gravity
b) Los Angeles Abrasion Test
c) Water Absorption of Aggregates

II TEST ON BITUMEN

a) Specific Gravity of Bitumen
b) Penetration Test
c) Viscosity Test
d) Softening Point Test
e) Ductility Test

III TESTS ON BITUMINOUS MIXES

a) Stripping Test
b) Determination of Binder Content
c) Marshall Stability and Flow Values

IV DEMONSTRATION OF FIELD TESTING EQUIPMENT

TOTAL: 60 PERIODS

OUTCOMES:

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

- Characterize various pavement materials through relevant tests and modern techniques.
- Understand, formulate and solve problems related to highway engineering.
- Get familiarized with the importance of highway engineering materials.
- Apply various tests on the materials used in highway construction work.
- Indentify the use of appropriate materials in highway engineering.
- Apply the fundamental principle of highway engineering associated with engineering problems.

REFERENCES:

1. Highway Materials and Pavement Testing, Nem Chand and Bros., Roorkee, Revised Fifth Edition, 2009
2. Methods for testing tar and bituminous materials, IS 1201–1978 to IS 1220– 1978, Bureau of Indian Standards
3. Methods of test for aggregates, IS 2386 – 1978, Bureau of Indian Standards.
4. Mix Design Methods Asphalt Institute Manual Series No. 2, Sixth Edition, 1997, Lexington, KY, USA.

CE17601	**DESIGN OF STEEL STRUCTURAL ELEMENTS**	**L**	**T**	**P**	**C**
		3	**2**	**0**	**4**

OBJECTIVES:

- To understand the properties of steel, the sections used for structural members, basic concepts of limit state method, IS code specifications for designing steel sections.
- To understand the IS code specifications for designing the connections in steel members.
- To understand the design procedure and codal provisions for design of tension members and the connections as per limit state method.
- To understand the behaviour of compression members and the design the members for the given load as per IS code
- To understand the behaviour of flexural members and design the beams and purlins

UNIT I INTRODUCTION AND ALLOWABLE STRESS DESIGN 9+6

Structural steel types – Mechanical Properties of structural steel - Indian structural steel products - Steps involved in the Design Process - Steel Structural systems and their Elements - Type of Loads on Structures and Load combinations - Code of practices, Loading standards and Specifications - Concept of Allowable Stress Method, and Limit State Design Methods for Steel structures-Relative advantages and Limitations - Strengths and Serviceability Limit states. Allowable stresses as per IS 800 section 11 - Concepts of Allowable stress design for bending and Shear – Check for Elastic deflection - Calculation of moment carrying capacity – Design of Laterally supported Solid Hot Rolled section beams - Allowable stress design of Angle Tension and Compression Members and estimation of axial load carrying capacity.

UNIT II CONNECTIONS IN STEEL STRUCTURES 9+6

Type of Fasteners - Bolts, Pins and welds - Types of simple bolted and welded connections Relative advantages and Limitations - Modes of failure - The concept of Shear lag - Efficiency of joints - Axially

loaded bolted connections for Plates and Angle Members using bearing type bolts – Prying forces and Hanger connection – Design of Slip critical connections with High strength Friction Grip bolts - Design of joints for combined shear and Tension - Eccentrically Loaded Bolted Bracket Connections - Welds - symbols and specifications - Effective area of welds - Fillet and Butt Welded connections - Axially Loaded connections for Plate and angle truss members and Eccentrically Loaded bracket connections.

UNIT III TENSION MEMBERS 9+6

Tension Members - Types of Tension members and sections – Behaviour of Tension Members - modes of failure - Slenderness ratio - Net area – Net effective sections for Plates, Angles and Tee in tension – Concepts of Shear Lag - Design of plate and angle tension members - Design of built up tension Members - Connections in tension members – Use of lug angles – Design of tension splice.

UNIT IV COMPRESSION MEMBERS 9+6

Types of compression members and sections – Behaviour and types of failures - Short and slender columns - Current code provisions for compression members - Effective Length, Slenderness ratio – Column formula and column curves - Design of single section and compound Angles - Axially Loaded solid section Columns - Design of Built up Laced and Battened type columns – Design of column bases – Plate and Gusseted bases for Axially loaded columns - Splices for columns.

UNIT V DESIGN OF FLEXURAL MEMBERS 9+6

Types of steel Beam sections - Behaviour of Beams in flexure - Codal Provisions – Classification of cross sections - Flexural Strength and Lateral stability of Beams – Shear Strength - Web Buckling, Crippling and deflection of Beams - Design of laterally supported Beams - Design of solid rolled section Beams - Design of Plated beams with cover plates - Design Strength of Laterally unsupported Beams – Design of laterally unsupported rolled section Beams - Purlin in Roof Trusses - Design of Channel and I section Purlins.

TOTAL: 45 PERIODS + 30 TUTORIALS

OUTCOMES:

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

- Get familiarized with the structural properties of steel and IS code specifications.
- Design of joints using bolted and welded connections as per the IS code specifications.
- Design tension members and the necessary connections in tension members as per IS 800-2007.
- Design all the types of the compression members for the given loading as per the IS code.
- Design the beams and purlins as per IS code.

TEXT BOOKS:

1. Gambhir. M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013.
2. Sai Ram. K.S. - Design of Steel Structures - Dorling Kindersley (India) Pvt. Ltd., New Delhi, 2nd Edition, 2015, www.pearsoned.co.in/kssairam
3. Shiyekar. M.R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd Edition, 2013.
4. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.

REFERENCES:

1. Narayanan.R.et.al. "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002

2. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2005
3. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800-2007, IK International Publishing House Pvt. Ltd., 2009
4. Shah.V.L. and Veena Gore, "Limit State Design of Steel Structures", IS 800-2007, Structures Publications, 2009.
5. IS800 :2007, General Construction in Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007

CE17602 STRUCTURAL ANALYSIS II

L	T	P	C
2	2	0	3

OBJECTIVES:

- To help students analyze determinate beams and frames subjected to rolling loads for sketching influence lines.
- To analyze indeterminate beams for plotting influence line diagram using Muller-Breslau principle.
- To analyze various structural forms of arches for different support conditions.
- To analyze suspension cables of various end conditions and space frames.
- To help students understand the concept of plastic analysis and application of the same to indeterminate beams and frames.

UNIT I INFLUENCE LINES FOR DETERMINATE BEAMS 9+3

Influence lines for reactions in statically determinate beams – Influence lines for shear force and bending moment – Calculation of critical stress resultants due to concentrated and distributed moving loads - absolute maximum bending moment - influence lines for member forces in pin jointed frames.

UNIT II INFLUENCE LINES FOR INDETERMINATE BEAMS 9+3

Muller Breslau's principle – Influence line for Shearing force, Bending Moment and support reaction components of propped cantilever, fixed beams and continuous beams (Redundancy restricted to one)

UNIT III ARCHES 9+3

Arches - Types of arches – Analysis of three hinged, two hinged and fixed arches - Parabolic and circular arches – Settlement and temperature effects.

UNIT IV CABLES AND SUSPENSION BRIDGES 9+3

Equilibrium of cables – length of cable – Anchorage of suspension cables – stiffening girders - cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders.

UNIT V PLASTIC ANALYSIS 9+3

Plastic theory - Statically indeterminate structures – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Collapse Load - Static and kinematic methods– Upper and lower bound theorems - Plastic analysis of indeterminate beams and frames.

TOTAL: 45 PERIODS + 15 TUTORIALS

OUTCOMES:

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

- Analyze and sketch influence lines for determinate beams and frames subjected to rolling loads.
- Understand and apply Muller-Breslau principle to analyze indeterminate beams subject to rolling loads.
- Analyze various structural forms of arches.

- Analyze suspension cables and also space frames using method of Tension Co-efficient.
- Understand the concept of plastic analysis and apply the same to analyze indeterminate beams and frames.

TEXTBOOKS:

1. Bhavikatti,S.S, Structural Analysis,Vol.1,Vikas Publishing House Pvt.Ltd.,NewDelhi-4, 2010.
2. Bhavikatti,S.S, Structural Analysis,Vol.2,Vikas Publishing House Pvt.Ltd.,NewDelhi-4, 2013.
3. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, Theory of structures, Laxmi, Publications, 2004.
4. Vazrani.V.N And Ratwani,M.M, Analysis of Structures, Vol.II, Khanna Publisers,2015.
5. Vaidyanathan.R and Perumal.P, Structural Analysis, Vol.2, Laxmi Publications, 2015.

REFERENCES:

1. Negi.L.S and Jangid R.S., Structural Analysis, Tata McGraw-Hill Publishers, 2004.
2. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co.Ltd.2002.
3. Gambhir. M.L., Fundamentals of Structural Mechanics and Analysis, PHI Learning Pvt. Ltd., 2011.
4. Prakash Rao D.S., Structural Analysis, Universities Press, 1996.

CE17603	IRRIGATION ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To estimate the irrigation water required for crop and evapotranspiration.
- To acquire knowledge on various irrigation methods, water distribution and its efficiencies.
- To learn various types of diversion and impounding structures and design the same.
- To impart knowledge on canal irrigation system and design of Lined and Unlined canals based on theories.
- To obtain knowledge on optimization of usage and management of irrigation water using modernized techniques.

UNIT I CROP WATER REQUIREMENT 9

Need and classification of irrigation - historical development and merits and demerits of irrigation - types of crops - crop season - duty, delta and base period - consumptive use of crops - estimation of Evapotranspiration using experimental and theoretical methods

UNIT II IRRIGATION METHODS 9

Tank irrigation – Well irrigation – Irrigation methods: Surface and Sub-Surface and Micro Irrigation – design of drip and sprinkler irrigation – ridge and furrow irrigation - Irrigation scheduling – Water distribution system - Irrigation efficiencies.

UNIT III DIVERSION AND IMPOUNDING STRUCTURES 9

Types of Impounding structures - Gravity dam – Forces on a dam - Design of Gravity dams; Earth dams, Arch dams - Diversion Head works - Weirs and Barrages.

UNIT IV CANAL IRRIGATION 9

Canal regulations – direct sluice - Canal drop – Cross drainage works - Canal outlets – Design of prismatic canal - Canal alignments - Canal lining - Kennedy's and Lacey's Regime theory - Design of unlined canal.

UNIT V WATER MANAGEMENT IN IRRIGATION 9

Modernization techniques - Rehabilitation – Optimization of water use - Minimizing water losses - On form development works - Participatory irrigation management - Water resources associations - Changing paradigms in water management - Performance evaluation - Economic aspects of irrigation.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Get familiarized with the crop water requirements.
- Acquire knowledge on various irrigation methods, water distribution and its efficiencies.
- Design various types of diversion and impounding structures.
- Get familiarized with the canal irrigation system and design the same.
- Optimize the usage and management of irrigation water using modernized techniques.

TEXTBOOKS:

1. Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
2. Punmia B.C., etal; Irrigation and water power Engineering, Laxmi Publications, 16th Edition, New Delhi, 2009
3. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23rd Revised Edition, New Delhi, 2009

REFERENCES:

1. Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers, 2005
2. Linsley R.K. and Franzini J.B, "Water Resources Engineering", McGraw-Hill Inc, 2000
3. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata McGraw-Hill Inc., New Delhi, 1997.

CE17604	**WATER SUPPLY ENGINEERING**	**L**	**T**	**P**	**C**
		2	**2**	**0**	**3**

OBJECTIVES:

- To get familiarized with water demand, population forecasting, water quality, characteristics and water quality standards.
- To design flow through pipes, laying, jointing and testing of pipes, appurtenances and pumps.
- To design water treatment plant units like flash mixers, clariflocculators, pulsator clarifier and sand filters.
- To acquire knowledge about advanced water treatment methods like water softening, desalination, RO plant, demineralization, adsorption, ion exchange, defluoridation and iron and manganese removal.
- To impart knowledge on the requirements of water distribution, design of service reservoirs, water distribution networks, house service connection and pipe fittings & fixtures.

UNIT I SOURCES OF WATER 9+3

Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality – Characterization – Significance – Drinking Water quality standards.

UNIT II CONVEYANCE FROM THE SOURCE 9+3

Water supply – intake structures – Functions; Pipes and conduits for water – Pipe materials – Hydraulics of flow in pipes – Transmission main design – Laying, jointing and testing of pipes – appurtenances – Types and capacity of pumps – Selection of pumps and pipe materials.

UNIT III WATER TREATMENT 9+3

Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation – Clarifloccuator - Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - Residue Management –Construction, Operation and Maintenance aspects.

UNIT IV ADVANCED WATER TREATMENT 9+3

Water softening – Desalination- R.O. Plant – demineralization – Adsorption - Ion exchange – Membrane Systems – RO Reject Management - Iron and Manganese removal - Defluoridation – Removal of Arsenic - Construction and Operation & Maintenance aspects – Recent advances.

UNIT V WATER DISTRIBUTION AND SUPPLY 9+3

Requirements of water distribution – Components – Selection of pipe material – Service reservoirs – Functions – Network design – Economics – Analysis of distribution networks - Computer applications – Appurtenances – Leak detection. Principles of design of water supply in buildings – House service connection – Fixtures and fittings, systems of plumbing and types of plumbing.

TOTAL: 45 PERIODS + 15 TUTORIALS

OUTCOMES:

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

- Get familiarized with water demand, population forecasting, water quality, characteristics and water quality standards.
- Design flow through pipes, laying, jointing and testing of pipes, appurtenances and pumps.
- Design water treatment plant units like flash mixers, clariflocculators, pulsator clarifier and sand filters.
- Acquire knowledge about advanced water treatment methods like water softening, desalination, RO plant, demineralization, adsorption, ion exchange, defluoridation and iron and manganese removal.
- Acquire knowledge on the requirements of water distribution, design of service reservoirs, water distribution networks, house service connection and pipe fittings & fixtures.

TEXTBOOKS:

1. Garg, S.K. Environmental Engineering, Vol.I Khanna Publishers, New Delhi, 2010.
2. Modi, P.N., Water Supply Engineering, Vol.I Standard Book House, New Delhi, 2010.
3. Punmia, B.C.,Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi, 2010.

REFERENCES:

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2. 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.

CE17605	**WASTE WATER ENGINEERING**	**L**	**T**	**P**	**C**
		2	**2**	**0**	**3**

OBJECTIVES:

- To get familiarized with the estimation of sanitary sewage flow, its design, storm water estimation and corrosion and its preventive measures.

- To understand the procedure behind the primary treatment process of sewage and its construction, operation and maintenance.
- To understand the procedure exists in the secondary treatment process of sewage using Activated Sludge, Aerated systems, Stabilization ponds etc., and their construction, operation and maintenance aspects.
- To learn the process of sewage disposal using various methods without affecting the environment.
- To acquire knowledge on the treatment of sludge using digesters, thickeners and their disposal.

UNIT I PLANNING AND DESIGN OF SEWERAGE SYSTEM 9+3

Characteristics and composition of sewage - population equivalent - Sanitary sewage flow estimation – Sewer materials – Hydraulics of flow in sanitary sewers – Sewer design – Storm drainage - Storm runoff estimation – sewer appurtenances – corrosion in sewers – prevention and control – sewage pumping - drainage in buildings - plumbing systems for drainage.

UNIT II PRIMARY TREATMENT OF SEWAGE 9+3

Objectives – Unit Operations and Processes – Selection of treatment processes - Onsite sanitation - Septic tank - Grey water harvesting – Primary treatment – Principles, functions and design of sewage treatment units - screens - grit chamber - primary sedimentation tanks – Construction, Operation and Maintenance aspects.

UNIT III SECONDARY TREATMENT OF SEWAGE 9+3

Objectives – Selection of Treatment Methods – Principles, functions and design of Activated Sludge Process and Extended aeration systems - Trickling filters – Sequencing Batch Reactor(SBR) – Membrane Bioreactor - UASB – Waste Stabilization Ponds - Other treatment methods -Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment – Construction, Operation and Maintenance aspects.

UNIT IV DISPOSAL OF SEWAGE 9+3

Standards for Disposal - Methods – dilution – Mass balance principle - Self purification of river - Oxygen sag curve – deoxygenation and reaeration – Streeter Phelps model - Land disposal – Sewage farming – sodium hazards - Soil dispersion system.

UNIT V SLUDGE TREATMENT AND DISPOSAL 9+3

Objectives - Sludge characterization – Thickening - Design of gravity thickener - Sludge digestion - Standard rate and High rate digester design - Biogas recovery - Sludge Conditioning and Dewatering – Sludge drying beds - ultimate residue disposal - recent advances.

TOTAL: 45 PERIODS + 15 TUTORIALS

OUTCOMES:

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

- Get familiarized with the estimation of sanitary sewage flow, its design, storm water estimation and corrosion and its preventive measures.
- Understand the procedure behind the primary treatment process of sewage and its construction, operation and maintenance.
- Understand the procedure exists in the secondary treatment process of sewage using Activated Sludge, Aerated systems, Stabilization ponds etc., and their construction, operation and maintenance aspects.
- Precede the process of sewage disposal using various methods without affecting the environment.

- Acquire knowledge on the treatment of sludge using digesters, thickeners and their disposal.

TEXTBOOKS:

1. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers, New Delhi, 2015.
2. Duggal K.N., "Elements of Environmental Engineering" S.Chand and Co. Ltd., New Delhi, 2014.
3. Punmia, B.C., Jain, A.K., and Jain.A.K., Environmental Engineering, Vol.II, Laxmi Publications, 2010.
4. Modi, P.N., "Sewage Treatment and Disposal & Waste water Engineering" Rajsons Publications Pvt. Ltd, Standard Book House (Since 1960).

REFERENCES:

1. Manual on Sewerage and Sewage Treatment Systems Part A,B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
2. Metcalf and Eddy- Wastewater Engineering–Treatment and Reuse, Tata Mc.Graw-Hill Company, New Delhi, 2010.
3. Syed R. Qasim "Wastewater Treatment Plants", CRC Press, Washington D.C., 2010
4. Gray N.F, "Water Technology", Elsevier India Pvt. Ltd., New Delhi, 2006.

CE17611	WATER AND WASTE WATER ANALYSIS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To analyze the physical, chemical and biological characteristics of water and wastewater.
- To suggest treatment process based on the characteristics studies.
- To quantify the dosage requirement for coagulation and chlorination process.
- To study the growth of micro-organism and its quantification.
- To quantify the sludge.

List of Experiments:

- Determination of pH, Turbidity and conductivity.
- Determination of Hardness.
- Determination of Alkalinity and Acidity.
- Determination of Chlorides.
- Determination of Phosphates and Sulphates.
- Determination of iron and fluoride.
- Determination of Optimum Coagulant dosage.
- Determination of residual chlorine and available chlorine in bleaching powder.
- Determination of Oil, and Grease.
- Determination of suspended, settleable, volatile and fixed solids.
- Determination Dissolved Oxygen and BOD for the given sample.
- Determination of COD for given sample.
- Determination of SVI of Biological sludge and microscopic examination.
- Determination of MPN index of given water sample.

OUTCOME:

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

- Quantify the pollutant concentration in water and wastewater.

- Propose treatment options based on the water and waste water characteristics.
- Determine the dosage of coagulant and chlorine required for treatment.
- Examine the conditions for the growth of micro-organisms.
- Determine the characteristics of sludge.

TOTAL: 60 PERIODS

REFERENCES:

1. Standards Methods for the Examination of Water and Wastewater, 17th Edition, WPCF, APHA and AWWA, USA, 1989.
2. IS 3025: 1986 Methods of sampling and test (physical and chemical) for water and waste water.

CE17612	IRRIGATION AND ENVIRONMENTAL ENGINEERING DRAWING	L	T	P	C
		0	0	4	2

OBJECTIVE:

- At the end of the semester, the student shall conceive, design and draw the irrigation and environmental engineering structures in detail showing the plan, elevation and Sections.

PART A: IRRIGATION ENGINEERING

1. TANK COMPONENTS **9**

Fundamentals of design - Tank surplus weir – Tank sluice with tower head - Drawings showing foundation details, plan and elevation

2. IMPOUNDING STRUCTURES **6**

Design principles - Earth dam – Profile of Gravity Dam

3. CROSS DRAINAGE WORKS **6**

General design principles - Aqueducts – Syphon aqueduct (Type III) – Canal drop (Notch Type) – Drawing showing plan, elevation and foundation details.

4. CANAL REGULATION STRUCTURES **9**

General Principles - Direct Sluice - Canal regulator - Drawing showing detailed plan, elevation and foundation details.

PART B: ENVIRONMENTAL ENGINEERING

1. WATER SUPPLY AND TREATMENT **15**

Design and Drawing of flash mixer, flocculator, clarifier – Rapid sand filter – Service reservoirs – Pumping station – House service connection for water supply and drainage.

2. SEWAGE TREATMENT & DISPOSAL **15**

Design and Drawing of screen chamber - Grit channel - Primary clarifier - Activated sludge process – Aeration tank – Trickling filter – Sludge digester – Sludge drying beds – Waste stabilization ponds - Septic tanks and disposal arrangements.

TOTAL: 60 PERIODS

OUTCOME:

- The students after completing this course will be able to design and draw various units of municipal water treatment plants and sewage treatment plants.

TEXTBOOKS:

1. Satya Narayana Murthy Challa, “Water Resources Engineering: Principles and Practice”, New Age International Publishers, New Delhi, 2002.

2. Garg, S.K., "Irrigation Engineering and Design of Structures", New Age International Publishers, New Delhi, 1997.
3. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 1999.
4. Manual on "Sewerage and Sewage Treatment Systems- Part A, B and C" CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.

REFERENCES:

1. Mohanakrishnan. A, "A few Novel and Interesting Innovative Irrigation Structures: conceived, Designed and Executed in the Plan Projects in Tamil Nadu", Publ. No. 44 and Water Resources Development & Management Publ.No.43, IMTI Thuvakudy, Trichy, 2011.
2. Raghunath, H.M. "Irrigation Engineering", Wiley India Pvt. Ltd., New Delhi, 2011.
3. Sharma R.K., "Irrigation Engineering and Hydraulic Structures", Oxford and IBH Publishing Co., New Delhi, 2002.
4. Peary, H.S., ROWE, D.R., Tchobanoglous, G., "Environmental Engineering", McGraw- HillBook Co., New Delhi, 1995.
5. Metcalf and Eddy, "Wastewater Engineering, Treatment and Reuse", Tata McGraw-Hill,New Delhi, 2010.
6. Qasim,S.R., Motley, E.M and Zhu.G. "Water works Engineering – Planning, Design and Operation", Prentice Hall, New Delhi, 2009.
7. Qasim, S. R. "Wastewater Treatment Plants, Planning, Design & Operation", CRC Press, New York 2010.

CE17701	ESTIMATION, COSTING AND VALUATION ENGINEERING	L	T	P	C
		2	2	0	3

OBJECTIVES:

- To know the concepts behind the estimation of building components and arriving the quantities.
- To analyse and estimate the different quantities of works for structures that comes under the environmental, irrigation, transportation and soil engineering stream.
- To frame an estimate based on specifications and develop chart documents based on tenders and contracts.
- To understand and apply the methods of valuation to be used in the preparation of estimate for existing buildings.
- To analyze and prepare a report on estimate for various structures based on its formulation principles.

UNIT I QUANTITY ESTIMATION 9+3

Philosophy – Purpose – Methods of estimation – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, bituminous and cement concrete roads, septic tank, soak pit, retaining walls – culverts (additional practice in class room using computer softwares)

UNIT II RATE ANALYSIS AND COSTING 9+3

Standard Data – Observed Data – Schedule of rates – Market rates – Standard Data for Man Hours and Machineries for common civil works – Rate Analysis for all Building works, canals, and Roads– Cost Estimates (additional practice in class room using Computer softwares) - (Analysis of rates for the item of work asked, the data regarding labour, rates of labour and rates of material to be given in the Examination Question Paper)

UNIT III SPECIFICATIONS, REPORTS AND TENDERS 9+3

Specifications – Detailed and general specifications (NRM 2) – Constructions – Sources – Types of specifications – Principles for report preparation – report on estimate of residential building – Culvert – Roads – TTT Act 2000 – Tender notices – types – tender procedures – Drafting model tenders , E-tendering- Digital signature certificates - Encrypting - Decrypting – Reverse auctions.

UNIT IV CONTRACTS 9+3

Contract – Types of contracts – Formation of contract – Contract conditions – Contract for labour, material, design, construction – Drafting of contract documents based on IBRD / MoRTH Standard bidding documents – Construction contracts – Contract problems – Arbitration and legal requirements - Construction disputes and resolution methods (FIDIC contract terms).

UNIT V VALUATION 9+3

Definitions – Various types of valuations – Valuation methods - Necessity – Capitalised value – Depreciation – Escalation – Valuation of land – Buildings – Calculation of Standard rent – Mortgage – Lease.

TOTAL: 45 PERIODS + 15 TUTORIALS

OUTCOMES:

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

- Estimate the building elements by implementing individual wall and centre line method and also compute the quantities of work for various miscellaneous elements.
- Estimate the quantities of works for some structures that come under the environmental, irrigation, transportation and soil engineering stream.
- Frame an estimate based on specifications and chart documents based on tenders and contracts.
- Apply the methods of valuation to be used in the preparation of estimate for existing buildings.
- Prepare a report on estimate for various structures based on its formulation principles.

TEXTBOOKS:

1. B.N Dutta ‘Estimating and Costing in Civil Engineering’, UBS Publishers & Distributors (P) Ltd, 2010.
2. B.S.Patil, ‘Civil Engineering Contracts and Estimates’, University Press, 2006
3. D.N. Banerjee, ‘Principles and Practices of Valuation’, V Edition, Eastern Law House, 1998

REFERENCES:

1. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD
2. Tamil Nadu Transparencies in Tenders Act, 1998
3. Arbitration and Conciliation Act, 1996
4. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996
5. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2003

CE17702	RAILWAYS, AIRPORTS, DOCKS AND HARBOUR ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the different elements of permanent way, construction methods and its geometric design.
- To understand the concepts of track laying, construction and maintenance.
- To formulate the objectives and layout of planning the airport according to the norms.
- To understand the basic concepts behind the airport design and runway orientation.

- To enhance the basic knowledge of harbour components, their design principles, coastal structures and its protection.

UNIT I RAILWAY PLANNING AND CONSTRUCTION 10

Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges - Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods - Geometric design of railway, gradient, super elevation, widening of gauge on curves - Level Crossings. .

UNIT II RAILWAY CONSTRUCTION AND MAINTENANCE 8

Earthwork – Stabilization of track on poor soil - Tunnelling Methods, drainage and ventilation – Calculation of Materials required for track laying - Construction and maintenance of tracks – Railway Station and yards and passenger amenities

UNIT III AIRPORT PLANNING 7

Air transport characteristics - airport classification - air port planning: objectives, components, layout characteristics, socio-economic characteristics of the Catchment area, criteria for airport site selection and ICAO stipulations, typical Airport Layouts, Case Studies, parking and Circulation Area

UNIT IV AIRPORT DESIGN 10

Runway Design: Orientation, Wind Rose Diagram, Problems on basic and Actual Length, Geometric Design, Configuration and Pavement Design Principles – Elements of Taxiway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings.

UNIT V HARBOUR ENGINEERING 10

Definition of Basic Terms: Harbour, Port, Satellite Port, Docks, Waves and Tides – Planning and Design of Harbours: Requirements, Classification, Location and Design Principles – Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage – Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works – Environmental concern of Port Operations – Coastal Regulation Zone, 2011

TOTAL: 45 PERIODS

OUTCOMES:

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

- Get familiarized with the different elements of permanent way, construction methods and its geometric design.
- Understand the concepts of track laying, construction and maintenance.
- Frame the objectives and layout of planning the airport according to the norms.
- Understand the basic concepts behind the airport design and runway orientation.
- Get familiarized with the basic knowledge of harbour components, their design principles, coastal structures and its protection.

TEXTBOOKS:

1. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering, V Scitech Publications (India), Chennai, 2010
2. Saxena Subhash, C.and Satyapal Arora, ACourse in Railway Engineering, Dhanapat Rai and Sons, Delhi, 1998

3. Khanna.S.K. Arora.M.G and Jain.S.S, Airport Planning and Design, Nemachand and Bros, Roorkee, 1994

REFERENCES:

1. C.Venkatramaiah., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels, Universities Press (India) Private Limited, Hyderabad, 2015.
2. Mundrey J S, Railway Track Engineering, McGraw Hill Education (India) Private Ltd, New Delhi, 2013

CE17703 STRUCTURAL DESIGN AND DRAWING

L	T	P	C
3	2	0	4

OBJECTIVES:

- To provide students an exposure about planning, design process and types of loading.
- To acquire the design knowledge and drawing of circular tank, rectangular tank, Underground rectangular tank and Intz tank.
- To gain a preliminary understanding of design knowledge and drawing about solid slab R.C Bridge and Tee beam bridge.
- To acquire knowledge on design and drawing of Retaining walls
- To acquire knowledge on Steel Roof Trusses, Roofing Elements and Purlins.

UNIT I RETAINING WALLS 9+6

Reinforced concrete Cantilever and Counter fort Retaining Walls – Horizontal Backfill with Surcharge – Design of Shear Key - Design and Drawing.

UNIT II FLAT SLAB AND BRIDGES 9+6

Design of Flat Slabs with and without drops by Direct Design Method of IS code - Design and Drawing - IRC Specifications and Loading – RC Solid Slab Bridge – Steel Foot-over Bridge - Design and Drawing.

UNIT III LIQUID STORAGE STRUCTURES 9+6

RCC Water Tanks - On ground, Elevated Circular, underground Rectangular Tanks – Hemispherical Bottomed Steel Water Tank - Design and Drawing

UNIT IV INDUSTRIAL STRUCTURES 9+6

Structural steel Framing - Steel Roof Trusses – Roofing Elements – Beam columns – Codal provisions - Design and Drawing.

UNIT V GIRDERS AND CONNECTIONS 9+6

Plate Girders – Behaviour of Components-Deign of Welded Plate Girder - Design of Industrial Gantry Girders – Design of Eccentric Shear and Moment Resisting connections.

TOTAL: 45 PERIODS + 30 TUTORIALS

Board Exam Question Pattern

Part- ATwo Mark questions -10 Total – 20 Marks

Part- B Two questions with choice either or - 40 Marks Each Total – 80 Marks

OUTCOMES:

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

- Get familiarized with various types of loading, planning and design process
- Get familiarized to design different types of circular tank, rectangular tank, Underground rectangular tank and intz tank.
- Get familiarized to design solid slab RC bridge, Tee Beam Bridge and read the drawing.
- Get familiarized to design the retaining wall and read the drawing.
- Get familiarized to design Steel Roof Trusses, Roofing Elements, Purlins and read the drawing.

TEXTBOOKS:

1. Krishnaraju N, Structural Design and Drawing, Universities Press, 2009.
2. PunmiaB.C, Ashok Kumar Jainand, Arun Kumar Jain, Comprehensive Design of Steel Structures, Laxmi Publications Pvt. Ltd., 2003.

REFERENCES:

1. Krishnamurthy D, Structural Design and Drawing VoI, II and III, CBS Publishers, 2010.
2. Shah V Land Veena Gore, Limit State Design of Steel Structures IS800-2007, Structures Publications, 2009.
3. IS 456(2000) Indian Standard Plain and Reinforced Concrete-Code of Practice, Bureau of Indian Standards, New Delhi.
4. SP34 Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi.
5. IS 800 (2007) Indian Standard General Construction In Steel—Code of Practice, Bureau of Indian Standards, New Delhi.
6. IS 875 Part 1 (2003) Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Code of Practice-Dead Load, Bureau of Indian Standards, New Delhi.
7. IS 875 Part 2 (2003) Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Code of Practice-Imposed Load, Bureau of Indian Standards, New Delhi.
8. IS 875 Part 3 (2003) Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Code of Practice-Wind Load, Bureau of Indian Standards, New Delhi.
9. IS 3370 Part 1 (2009) Indian Standard Concrete Structures for Storage of Liquids-Code of Practice–General Requirements, Code of Practice, Bureau of Indian Standards, New Delhi.
10. IS 3370 Part 2 (2009) Indian Standard Concrete Structures for Storage of Liquids-Code of Practice-Reinforced Concrete Structures, Code of Practice, Bureau of Indian Standards, New Delhi.
11. IS 3370–Part 4 (2008) Indian Standard Code of Practice for Concrete Structures for The Storage of Liquids-Design Tables, Code of Practice, Bureau of Indian Standards, New Delhi.
12. IS 804 (2008) Indian Standard Specification for Rectangular Pressed Steel Tanks, Code of Practice, Bureau of Indian Standards, New Delhi.
13. IS 805 (2006) Indian Standard Code of Practice for Use of Steel in Gravity Water Tanks, Code of Practice, Bureau of Indian Standards, New Delhi.
14. IRC 112-2011, Code of Practice for Concrete Road Bridges, The Indian Roads Congress, New Delhi.
15. IRC 6-2014, Standard Specifications and Code of Practice for Road Bridges Section: II-Loads and Stresses, The Indian Roads Congress, New Delhi.

CE17711	**CREATIVE AND INNOVATIVE PROJECT**	**L**	**T**	**P**	**C**
	(Activity Based - Subject Related)	**0**	**0**	**4**	**2**

OBJECTIVE:

- To use the knowledge acquired in Civil Engineering to do a mini project, which allows the students to come up with designs, fabrication or algorithms and programs expressing their ideas in a novel way.

TOTAL: 60 PERIODS

STRATEGY

The student has to identify a topic of interest on consultation with Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design / fabrication or develop computer code. Demonstrate the novelty of the project through the results and outputs.

CE17712	INDUSTRIAL TRAINING	L	T	P	C
	(4 Weeks During VI Semester – Summer)	**0**	**0**	**0**	**2**

OBJECTIVES:

- To enhance the knowledge of the students in professional engineering practice sought through industrial training on different current technologies.
- To expose students to real work life situations and to equip them with abreast of new technology that intensify their job acumen.
- To employ the students in structural industrial projects and strengthen the practical skills of the students.
- To develop significant commitment in the students' profession and specialization.

STRATEGY:

The students individually undertake training in reputed civil engineering companies for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

OUTCOMES:

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

- Apply prior acquired knowledge in a real-life environment.
- Integrate classroom theory with workplace practice.
- Acquire knowledge from the industry professionals who have assortment of knowledge in working in live-projects.
- Work on a research project or undertake work experience under the guidance of industry and academic supervision.
- Extend the knowledge through research and development in the chosen fields of specialization.

CE17713	COMPUTER AIDED DESIGN AND DRAFTING LABORATORY	L	T	P	C
		0	**0**	**4**	**2**

OBJECTIVES:

- To provide students an exposure to design, analysis and detailing of cantilever and counterfort retaining wall by using AutoCAD and STAAD Pro.
- To acquire knowledge to the Design, analysis and detailing of water tanks by using AutoCAD and STAAD Pro.
- To acquire knowledge to understand the plate girder bridge design and analysis by using STAAD Pro.
- To gain the concepts of design and analysis of slab culvert by using STAAD Pro.
- To provide students an exposure to design, analysis of hemispherical bottomed steel tank by using STAAD Pro.

LIST OF EXPERIMENTS:

1. Design and drawing of RCC cantilever and counter fort type retaining walls with reinforcement details
2. Design of solid slab and RCC Tee beam bridges for IRC loading and reinforcement details
3. Design and drafting of circular and rectangular RCC water tanks
4. Design of plate Girder Bridge - Truss Girder bridges – Detailed Drawings including connections
5. Design of hemispherical bottomed steel tank

TOTAL: 60 PERIODS

OUTCOMES:

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

- Get familiarized about the design, analysis and detailing of cantilever and counterfort retaining wall.
- Gained knowledge on the Design, analysis and detailing of water tanks.
- Get familiarized on the Design of plate Girder Bridge.
- Gained knowledge on the design of slab culvert.
- Get familiarized in analysis and design concepts of hemispherical bottomed steel tank.

TEXT BOOKS:

1. Krishnaraju,N. "Structural Design & Drawing, Universities Press, 2009.
2. Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "Comprehensive Design of Steel Structures, Laxmi Publications Pvt. Ltd., 2003.

REFERENCES:

1. Krishnamurthy, D., "Structural Design & Drawing – Vol. II and III, CBS Publishers, 2010.
2. Shah V L and Veena Gore, "Limit State Design of Steel Structures" IS800-2007, Structures Publications, 2009.

EXAMINATION DURATION: 3 HOURS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Sl.No.	Description of Equipment	Quantity
1.	Models of Structures	1 each
2.	Computers Pentium IV	30 No's
3.	Analysis and Design Software - Minimum 5 use License	1 No

CE17811 PROJECT WORK

L	T	P	C
0	0	20	10

OBJECTIVES:

- To develop the ability to interpret a specific problem.
- To formulate a proper methodology.
- To precede the work right from its identification and literature review till the successful solution of the same.
- To infer the various results and conclude the result.
- To train the students in preparing project reports and to face reviews and viva voce.

STRATEGY:

The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one

external examiner.

TOTAL: 300 PERIODS

OUTCOME:

On completion of the project work students will be in a position to pursue any challenging practical problems and find solution by formulating proper methodology

CE17E51	ADVANCED SURVEYING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge on the astronomical surveying and determination of time, latitude and longitude.
- To obtain knowledge on the aerial surveying, photogrammetry and photo interpretation.
- To gain knowledge on the applications of total station in surveying.
- To acquire knowledge on the GPS concept in surveying and its data processing applications.
- To visualize the various other methods of surveying for curve setting, hydrographic survey and tunneling.

UNIT I ASTRONOMICAL SURVEYING 9

Astronomical terms and definition – Motion of sun and stars – Celestial co-ordinate System - Time system - Nautical Alamance – Apparent attitude and corrections – Field observations and determinations of time, longitude, latitude and azimuth by attitude and Hour angle method.

UNIT II AERIAL SURVEYING 9

Terrestrial Photogrammetry – Terrestrial stereo photogrammetry – Aerial photogrammetry – overlaps – scale of photographs – Vertical and titled photographs distortion in aerial photographs – stereoscopic vision - photo interpretation – Applications.

UNIT III TOTAL STATION SURVEYING 9

Classification – basic measuring and working principles of an Electro – optical and Microwave total station - sources of errors in Electro – optical and Microwave total station – Care and Maintenance of total station – trilateration – Applications.

UNIT IV GPS SURVEYING 9

Basic concepts – Space, Control and User segments – Satellite configuration – Signal structure – Orbit determination and representation – Anti spoofing and selective availability – hand held and geodetic receivers – Field work procedure – Data processing Applications.

UNIT V MISCELLANEOUS 9

Reconnaissance – Route surveys for highways, railways and waterways – simple, compound, reverse, transition and vertical curve – setting out methods - hydrographic surveying – tides – MSL – Sounding methods – measurement of current and discharge – Tunnel alignment and setting out – Settlement and Deformation studies.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Get familiarized on the astronomical surveying and determination of time, latitude and longitude
- Get familiarized on the aerial surveying, photogrammetry and photo interpretation
- Use the knowledge acquired on the applications of total station in surveying
- Get familiarized on the GPS concept in surveying and its data processing applications
- Carry out the various other methods of surveying for curve setting, hydrographic survey and tunneling.

TEXT BOOKS:

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. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004.
4. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1993.

REFERENCES:

1. Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2004.
2. Arora K.R. "Surveying Vol I & II", Standard Book House, 10th Edition 2008.
3. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer – Verlag, Berlin, 2003.
4. Seeber G, Satellite Geodesy, Water De Gruyter, Berlin, 1998.

CE17E52 GEOGRAPHIC INFORMATION SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce basic concepts of GIS, its history software, hardware and data
- To gain knowledge on the data structures and data models, data compression and entity relationship
- To obtain knowledge on data input raster and vector data, coordinate transformation and Georeferencing and topologies adjacency, connectivity and containment
- To gain knowledge on basic aspect on data quality and its standards
- To acquire knowledge on data conversion, data outputs like charts and graphs and GIS distribution

UNIT I FUNDAMENTALS OF GIS 9

Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements.

UNIT II SPATIAL DATA MODELS 9

Database Structures – Relational, Object Oriented – Entities – ER diagram - data models - conceptual, logical and physical models - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID data models.

UNIT III DATA INPUT AND TOPOLOGY 9

Scanner - Raster Data Input – Raster Data File Formats – Georeferencing – Vector Data Input – Digitiser – Datum Projection and reprojection - Coordinate Transformation – Topology - Adjacency, connectivity and containment – Topological Consistency – Non topological file formats - Attribute Data linking – Linking External Databases – GPS Data Integration.

UNIT IV DATA QUALITY AND STANDARDS 9

Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards – Interoperability - OGC - Spatial Data Infrastructure.

UNIT V DATA MANAGEMENT AND OUTPUT 9

Import/Export – Data Management functions- Raster to Vector and Vector to Raster Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise vs. Desktop GIS - distributed GIS.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course the students will be able to

- Get familiarized with the basic concepts of GIS, its history, software, hardware and data
- Get familiarized on the data structures and data models , data compression and entity relationship
- Apply principles on data input raster and vector data, coordinate transformation and Geo referencing and topologies adjacency, connectivity and containment
- Get familiarized on basic aspect on data quality and its standards
- Get familiarized on data conversion, data outputs like charts and graphs and GIS distribution

TEXT BOOKS:

1. Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition, 2011.
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction Geographical Information Systems, Pearson Education, 2nd Edition,2007.

REFERENCE:

1. C.P. Lo Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems,Prentice-Hall India Publishers, 2006.

CE17E53 GEOINFORMATICS APPLICATIONS FOR CIVIL ENGINEERS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To gain a preliminary understanding of fundamentals of GIS
- To acquire knowledge on different spatial data models
- To obtain knowledge on data input and topology.
- To know data quality and standards.
- To develop a knowledge on data management and output.

UNIT I LAND RESOURCE MANAGEMENT 6

Total Station and GPS Surveys – Topographic and Bathymetric Surveys – Cadastral Information – Soil and Land Use Surveys - Land Information System (LIS) – Real Estate Information System

UNIT II STRUCTURAL STUDIES 6

Deformation studies of deflection - Dam deformation - structural movement - Pavement yield - shifting sand - bank and shoreline – Landslide Risk Analysis

UNIT III SOIL CONSERVATION AND MANAGEMENT 9

Soil survey interpretation and mapping - impact of agricultural and industrial activity on soil properties - soil erosion - factors influencing soil erosion - soil contamination using Hyper spectral Remote Sensing - mining pollution - EMR responses with contaminated soil - modeling soil characteristics using satellite data - soil degradation assessment using Remote Sensing and GIS - Land reclamation studies

UNIT IV URBAN AND TRANSPORTATION MANAGEMENT 12

Monitoring Urban Growth through Remote Sensing - Geo-demographic Analysis – Property Market Analysis Urban Renewal - traffic analysis - accident analysis - site suitability analysis for transport infrastructure – transportation databases: creation and maintenance - Vehicle routing – Highway maintenance system – Intelligent Transportation System

UNIT V WATER RESOURCES PLANNING AND MANAGEMENT 12

Location of storage/diversion works – capacity curve generation – sediment yield - modelling of catchments – Delineation of watershed - Watershed modelling for sustainable development - Rainfall – Runoff modelling – LiDAR Mapping for Urban area – Water quality mapping and monitoring – Flood Risk Zoning - Flood damage assessment – Flood Modelling - Assessment of droughts and mitigation

TOTAL: 45 PERIODS

OUTCOMES:

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

- Get familiarized with the fundamentals of GIS.
- Recognize different spatial data models.
- Examine data input and topology
- Assess the data quality and standards
- Analyse data management and output.

TEXTBOOKS:

1. Basudeb Bhatta, 'Remote Sensing and GIS', Second edition, Oxford University Press 2011.
2. C.P.Lo. Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Second edition, PHI Learning Private Limited, Delhi, 2014.

REFERENCES:

1. Andrew N. Rencz, Manual of Remote Sensing: Remote Sensing for Natural Resource Management and Environmental Monitoring, John Wiley & Sons Inc, April 2004
2. Rashed, Tarek, Jürgens, Carsten (Eds.), Remote Sensing of Urban and Suburban Areas, Springer, 1st Edition. 2010.
3. HarveyJ.Miller, Shih-Lung Shaw, Geographic Information Systems for Transportation – Principles and Applications, Oxford University Press, 2001.
4. Gert A. Schulitz Edwin T. Engman, Remote Sensing in hydrology and Water Management, Springer - verlag Berlin Heidelberg Germany - 2000.

GE17E51 HUMAN VALUES AND PROFESSIONAL ETHICS L T P C

3 0 0 3

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law - Case studies

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility

TOTAL: 45 PERIODS

OUTCOMES:

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

- Apply ethics in society,
- Discuss the ethical issues related to engineering
- Realize the responsibilities and
- Realize the rights in the society
- Understand the global issues and its impact.

TEXTBOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,NewDelhi 2013.

6. World Community Service Centre, " Value Education", Vethathiri publications, Erode, 2011

GE17E54 INTELLECTUAL PROPERTY RIGHTS L T P C
3 0 0 3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO – TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 10

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.

UNIT III AGREEMENTS AND LEGISLATIONS 10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 7

Infringement of IPR's, Enforcement Measures, Emerging issues – Case Studies.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the basics of Intellectual Property right.
- Understand the registration procedures of IPRs.
- Know the different agreements and legislation related to IPRs.
- Know the digital IP laws.
- Understand the Violation and enforcement measures of IPRs

TEXT BOOKS:

1. S.V. Satarkar, Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi,2002.

2. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012

REFERENCES:

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.

2. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", Mc Graw Hill Education, 2011.

3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

CE17E71	GROUND IMPROVEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To expose students to various problematic soils and improvement techniques.
- To acquire knowledge on dewatering and various drainage techniques.
- To familiarise on different methods for in-situ treatment of cohesionless and cohesive soils.
- To ensure that students begin to understand the concepts of earth reinforcement and about the uses of geotextile along with its applications.
- To develop a knowledge on grouting and its various techniques

UNIT I PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES 8

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.

UNIT II DEWATERING 10

Dewatering Techniques - Well points – Vacuum and electro-osmotic methods – Seepage analysis for two dimensional flows for fully and partially penetrated slots in homogeneous deposits – Design for simple cases.

UNIT III INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS 10

Insitu densification of cohesionless soils – Shallow as deep compaction – Dynamic compaction - Vibroflotation, Sand compaction piles and deep compaction. Consolidation of cohesionless 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.

UNIT IV EARTH REINFORCEMENT 9

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.

UNIT V GROUTING TECHNIQUES 8

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

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, students will be able to

- Get familiarized with the role of ground improvement in foundation engineering and identify different methods, selection of suitable methods and application.
- Analyze various drainage and dewatering techniques and general design of the same.
- Assess limits and applications of the different methods for insitu treatment of cohesionless and cohesive soils

- Get familiarized the concepts of earth reinforcement and about the uses of geotextile along with itsapplications.
- Get familiarized with grouting and its various techniques.

TEXTBOOKS:

1. Purushothama Raj. P, "Ground Improvement Techniques", Lakshmi Publications, 2nd Edition, 2016.
2. Koerner, R.M. "Construction and Geotechnical Methods in Foundation Engineering", McGraw Hill, 1994.
3. Nihar Ranjan Patra, "Ground Improvement Techniques", Vikas Publishing House, First Edition, 2012.
4. Mittal.S, "An Introduction to Ground Improvement Engineering", Medtech Publisher, First Edition, 2013.

REFERENCES:

1. Moseley, M.P., "Ground Improvement" Blockie Academic and Professional, 1992.
2. Moseley, M.P and Kirsch. K., 'Ground Improvement", Spon Press, Taylor and Francis Group, London, 2nd Edition, 2004.
3. Jones C.J.F.P. "Earth Reinforcement and Soil Structure", Thomas Telford Publishing, 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 IndiaPvt.Ltd. New Delhi, 2011.
7. Koerner, R.M., "Designing with Geosynthetics" (Sixth Edition), Xlibris Corporation, U.S.A, 2012.
8. IS Code 9759: 1981 (Reaffirmed 1998) "Guidelines for Dewatering During Construction", Bureau ofIndian Standards, New Delhi.
9. IS Code 15284 (Part 1): 2003 "Design and Construction for Ground Improvement – Guidelines" (StoneColumn), Bureau of Indian Standards, New Delhi.

CE17E72	COMPREHENSION IN CIVIL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of structural engineering such as Engineering mechanics, Solid mechanics, Structural Analysis, Concrete structures, Steel structures, Construction materials and management.
- To comprehend the knowledge in the field of Geotechnical Engineering which includes Soil mechanics and Foundation engineering.
- To acquire familiarity on the concepts of Water resource engineering which embraces Fluid mechanics, Hydraulics, Hydrology and Irrigation.
- To impart information on Environmental Engineering comprising of Water and waste water quality and treatment, Air pollution and Noise Pollution.
- To inculcate the knowledge on Transportation engineering which includes Highway Engineering, Traffic Engineering and Geomatics Engineering.

UNIT I STRUCTURAL ENGINEERING **9**

Engineering Mechanics: System of Forces and Sectional Properties

Solid Mechanics

Structural Analysis: Statically determinate and indeterminate structures by force/displacement methods, Analysis of trusses, arches, beams, cables and frames; Influence lines, Concept of plastic analysis - beams and frames.

Construction Materials & Concrete Structures: Concrete, Materials used for Construction activities, Testing of materials, Working stress and Limit state design concepts; Design of beams, slabs, columns; Bond and development length;

Steel Structures: and Limit state design concepts; Design of tension and compression members, and

flexural members with their connections, plate girders and trusses; Prestressed concrete beams.
Construction Management - PERT & CPM.

UNIT II GEOTECHNICAL ENGINEERING 9

Soil Mechanics: Soil index properties, clay mineralogy, soil classification, compaction, effective stress in soil, capillarity, permeability, well hydraulics, seepage, stress distribution in homogeneous and isotropic soil, immediate and consolidation settlement, computation of consolidation settlement, shear strength of cohesive and cohesionless soil, slope stability.
Foundation Engineering: Subsurface exploration, bearing capacity of shallow foundation, in-situ tests, contact pressure distribution, deep foundation, lateral earth pressure on retaining walls.

UNIT III WATER RESOURCES ENGINEERING 9

Fluid Mechanics: Properties of fluids, fluid statics; Continuity, momentum and energy equations and their applications; Types of fluid flow, Flow in pipes, pipe networks; Boundary layer.
Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude, Flow-through Open Channel.
Hydrology: Hydrologic cycle, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing, surface run-off models, groundwater hydrology - steady state well hydraulics and aquifers;
Irrigation: Types of irrigation systems and methods; Crop water requirements - Duty, delta, evapo-transpiration; Gravity Dams and Spillways; Lined and unlined canals.

UNIT IV ENVIRONMENTAL ENGINEERING 9

Water and Waste Water Quality: Basics of water quality standards - Physical, chemical and biological parameters; Water quality index; Water requirement; Water distribution system; Sewerage system design, quantity of domestic wastewater, Effluent discharge standards.
Air Pollution: Types of pollutants and sources, air pollution control, AQI and limits.
Noise Pollution: Sources and Standards.

UNIT V TRANSPORTATION & GEOMATICS ENGINEERING 9

Highway Engineering: Geometric design of highways - cross-sectional elements- - Highway materials - Design of flexible and rigid pavement using IRC codes.
Traffic Engineering: Traffic studies on flow and speed, peak hour factor, accident study, Traffic signs; Signal design, Types of intersections; Highway capacity.
Surverying: Principles of surveying; Errors and adjustment; Maps - scale, coordinate system; Distance and angle measurement – Levelling – Traversing.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the concepts of structural engineering such as Engineering mechanics, Solid mechanics, Structural Analysis, Concrete structures, Steel structures, Construction materials and management.
- Comprehend the knowledge in the field of Geotechnical Engineering which includes Soil mechanics and Foundation engineering.
- Apprehend the concepts of Water resource engineering which embraces Fluid mechanics, Hydraulics, Hydrology and Irrigation.
- Get familiarized on Environmental Engineering comprising of Water and waste water quality and treatment, Air pollution and Noise pollution.
- Apprehend the concepts on Transportation engineering which includes Highway Engineering, Traffic Engineering and Geomatics Engineering.

CE17E73 AIR POLLUTION AND CONTROL ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To get familiarized with structure and composition of the atmosphere, primary and secondary airpollutants, their effects, ambient air quality emission standards and sampling.
- To get familiarized with the fundamentals of atmospheric stability, wind profiles, plume patterns anddispersion theories and models.
- To select and to choose suitable air pollution control equipments based on the characteristics of theparticulate pollutants.
- To get familiarized with design and performance equations of absorption, adsorption, incineration,condensation, bio filters and bio scrubbers.
- To acquire knowledge about indoor air pollutants, its managing strategies, noise pollution and itscontrol.

UNIT I INTRODUCTION 7

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility - Ambient Air Quality and Emission standards – Ambient and stack sampling and Analysis of Particulate and Gaseous Pollutants.

UNIT II METEOROLOGY 6

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns - Atmospheric Diffusion Theories – Dispersion models, Plume rise.

UNIT III CONTROL OF PARTICULATE CONTAMINANTS 11

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle, Design and performance equations of Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations.

UNIT IV CONTROL OF GASEOUS CONTAMINANTS 11

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations.

UNIT V INDOOR AIR QUALITY MANAGEMENT 10

Sources, types and control of indoor air pollutants, sick building syndrome and Building related illness - Sources and Effects of Noise Pollution – Measurement – Standards – Control and Preventive measures.

TOTAL: 45 PERIODS.

OUTCOMES:

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

- Get familiarized with structure and composition of the atmosphere, primary and secondary airpollutants, their effects, ambient air quality emission standards and sampling.
- Get familiarized with the fundamentals of atmospheric stability, wind profiles, plume patterns anddispersion theories and models.
- Select and choose suitable air pollution control equipments based on the characteristics of theparticulate pollutants.
- Get familiarized with design and performance equations of absorption, adsorption,

incineration,condensation, bio filters and bio scrubbers.

- Acquire knowledge about indoor air pollutants, its managing strategies, noise pollution and itscontrol.

TEXTBOOKS:

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo,springer science + science media LLC,2004.
2. Noel de Nevers, "Air Pollution Control Engineering", Waveland press,Inc 2017.
3. Anjaneyulu. Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India 2002.

REFERENCES:

1. David H.F. Liu, Bela G. Liptak, "Air Pollution", Lweis Publishers, 2000.
2. Arthur C. Stern, "Air Pollution (Vol.I – Vol.VIII)", Academic Press, 2006.
3. Wayne T.Davis, "Air Pollution Engineering Manual", John Wiley & Sons, Inc, 2000.
4. M.N Rao and HVN Rao, "Air Pollution",Tata Mcgraw Hill Publishing Company limited,2007.
5. C.S.Rao, "Environmental Pollution Control Engineering", New Age International(P) Limited Publishers,2006.

CE17E74	CONSTRUCTION PLANNING AND SCHEDULING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To obtain knowledge on formulating construction activities and its duration based on precedencerelationships and resource requirements.
- To know the techniques for the preparation of the schedule and bar charts based on CPM and PERTtechniques.
- To forecast the project budget by adopting accounting and cost control systems.
- To analyze and frame the control and safety measures by statistical methods in construction.
- To acquire the knowledge of Organizing and administering the project information in the database.

UNIT I CONSTRUCTION PLANNING 6

Basic concepts in the development of construction plans - Choice of Technology and Construction method - Defining Work Tasks - Work breakdown structure – Definition - Precedence relationships among activities - Estimating Activity Durations - Estimating Resource Requirements for work activities - coding systems.

UNIT II SCHEDULING PROCEDURES AND TECHNIQUES 12

Relevance of construction schedules - Bar charts - The critical path method - Calculations for critical path scheduling - Activity float and schedules - Presenting project schedules - Critical path scheduling for Activity-on-node and with leads, Lags and Windows - Calculations for scheduling with leads, lags and windows-Resource oriented scheduling - Scheduling with resource constraints and precedences - Use of Advanced Scheduling Techniques - Scheduling with uncertain durations - Crashing and time/cost tradeoffs - Improving the Scheduling process – Introduction to application software (Primavera and MS Project).

UNIT III COST CONTROL MONITORING AND ACCOUNTING 9

The cost control problem - The project budget - Forecasting for Activity cost control – financial accounting systems and cost accounts - Control of project cash flows - Schedule control - Schedule and Budget updates -Relating cost and schedule information.

UNIT IV QUALITY CONTROL AND SAFETY DURING CONSTRUCTION 9

Quality and safety Concerns in - Organizing for Quality and Safety - Work and Material Specifications - Total Quality control - Quality control by statistical methods - Statistical Quality control with sampling by Attributes - Statistical Quality control by Sampling and Variables - Safety during construction.

UNIT V ORGANIZATION AND USE OF PROJECT INFORMATION 9

Types of project information - Accuracy and Use of Information - Computerized organization and use of Information - Organizing information in databases - relational model of Data bases - Other conceptual Models of Databases - Centralized database Management systems - Databases and application programs - Information transfer and Flow.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Formulate construction activities and its duration based on precedence relationships and resourcerequirements.
- Prepare the schedule and bar charts based on CPM and PERT techniques.
- Forecast the project budget by adopting accounting and cost control systems.
- Frame the control and safety measures by statistical methods and apply the same in construction.
- Organize and administer the project information in the database.

TEXTBOOKS:

1. Chitkara K.K. “Construction Project Management Planning”, Scheduling and Control, TataMcGraw Hill Publishing Co., New Delhi, 2009.
2. Srinath L.S., “PERT and CPM Principles and Applications“, Affiliated East West Press, 2001.

REFERENCES:

1. Chris Hendrickson and Tung Au, “Project Management for Construction – Fundamentals Concepts forOwners”, Engineers, Architects and Builders, Prentice Hall, Pitsburgh, 2000.
2. Moder J, Phillips C and Davis E, “Project Management with CPM”, PERT and Precedence Diagramming, Van Nostrand Reinhold Co., 3rd Edition, 1985.
3. Willis E.M., “Scheduling Construction projects”, John Wiley and Sons, 1986.
4. Halpin D.W., “Financial and Cost Concepts for Construction Management”, John Wiley andSons, New York, 1985.

CE17E75	PAVEMENT ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain a preliminary understanding of various types of pavement and stress distribution on layeredsystem.
- To acquire knowledge on design of flexible pavements as per IRC guidelines.
- To acquire knowledge on design of rigid pavements as per IRC guidelines.
- To ensure that students begin to understand the performance evaluation and maintenance of pavements.
- To develop a knowledge on pavement stabilization techniques.

UNIT I TYPE OF PAVEMENT AND STRESS DISTRIBUTIONON LAYERED SYSTEM 8

Introduction – Pavement as layered structure – Pavement types rigid and flexible - Resilient modulus - Stressand deflections in pavements under repeated loading.

UNIT II DESIGN OF FLEXIBLE PAVEMENTS 10

Flexible pavement design Factors influencing design of flexible pavement, Empirical – Mechanistic empirical and theoretical methods – Design procedure as per IRC guidelines – Design and specification of rural roads.

UNIT III DESIGN OF RIGID PAVEMENTS 9

Cement concrete pavements Factors influencing CC pavements – Modified Westergaard approach – Design procedure as per IRC guidelines – Concrete roads and their scope in India.

UNIT IV PERFORMANCE EVALUATION AND MAINTENANCE 10

Pavement Evaluation - Causes of distress in rigid and flexible pavements – Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling, Roughness, Skid Resistance. Structural Evaluation by Deflection Measurements - Pavement Serviceability index, - Pavement maintenance (IRC Recommendations only).

UNIT V STABILIZATION OF PAVEMENTS 8

Stabilisation with special reference to highway pavements – Choice of stabilizers – Testing and field control - Stabilisation for rural roads in India – Use of Geosynthetics in roads.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, students will be able to

- Get familiarized with the various types of pavement and stress distribution on layered system.
- Use the IRC guidelines for the design of flexible pavements.
- Use the IRC guidelines for the design of rigid pavements.
- Assess the performance of pavements and maintenance of pavements in accordance with IRC Recommendations

TEXTBOOKS:

1. Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, “Highway Engineering”, New Chand and Brothers,Revised 10th Edition, 2014.
2. Kadiyali, L.R., “Principles and Practice of Highway Engineering”, Khanna tech. Publications, New Delhi,2005.

REFERENCES:

1. Yoder, R.J. and Witchak M.W. “Principles of Pavement Design”, John Wiley 2000.
2. Guidelines for the Design of Flexible Pavements, IRC-37–2001, The Indian roads Congress, New Delhi.
3. Guideline for the Design of Rigid Pavements for Highways, IRC 58-1998, The Indian RoadCongress, New Delhi.

CE17E76	**TRANSPORT AND ENVIRONMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVE:

- To acquire knowledge of transportation projects on the environment.
- To acquire knowledge on methods of impact analysis and their applications.
- To acquire knowledge in Environmental Laws on transportation projects and socio-economic impacts.
- To acquire knowledge on the mitigative measures adopted in the planning stage.
- To predict and assess the impact of transportation projects.

UNIT I INTRODUCTION 8

Environmental Inventory, Environmental Assessment, Environmental Impact Assessment (EIA), Environmental Impact of Transportation Projects, Need for EIA, EIA Guidelines for Transportation Project, Historical Development.

UNIT II METHODOLOGIES 8

Elements of EIA – Screening and Scoping – Methods of Impact Analysis – Applications – Appropriate methodology.

UNIT III ENVIRONMENTAL IMPACT, PREDICTION AND ASSESSMENT 10

Prediction and Assessment of Impact of Transportation Project at various stages on water, air, noise, land acquisition and resettlement, Socio economic impact, indigenous people, aesthetics, health and safety, energystudies, IRC guidelines.

UNIT IV ENVIRONMENTAL MITIGATION AND MANAGEMENT PLAN 10

Mitigation of the impact on Natural and Man-made Environment, Health, Water, Land, Noise, Air, Public participation, Environmental Management Plan, Energy Conservation, Methods to reduce Global Warming.

UNIT V EIA CASE STUDIES 9

EIA Case Studies on Highway, Railway, Airways and Waterways Projects

TOTAL: 45 PERIODS

OUTCOMES:

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

- Acquire knowledge of Transportation projects on the environment.
- Acquire knowledge on methods of impact analysis and their applications.
- Acquire knowledge of Environmental Laws on transportation projects and socio-economic impacts.
- Acquire knowledge on the mitigative measures adopted in the planning stage.
- Predict and assess the impact of transportation projects.

TEXTBOOKS:

1. Canter L.R., Environmental Impact Assessment, McGraw Hill, New Delhi, 1996.
2. Indian Road Congress (IRC), Environmental Impact of Highway Projects, IRC, Delhi, 1998.
3. P. Meenakshi, Elements of Environmental Science and Engineering, Prentice Hall of India, New Delhi,2006
4. Thirumurthy A.M., Introduction to Environmental Science and Management, Shroff Publishers, Bombay,2005.

REFERENCES:

1. John G.Rau and David, C.Hooten, Environmental Impact Analysis Handbook, McGraw HillBook Company, 1995
2. James H.Banks, Introduction to Transportation Engineering, McGraw Hill Book Company, 2000
3. World Bank, A Handbook on Roads and Environment, Vol.I and II, Washington DC, 1997
4. Priya Ranjan Trivedi, International Encyclopaedia of Ecology and Environment – EIA, Indian Institute ofEcology and Environment, New Delhi, 1998

CE17E77	TRAFFIC ENGINEERING AND MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge on the components of Traffic Engineering and Road, Traffic and Land

UseCharacteristics.

- To acquire comprehensive knowledge of traffic surveys and studies such as 'Volume Count', 'Speedand delay', 'Origin and Destination', 'Parking', 'Pedestrian' and 'Accident surveys'.
- To get familiarized with various traffic control aids and its computer applications.
- To design the 'intersections at grade' and 'grade separators.
- To get familiarized with various traffic management measures.

UNIT I INTRODUCTION 9

Significance and scope, Characteristics of Vehicles and Road Users, Skid Resistance and Braking Efficiency (Problems), Components of Traffic Engineering- Road, Traffic and Land Use Characteristics

UNIT II TRAFFIC SURVEYS AND ANALYSIS 9

Surveys and Analysis - Volume, Capacity, Speed and Delays, Origin and Destination, Parking, Pedestrian Studies, Accident Studies and Safety Level of Services- Problems

UNIT III TRAFFIC CONTROL 9

Traffic signs, Road markings, Design of Traffic signals and Signal co-ordination (Problems), Traffic control aids and Street furniture, Street Lighting, Computer applications in Signal design

UNIT IV GEOMETRIC DESIGN OF INTERSECTIONS 9

Conflicts at Intersections, Classification of Intersections at Grade, - Channelized and Un channelized Intersection - Grade Separators (Concepts only), Principles of Intersection Design, Elements of Intersection Design, Channelization and Rotary design (Problems), Grade Separators

UNIT V TRAFFIC MANAGEMENT 9

Traffic Management- Traffic System Management (TSM) and Travel Demand Management (TDM), Traffic Forecasting techniques, Restrictions on turning movements, One-way Streets, Traffic Segregation, Traffic Calming, Tidal flow operations, Exclusive Bus Lanes - Introduction to Intelligence Transport System (ITS)

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, students will be able to

- Get familiarized on the components of Traffic Engineering and Road, Traffic and Land Use Characteristics.
- Acquire comprehensive knowledge of traffic surveys and studies such as 'Volume Count', 'Speed and delay', 'Origin and Destination', 'Parking', 'Pedestrian' and 'Accident surveys'.
- Get familiarized with various traffic control aids and its computer applications.
- Design the 'intersections at grade' and 'grade separators.
- Get familiarized with various traffic management measures.

TEXT BOOKS:

1. Khanna K and Justo C E G, Highway Engineering, Khanna Publishers, Roorkee, 2001.
2. Kadiyali L R, Traffic Engineering and Transport Planning, Khanna Technical Publications, Delhi,2000.

REFERENCES:

1. Indian Roads Congress (IRC) specifications: Guidelines and special publications on Traffic Planningand Management
2. Guidelines of Ministry of Road Transport and Highways, Government of India.

3. Subhash C.Saxena, A Course in Traffic Planning and Design, Dhanpat Rai Publications, New Delhi,1989.

CE17E78	ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart the knowledge and skills to identify, assess and mitigate the environmental and socialimpacts of developmental projects.
- To examine the assessment of impact on various environmental components.
- To plan for the mitigation of adverse impact and to monitor the same.
- To assess the economic value of environmental impact through cost benefit analysis.
- To relate the monitoring and assessment methods with various case studies.

UNIT I INTRODUCTION 9

Impacts of Development on Environment – Rio Principles of Sustainable Development - Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle – EIA Notification and Legal Framework – Stakeholders and their Role in EIA – Selection & Registration Criteria for EIA Consultants.

UNIT II ENVIRONMENTAL ASSESSMENT 9

Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise and energy, flora and fauna - Matrices – Networks – Checklist Methods - Mathematical models for Impact prediction – Analysis of alternatives.

UNIT III ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Review of EIA Reports – Public Hearing - Environmental Clearance Post Project Monitoring.

UNIT IV SOCIO ECONOMIC ASSESSMENT 9

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan - Economic valuation of Environmental impacts – Cost benefit Analysis.

UNIT V CASE STUDIES 9

EIA case studies pertaining to Infrastructure Projects – Real Estate Development - Roads and Bridges – Mass Rapid Transport Systems - Ports and Harbour – Airports - Dams and Irrigation projects - Power plants
– CETP's - Waste Processing and Disposal facilities – Mining Projects.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Acquire knowledge and skills to identify, assess and mitigate the environmental and social impactsof developmental projects.
- Examine the assessment of impact on various environmental components.
- Plan for the mitigation of adverse impact and to monitor the same.
- Access the economic value of environmental impact through cost benefit analysis.

- Relate the monitoring and assessment methods with various case studies.

TEXTBOOKS:

1. Canter, R.L, "Environmental impact Assessment ", 2nd Edition, McGraw Hill Inc, New Delhi,1995.
2. Lohani B, J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu, "Environmental Impact Assessment for Developing Countries in Asia", Volume 1 – Overview, Asian Development Bank, 1997.
3. Peter Morris, RikiTherivel "Methods of Environmental Impact Assessment", Routledge Publishers, 2009.

REFERENCES:

1. Becker H. A., Frank Vanclay,"The International handbook of social impact assessment" conceptualand methodological advances, Edward Elgar Publishing,2003.
2. Barry Sadler and Mary McCabe, "Environmental Impact Assessment Training Resource Manual",United Nations Environment Programme,2002.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I and II", Blackwell ScienceNew York, 1998.
4. Ministry of Environment and Forests EIA Notification and Sectoral Guides, Government of India,New Delhi, 2010.

CE17E79	MUNICIPAL SOLID WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To be familiar with the sources, types, generation rates, sampling, characterization, effects of improper disposal of municipal solid waste and the role of NGO's & Legislation in MSWM.
- To plan and devise suitable onsite storage methods for solid waste and onsite segregation methodsand to know about the source reduction techniques.
- To suggest suitable collection method for solid waste, and to manage operation and maintenance oftransfer stations.
- To adopt suitable resource recovery techniques for various kinds of solid waste and manage itsfunctioning under Indian conditions.
- To design and manage sanitary landfills, landfill liners; management of leachate, landfill gas, anddumpsite rehabilitation.

UNIT I SOURCES AND CHARACTERISTICS 9

Sources and types of municipal solid wastes - Public health and environmental impacts of improper disposal of solid wastes - sampling and characterization of wastes - factors affecting waste generation rate and characteristics - Elements of integrated solid waste management – Requirements and salient features of Solidwaste management rules (2016) - Role of public and NGO's - Public Private participation – Elements of Municipal Solid Waste Management Plan.

UNIT II SOURCE REDUCTION, WASTE STORAGE AND RECYCLING 8

Waste Management Hierarchy - Reduction, Reuse and Recycling - source reduction of waste – On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – case studies under Indian conditions – Recycling of Plastics and Construction/Demolition wastes.

UNIT III COLLECTION AND TRANSFER OF WASTES 8

Methods of Residential and commercial waste collection – Collection vehicles – Manpower – Collection

routes – Analysis of waste collection systems; Transfer stations – location, operation and maintenance; options under Indian conditions - Field problems - solving.

UNIT IV PROCESSING OF WASTES 12

Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

UNIT V WASTE DISPOSAL 8

Land disposal of solid waste - Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas - Landfill bioreactor - Dumpsite Rehabilitation.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Familiar with the sources, types, generation rates, sampling, characterization, effects of improperdisposal of municipal solid waste and the role of NGO's & Legislation in MSWM**.**
- Plan and devise suitable onsite storage methods for solid waste and onsite segregation methods andto know about the source reduction techniques.
- Suggest suitable collection method for solid waste, and to manage operation and maintenance oftransfer stations**.**
- Suitable resource recovery techniques for various kinds of solid waste and manage its functioningunder Indian conditions.
- Design and manage sanitary landfills, landfill liners; management of leachate, landfill gas, anddumpsite rehabilitation.

TEXTBOOKS:

1. William A. Worrell, P. Aarne Vesilind (2012) Solid Waste Engineering, Cengage Learning, 2012.
2. John Pitchel (2014), Waste Management Practices-Municipal, Hazardous and industrial – CRCPress, Taylor and Francis, New York.

REFERENCES:

1. CPHEEO (2014), "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi.
2. 2 George Tchobanoglous and Frank Kreith(2002).Handbook of Solid waste management, McGrawHill, New York.

CE17E81 WATER RESOURCES ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To understand the concept of water resources, planning, and development.
- To analyze the hydrologic data and its network design.
- To understand the concept of consumptive, non-consumptive uses of water, water quality and waterbudget.
- To gain the knowledge on various types of reservoir, operation, storage capacity fixation and designfloods.

- To acquire knowledge on estimation of cost, evaluation of benefits, discounting techniques and itsapplication.

UNIT I WATER RESOURCES 9

Water resources survey – Water resources of India and Tamilnadu – Description of water resources planning – Economics of water resources planning, physical and socio economic data – National Water Policy – Collection of meteorological and hydrological data for water resources development

UNIT II NETWORK DESIGN 12

Hydrological Cycle – Hydrological Design - Hydrologic measurements – Analysis of hydrologic data – Hydrologic station network – Station network design – Statistical techniques in network design.

UNIT III RESERVOIR PLANNING AND MANAGEMENT 9

Reservoir – Single and multipurpose – Multi objective – Fixation of storage capacity – strategies for reservoir operation – Sedimentation of Reservoirs – Design floods – levees and flood walls – channel improvement.

UNIT IV WATER RESOURCE NEEDS 9

Consumptive and non-consumptive water use - Estimation of water requirements for irrigation, for drinking and navigation - Water characteristics and quality – Scope and aims of master plan - Concept of basin as a unit for development - Water budget and development plan - Design of Dams – Concrete Gravity Dam – C/S, design and stability analysis.

UNIT V ECONOMIC ANALYSIS 6

Estimation of cost and Evaluation of Benefits – Discount rate – Discounting factors – Discounting techniques – computer Applications.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Get familiarized with the concept of water resources, planning, and development.
- Use hydrologic data and network design for hydrologic measurements.
- Get familiarized with the concept of consumptive, non-consumptive uses of water, water quality andwater budget.
- Understand the concept various types of reservoir, operation, storage capacity fixation and designfloods.
- Identify the use of cost estimation, evaluation of benefits, discounting techniques and its applicationin impounding structures.

TEXTBOOKS:

1. Linsley R.K. and Franzini J.B, “Water Resources Engineering”, McGraw-Hill Inc, 2000.
2. Douglas J.L. and Lee R.R., “Economics of Water Resources Planning”, Tata McGraw-Hill Inc. 2000.
3. Duggal, K.N. and Soni, J.P., “Elements of Water Resources Engineering”, New Age InternationalPublishers

REFERENCE:

1. Chaturvedi M.C., “Water Resources Systems Planning and Management”, Tata McGraw-Hill Inc., NewDelhi, 1997.

CE17E82	PARTICIPATORY WATER RESOURCES MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn basic concept of sociology and participatory approach in water resources management
- To acquire knowledge on farmer participation – sustained system performance , WUA and constraints in organizing farmers association
- To understand the multiple use of water , delivery systems , development and issues in Inter-sectoralwater allocation
- To gain a preliminary understanding of approaches involved in water marketing, conservation andwater rights
- To understand the concept of watershed development, management principles, problems in watershed management and assessment of management measures.

UNIT I FUNDAMENTALS: SOCIOLOGY AND PARTICIPATORY APPROACH 6

Sociology – Basic concepts – Perspectives - Social Stratification – Irrigation as a Socio technical Process - Participatory concepts – Objectives of participatory approach.

UNIT II UNDERSTANDING FARMERS PARTICIPATION 10

Farmers participation – Need and Benefits – Comparisons of cost and benefit - Sustained system performance - Kinds of participation – Context of participation, factors in the environment – WUA - Constraints in organizing FA – Role of Community Organiser – Case Studies.

UNIT III ISSUES IN WATER MANAGEMENT 9

Multiple use of water – Issues in Inter-sectoral Water Allocation - domestic, irrigation, industrial sectors - modernization techniques – Rehabilitation – Command Area Development - Water delivery systems

UNIT IV PARTICIPATORY WATER CONSERVATION 10

Global Challenges - Social – Economic – Environmental - Solutions – Political - Water Marketing – Water Rights - Consumer education – Success Stories Case Studies

UNIT V PARTICIPATORY WATERSHED DEVELOPMENT 10

Concept and significance of watershed - Basic factors influencing watershed development - Principles of watershed management - Definition of watershed management – Identification of problems - Watershed approach in Government programmes - People's participation – Entry point activities - Evaluation of watershed management measures.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Get familiarized with basic concept of sociology and participatory approach in water resourcesmanagement
- Get knowledge on farmers participation – sustained system performance , WUA and constraints inorganizing farmers association
- Perceive the multiple use of water , delivery systems , development and issues in Inter-sectoral waterallocation
- Assess the preliminary understanding of approaches involved in water marketing, conservation andwater rights
- Get familiarized with the concept of watershed development, management principles, problems

inwatershed management and assessment of management measures.

TEXTBOOKS:

1. Sivasubramaniyan, K. Water Management, SIMRES Publication, Chennai, 2011
2. Uphoff.N, Improving International Irrigation management with Farmer Participation – Getting the process Right – Studies in water Policy and management, No.11, Westviewpress, Boulder,CO, 1986.
3. Tideman, E.M., "Watershed Management", Omega Scientific Publishers, New Delhi, 1996.

REFERENCE:

1. Chambers Robert, Managing canal irrigation, Cambridge University Press, 1989

CE17E83 GROUND WATER ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To acquire knowledge on rock properties, storage and various groundwater estimation methods
- To obtain knowledge on various methods of estimating flow in well hydraulics.
- To understand the concepts of management model utilized for the effective groundwater management.
- To learn the impact of water quality standards and its environmental concern.
- To gain a preliminary understanding of artificial recharge, storage, sea water intrusion and itsremedial schemes.

UNIT I HYDROGEOLOGICAL PARAMETERS 9

Introduction – Water bearing Properties of Rock – Type of aquifers - Aquifer properties – permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation – GEC norms - Steady state flow - Darcy's Law - Groundwater Velocity –- Dupuit Forchheimer assumption – Steady Radial Flow into a Well

UNIT II WELL HYDRAULICS 9

Unsteady state flow - Theis method - Jacob method – Chow's method – Law of Times – Theis Recovery – Bailer method – Slug method - tests - Image well theory – Partial penetrations of wells – Well losses – Specific Capacity and Safe yield - Collector well and Infiltration gallery

UNIT III GROUNDWATER MANAGEMENT 9

Need for Management Model – Database for Groundwater Management – Groundwater balance study – Introduction to Mathematical model – Model Conceptualization – Initial and Boundary Condition – Calibration – Validation – Future Prediction – Sensitivity Analysis – Uncertainty – Development of a model

UNIT IV GROUNDWATER QUALITY 9

Ground water chemistry - Origin, movement and quality - Water quality standards – Drinking water – Industrial water – Irrigation water - Ground water Pollution and legislation - Environmental Regulatory requirements.

UNIT V GROUNDWATER CONSERVATION 9

Artificial recharge techniques – Reclaimed wastewater recharge – Soil aquifer treatment (SAT) – Aquifer Storage and Recovery (ASR) Seawater Intrusion and Remediation – Ground water Basin management and Conjunctive use – Protection zone delineation, Contamination source inventory and remediation schemes

TOTAL: 45 PERIODS

OUTCOMES:

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

- Get familiarized on rock properties, storage and various groundwater estimation methods.
- Apply the knowledge on various methods of estimating flow in well hydraulics.
- Understand the concepts of management model utilized for the effective groundwater management.
- Understand the impact of water quality standards and its environmental concern.
- Get familiarized on artificial recharge, storage, sea water intrusion and its remedial schemes.

TEXTBOOKS:

1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.
2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000.

REFERENCES:

1. Fitts R Charles, "Groundwater Science". Elsevier, Academic Press, 2002.
2. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.

CE17E84	**APPLIED HYDROLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To gain a preliminary understanding of precipitation
- To develop a knowledge on abstraction from precipitation
- To develop hydrographs.
- To understand flood and flood routing
- To develop a knowledge on ground water hydrology

UNIT I PRECIPITATION AND ABSTRACTIONS 10

Hydrological cycle - Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges - Spatial analysis of rainfall data using Thiessen and Isohyetal methods - Interception - Evaporation. Horton's equation, pan evaporation measurements and evaporation suppression – Infiltration - Horton's equation - double ring infiltrometer, infiltration indices.

UNIT II RUNOFF 8

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical – Strange's table and SCS methods – Stage discharge relationships - flow measurements - Hydrograph – Unit Hydrograph – IUH

UNIT III FLOOD AND DROUGHT 9

Natural Disasters - Flood Estimation - Frequency analysis - Flood control - Definitions of droughts - Meteorological, hydrological and agricultural droughts - IMD method - NDVI analysis - Drought Prone AreaProgramme (DPAP)

UNIT IV RESERVOIRS 8

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve

UNIT V GROUNDWATER AND MANAGEMENT 10

Origin - Classification and types - properties of aquifers - governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, students will be able to

- Get familiarized with different forms of precipitation.
- Assess losses from precipitation
- Infer hydrograph.
- Assess floods and flood routing
- Get familiarized with ground water hydrology.

TEXTBOOKS:

- Subramanya .K. "Engineering Hydrology"- Tata McGraw Hill, 2010
- Jayarami Reddy .P. "Hydrology", Tata McGraw Hill, 2008.
- Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International BookCompany, 1995.

REFERENCES:

- David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007
- Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill InternationalBook Company, 1998.
- Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.

GE17451 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To facilitate the understanding of basic quality management in engineering.
- To facilitate the understanding of various principles of TQM.
- To be acquainted with management tools, six sigma and benchmarking.
- To be acquainted with quality functions, TPM concepts &continuous improvement tools.
- To learn various quality systems and TQM implementation in manufacturing and service sectors.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints and Customer retention - Costs of quality.

UNIT II TQM PRINCIPLES 9

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma, Lean Six Sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures. POKA - YOKE.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 - ISO 9001:2015 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits – ISO 9000:2005, ISO 9004:2009 - TQM Implementation in manufacturing and service sectors. Quality System for Automotive Supplier TS 16949, Quality System for Telecom Industries - TL 9000

TOTAL: 45 PERIODS

OUTCOMES:

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

- Have Ability to explain the importance of quality in engineering.
- Have Ability to explain various principles in TQM.
- Can explore the knowledge of implementing various TQM tools.
- Have Ability to create rapport among workers to form a quality team.
- Have Ability to explain the benefits of implementing ISO-9000 & ISO-14000 in manufacturing andservice sectors.

TEXT BOOK:

1. Dale H. Besterfiled, et at., "Total quality Management", Third Edition, Pearson EducationAsia, Indian Reprint, 2011.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th
2. Edition, First Indian Edition, Cengage Learning, 2012.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall(India) Pvt. Ltd., 2006.

CE17E85 COMPUTER AIDED DESIGN OF STRUCTURES L T P C

3 0 0 3

OBJECTIVES:

- To introduce students about the software importance and applications in industry.
- To acquire knowledge in creating models using the software
- To understand the working principles of softwares using finite element methods and its applications.
- To analyze and design a steel or concrete structure using software program – linear analysis.
- To acquire knowledge in artificial intelligence and its applications in industry.

UNIT I INTRODUCTION 9

Fundamental reason for implementing CAD - Software requirements – Hardware components in CAD system – Design process - Applications and benefits.

UNIT II COMPUTER GRAPHICS 9

Graphic Software – Graphic primitives - Transformations - 2 Dimensional and 3 Dimensional transformations – Concatenation - Wire frame modeling - Solid modeling - Graphic standards - Drafting packages.

UNIT III STRUCTURAL ANALYSIS 9

Principles of structural analysis - Fundamentals of finite element analysis - Concepts of finite elements –

Stiffness matrix formulation – Variational Method – Weighted residual method – Problems – Convergence criteria – Analysis packages and applications.

UNIT IV DESIGN AND OPTIMIZATION 9

Principles of design of steel and RC structures - Beams and Columns - Applications to simple design problems - Optimization techniques - Algorithms - Linear programming – Simplex Method.

UNIT V EXPERT SYSTEMS 9

Introduction to artificial intelligence - Knowledge based expert systems – Applications of Knowledge Based Expert Systems - Rules and decision tables - Inference mechanisms - simple applications.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, students will be able to

- Get familiarized in analysis and design of any structure using softwares.
- Able to deal with CAD software and hardware components
- Able to create any type of model using software and understand the finite element analysis concepts
- Get familiarized in latest artificial intelligence in industry
- Get familiarized in understanding the importance and applications using the software

TEXTBOOKS:

1. Groover M.P. and Zimmers E.W. Jr., "CAD/CAM, Computer Aided Design and Manufacturing", PrenticeHall of India Ltd, New Delhi, 1993.
2. Krishnamoorthy C.S.Rajeev S., "Computer Aided Design", Narosa Publishing House, NewDelhi, 2001.

REFERENCES:

1. Harrison H.B., "Structural Analysis and Design", Part I and II Pergamon Press, Oxford,1990.
2. Rao S.S., "Optimisation Theory and Applications", Wiley Eastern Limited, New Delhi, 1984.
3. Richard Forsyth (Ed), "Expert System Principles and Case Studies", Chapman and Hall, London, 1989.

CE17E86 DESIGN OF PRESTRESSED CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the need for prestressing in a structure and to explain the methods, types and advantages of prestressing to the students.
- To explain the design concept of flexure and shear in prestressed concrete beams as per the IS code
- To analyze the beams for short and long term deflections and to design the anchorage zones ofprestressed beams
- To introduce the students to the design concepts of composite and continuous beams
- To explain the design concepts for tension and compression members and the concept of partialprestressing.

UNIT I INTRODUCTION – THEORY AND BEHAVIOUR 9+3

Basic concepts – Advantages and disadvantages – Materials required – Systems and methods of prestressing - Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – Effect of tendon profile on deflections – Factors influencing deflections –

Calculation of deflections – Short term and long term deflections - Losses of prestress – Estimation of crack width.

UNIT II DESIGN FOR FLEXURE AND SHEAR 9+3

Basic assumptions of flexural design – Permissible stresses in steel and concrete as per I.S.1343 Code – Different Types of sections - Design of sections of Type I and Type II post-tensioned and pre tensioned beams – Check for flexural capacity based on I.S. 1343 Code – Influence of Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code.

UNIT III DEFLECTION AND DESIGN OF ANCHORAGE ZONE 9+3

Factors influencing deflections – Short term deflections of uncracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit states. Determination of anchorage zone stresses in post-tensioned beams – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS 9+3

Analysis and design of composite beams – Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.

UNIT V TENSION AND COMPRESSION MEMBERS 9+3

Role of prestressing in members subjected to Tensile forces and compressive forces - Design of tension and compression members – Tanks, pipes and poles – Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

TOTAL: 45 PERIODS + 15 TUTORIALS

OUTCOMES:

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

- Familiar with the design philosophies and methods of prestressing and advantages of using prestressed concrete structures
- Analyze and design prestressed concrete beams for flexure and shear
- Analyze the beams for short and long term deflection and will be able to design the anchorage zone.
- Analyze and design prestressed concrete composite and continuous beams as per IS code.
- Design tension and compression members and the use of partial prestressing for structural members.

TEXTBOOKS:

1. Krishna Raju N., "Prestressed concrete", 5th Edition, Tata McGraw Hill Company, New Delhi, 2012
2. Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2012

REFERENCES:

1. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2002.
2. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2013
3. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt.Ltd., New Delhi, 2013.
4. IS1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, 2012

CE17E87	MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand facets of maintenance and to apply repair strategies based on assessment.
- To understand the strength and durability aspects of concrete for quality assurance.
- To gain knowledge about various types of special concretes.
- To understand and apply various repair and protection techniques for deteriorated structures especially by corrosion.
- To help students to become familiar with retrofitting and rehabilitation of structures by strengtheningand demolition techniques.

UNIT I MAINTENANCE AND REPAIR STRATEGIES 9

Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspectsof Inspection, Assessment procedure for evaluating damaged structure, causes of deterioration.

UNIT II STRENGTH AND DURABILITY OF CONCRETE 9

Quality assurance for concrete – Strength, Durability - Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion.

UNIT III SPECIAL CONCRETES 9

Polymer concrete, Sulphur infiltrated concrete, Fiber-reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

UNIT IV TECHNIQUES FOR REPAIR AND PROTECTION METHODS 9

Non-destructive Testing Techniques, Load Test for Stability - Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement,cathodic protection.

UNIT V REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES 9

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage, earthquake - Transportation of Structures from one place to other – Structural Health Monitoring - demolition techniques - Engineered demolition methods - Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Get familiarized with the facets of maintenance and decide repair strategies based on assessment.
- Understand the strength and durability aspects of concrete with a correlation to quality assurance.
- Become familiar with various special concretes in use with a view of applying it in concrete repair.
- Gain knowledge on various repair and protection techniques with special reference to corrosionaffected concrete.

- Get familiarized with retrofitting and rehabilitation through strengthening and demolition.

TEXT BOOKS:

1. Shetty M.S., ConcreteTechnology-Theory and Practice, S.Chand and Company, 2008.
2. B.Vidivelli, Rehabilitation of Concrete Structures Standard Publishes Distribution.1st edition2009.
3. P.C.Varghese, Maintenance Repair and Rehabilitation & Minor works of building, Prentice Hall India Pvt Ltd 2014.
4. R. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth- Heinemann, Elsevier, New Delhi 2012

REFERENCES:

1. DovKominetzky.M.S.,-Design and Construction Failures, Galgotia Publications Pvt. Ltd., 2001
2. Ravishankar.K & Krishnamoorthy.T.S, Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures, Allied Publishers, 2004.
3. Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.
4. Hand Book on "Repair and Rehabilitation of RCC Buildings"–Director General works CPWD, Govt of India, New Delhi – 2002.

CE17E88	STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concept of Formulation of Equations of motion of SDOF system for free and forced vibration of damped and undamped structures.
- To gain knowledge about basic principles of free and forced vibration both undamped and damped multiple degree of freedom systems.
- To ensure that students understand the Elements of Engineering Seismology.
- To acquire knowledge on the performance of structures under earthquake loading and apply various methods to calculate earthquake forces as per IS: 1893 – 2002.
- To gain the knowledge about guidelines for Earthquake Resistant Design and detailing as per IS: 13920 – 1993.

UNIT I SINGLE DEGREE OF FREEDOM SYSTEM 9

Definition of degree of freedom – Idealization of structure as Single Degree of Freedom (SDOF) system – Formulation of equation of motion for various SDOF systems – D'Alembert's Principles – Effect of damping – Free and forced vibration of damped and undamped structures – Response to harmonic forces and periodic forces.

UNIT II MULTI DEGREE OF FREEDOM SYSTEM 9

Formulation of equation of motion for multi degree of freedom (MDOF) system – Evaluation of natural frequencies and modes – Eigen values and Eigen vectors – Response to free and forced vibration of undamped and damped MDOF systems – Modal superposition methods.

UNIT III INTRODUCTION TO EARTHQUAKE ENGINEERING 9

Elements of Engineering Seismology – Definitions, Introduction to Seismic hazard, Earthquake phenomenon –

Seismo-tectonics – Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters.

UNIT IV EARTHQUAKE EFFECTS ON STRUCTURES 9

Effect of earthquake on different types of structures – Behaviour of RCC, Steel and prestressed Concrete Structures under earthquake loading – Pinching Effect – Bouchinger Effects – Evaluation of Earthquake forces – IS Code 1893: 2002 – Response Spectra – Lessons learnt from past earthquakes.

UNIT V CONCEPTS OF EARTHQUAKE RESISTANT DESIGN 9

Causes of damage – Planning considerations/Architectural concept (IS 4326-1993) – Guidelines for Earthquake resistant design – Earthquake resistant design of masonry buildings – Design consideration – Guidelines – Earthquake resistant design of R.C.C. buildings – Lateral load analysis – Design and detailing (IS 13920:1993).

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, students will be able to

- Use the concept of static and dynamic analysis of structures to perform analysis of SDOF using Numerical methods.
- Analyse multi degree of freedom system concept using Numerical methods.
- Get familiarized with different types of theories, causes, and characteristic of earthquake.
- Analyze and design the ductile details of structures for seismic resistant design as per Indian standards.
- Get familiarized with Planning considerations for Earthquake resistant design for masonry and Reinforced Cement Concrete buildings as per guideline of IS codes.

TEXTBOOKS:

1. Mario Paz, Structural Dynamics – Theory and Computations, Fourth Edition, CBS publishers, 1997.
2. Agarwal. P and Shrikhande. M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2007.

REFERENCES:

1. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.
2. Jai Krishna, Chandrasekaran.A.R., and Brijesh Chandra, Elements of Earthquake Engineering, South Asia Publishers, 1994.
3. Minoru Wakabayashi, Design of Earthquake Resistant Buildings, Mc Graw – Hill Book Company, 1986
4. Humar.J.L, Dynamics of Structures, Prentice Hall Inc., 1990.
5. Anil K Chopra, Dynamics of structures – Theory and applications to Earthquake Engineering, Prentice Hall Inc., 2007.
6. Moorthy.C.V.R., Earthquake Tips, NICEE, IIT Kanpur, 2002.

CE17E89	**PREFABRICATED STRUCTURES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To provide students an exposure to principles of prefabrication and its methods of production.

- To ensure that students begin to understand the various prefabricated structural components
- To gain a preliminary understanding of approaches of joint flexibility and material properties
- To acquire knowledge on various types of joints in prefabricated structural components and its detailing
- To understand the impact of progressive collapse and various is codes on abnormal loads.

UNIT I INTRODUCTION 9

Need for prefabrication – Principles of prefabrication – Modular coordination – Standardization – Materials – Systems – Production – Transportation – Erection.

UNIT II PREFABRICATED COMPONENTS 9

Behaviour and types of structural components – Large panel systems – roof and floor slabs – Walls panels - Beams - Columns - Shear walls.

UNIT III DESIGN PRINCIPLES 9

Design philosophy - Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems.

UNIT IV JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS 9

Types of Joints – based on action of forces - compression joints - shear joints - tension joints - based on function - construction, contraction, expansion - Design of expansion joints - Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation.

UNIT V DESIGN FOR ABNORMAL LOADS 9

Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones etc., - Importance of avoidance of progressive collapse.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, students will be able to

- Get familiarized with principles of prefabrication and its methods of production
- Assess vulnerability and various prefabricated structural components.
- Analyze the importance of joint flexibility and materials used for prefabrication.
- Get familiarized with various joints used in structural components and its detailing.
- Manage progressive collapse and importance of abnormal loads

TEXTBOOKS:

1. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers, USA, 1991.
2. Lewitt,M. " Precast Concrete- Materials, Manufacture, Properties And Usage", Applied Science Publishers , London And New Jersey, 1982.
3. Bachmann, H. and Steinle, A. "Precast Concrete Structures", Ernst & Sohn, Berlin, 2011.

REFERENCES:

1. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
2. "Handbook on Precast Concrete Buildings", Indian Concrete Institute,2016.
3. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.