You Choose, We Do It
St. JOSEPH'S COLLEGE OF ENGINEERING
(An Autonomous Institution)
St. Joseph's Group of Institutions
OMR, Chennai - 119

DEPARTMENT OF CIVIL ENGINEERING

B.E. CIVIL ENGINEERING

CURRICULUM & SYLLABUS

(1st to 8th Semester)

under

REGULATIONS 2021

(Approved in the Third Board of Studies meeting held on 7th February 2023

and Academic Council Meeting held on 17th February 2023)

DEPARTMENT OF CIVIL ENGINEERING

B.E. CIVIL ENGINEERING

REGULATIONS – 2021

(CHOICE BASED CREDIT SYSTEM)

CURRICULUM AND SYLLABI

PROGRAM OUTCOMES (POs)

Engineering graduates will be able to:

PO:1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO: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.

PO:3 Design/development of solutions: Design solution for complex engineering problems and design systems components or process that meet the specified needs with appropriate consideration for the public health and safety , and the cultural, societal, and environmental considerations.

PO: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.

PO: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.

PO: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.

PO:7 Environmental 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.

PO:8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO:9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO: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.

PO: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.

PO: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 EDUCATIONAL OBJECTIVES (PEOs)

Engineering Graduates will be able to

PEO:1 Graduates of the programme will apply principles of basic and engineering sciences in analysis, design and operation of Civil Engineering systems

PEO:2 Graduates of the programme will contribute to the development of sustainable Infrastructure for the betterment of society.

PEO:3 Graduates of the programme will engage in lifelong learning and adapt to changing professional and societal needs with focus on research & development and industry interaction.

PEO:4 Graduates of the programme will discharge their duties as professional Civil Engineers with quality and ethics.

PROGRAM SPECIFIC OBJECTIVES (PSOs)

PSO 1: The students graduating in Civil Engineering will have profound foundation in Mathematical, Scientific and Engineering domains necessary to achieve professional and productive excellence in technical and non-technical problem solving and analyzing engineering problems.

PSO 2: The students graduating in Civil Engineering will have the ability to Create, select, and apply appropriate techniques, resources, and modern engineering tools such as CAD, STAAD-Pro and GIS including prediction and modelling to complex Civil Engineering activities with an understanding of the limitations.

PSO 3: The students graduating in Civil Engineering will have the ability to 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 Civil Engineering projects and in multidisciplinary environments.

Vision of the Department

To educate the new generation Civil Engineers to meet the future technological needs by imparting sound technical knowledge and to improve professional leadership and management quality in public service.

Mission of the Department

- To enhance and enrich the technical knowledge in civil engineering through teaching-learning process.
- To educate the students about the significance of professional and ethical practices.
- To facilitate the understanding and implementation of innovative ideas through research and development.
- To develop personal competence among students which will improve their entrepreneurial and managerial skills.

CURRICULUM

SEMESTER I

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	HS1101	Communicative English **(Common for all Branches of B.E. / B. Tech Programmes)**	HSC	3	3	0	0	3
2	MA1102	Engineering Mathematics – I **(Common for all Branches of B.E. / B. Tech Programmes)**	BSC	4	4	0	0	4
3	PH1103	Engineering Physics **(Common for all Branches of B.E. / B. Tech Programmes)**	BSC	3	3	0	0	3
4	CY1104	Engineering Chemistry **(Common for all Branches of B.E. / B. Tech Programmes)**	BSC	3	3	0	0	3
5	GE1105	Problem Solving and Python Programming **(Common for all Branches of B.E. / B. Tech Programmes)**	ESC	3	3	0	0	3
6	GE1106	Engineering Graphics **(Common for all Branches of B.E. / B. Tech Programmes)**	ESC	6	2	0	4	4
PRACTICAL								
7	GE1107	Python Programming Laboratory **(Common for all Branches of B.E. / B. Tech Programmes)**	ESC	4	0	0	4	2
8	BS1108	Physics and Chemistry Laboratory **(Common for all Branches of B.E. / B. Tech Programmes)**	BSC	4	0	0	4	2
Total				**30**	**18**	**0**	**12**	**24**

SEMESTER II

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	HS1201	Professional English **(Common for all Branches of B.E. / B. Tech Programmes)**	HSC	3	3	0	0	3
2	MA1202	Engineering Mathematics -II **(Common for all Branches of B.E. / B. Tech Programmes Except AI-DS& AI-ML)**	BSC	4	4	0	0	4
3	PH1251	Physics for Civil Engineering	BSC	3	3	0	0	3
4	GE1204	Environmental Science and Engineering **(Common for all Branches of B.E. / B. Tech Programmes)**	HSC	3	3	0	0	3
5	BE1253	Basic Electrical and Electronics Engineering	ESC	3	3	0	0	3
6	GE1206	Engineering Mechanics **(Common for Civil & Mechanical)**	ESC	4	3	1	0	4
PRACTICAL								
7	GE1207	Engineering Practices Laboratory **(Common for all Branches of B.E. / B. Tech Programmes)**	ESC	4	0	0	4	2
8	CE1208	Computer aided drafting Laboratory	PCC	4	0	0	4	2
Total				**28**	**19**	**1**	**8**	**24**

SEMESTER III

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MA1301	Transforms and Partial Differential Equations	BSC	4	3	0	0	4
2	CE1302	Engineering Geology and Construction Materials	PCC	3	3	0	0	3
3	CE1303	Strength of Materials	PCC	3	3	0	0	3
4	CE1304	Concrete Technology	PCC	3	3	0	0	3
5	CE1305	Fluid Mechanics	PCC	3	3	0	0	3
6	CE1306	Surveying	PCC	3	3	0	0	3
PRACTICAL								
7	CE1307	Strength of Materials Laboratory	PCC	4	0	0	4	2
8	CE1308	Surveying laboratory	PCC	4	0	0	4	2
Total				**27**	**18**	**0**	**8**	**23**

SEMESTER IV

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MA1455	Numerical Methods	BSC	4	4	0	0	4
2	CE1402	Water Supply Engineering	PCC	3	3	0	0	3
3	CE1403	Highway Engineering	PCC	3	3	0	0	3
4	CE1404	Applied Hydraulic Engineering	PCC	3	3	0	0	3
5	CE1405	Structural Analysis – I	PCC	3	3	0	0	3
6	CE1406	Geotechnical Engineering - I	PCC	3	3	0	0	3
PRACTICAL								
7	CE1407	Advanced Surveying Laboratory	PCC	4	0	0	4	2
8	CE1408	Hydraulic Engineering Laboratory	PCC	4	0	0	4	2
9	HS1310	Professional Skills laboratory	EEC	1	0	0	1	1
Total				**28**	**19**	**0**	**9**	**24**

SEMESTER V

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	CE1501	Structural Analysis – II	PCC	3	3	0	0	3
2	CE1502	Geotechnical Engineering - II	PCC	3	3	0	0	3
3	CE1503	Railways, Airports and Harbour Engineering	PCC	3	3	0	0	3
4	CE1504	Wastewater Engineering	PCC	3	3	0	0	3
5	CE1505	Design of Reinforced Concrete Elements	PCC	3	3	0	0	3
6		Professional Elective – I	PEC	3	3	0	0	3
PRACTICAL								
7	CE1507	Environmental Engineering Laboratory	PCC	4	0	0	4	2
8	CE1508	Soil Mechanics Laboratory	PCC	4	0	0	4	2
Total				**26**	**18**	**0**	**8**	**22**

SEMESTER VI

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	CE1601	Irrigation Engineering	PCC	3	3	0	0	3
2	CE1602	Construction Management	PCC	3	3	0	0	3
3	CE1603	Design of Steel Structures	PCC	3	3	0	0	3
4		Professional Elective – II	PEC	3	3	0	0	3
5		Professional Elective – III	PEC	3	3	0	0	3
6		Open Elective – I	OEC	3	3	0	0	3
PRACTICAL								
7	CE1607	Construction Materials and Highway Engineering Laboratory	PCC	4	0	0	4	2
8	CE1608	Irrigation and Environmental Engineering Drawing	PCC	4	0	0	4	2
Total				**26**	**18**	**0**	**8**	**22**

SEMESTER VII

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	CE1701	Estimation, Costing and Valuation	PCC	3	3	0	0	3
2	CE1702	Structural Design and Drawing	PCC	5	3	0	2	4
3		Open Elective – II	OEC	3	3	0	0	3
4		Professional Elective – IV	PEC	3	3	0	0	3
5		Professional Elective – V	PEC	3	3	0	0	3
PRACTICAL								
6	CE1707	Summer Internship / Summer training (4 weeks)	IPT	0	0	0	0	2
8	CE1708	Design Project	EEC	4	0	0	4	2
MANDATORY COURSE								
9	AD100X	Audit Course	AC	2	2	0	0	0
Total				**25**	**17**	**0**	**8**	**20**

SEMESTER VIII

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1		Professional Elective – VI	PEC	3	3	0	0	3
2		Professional Elective – VII	PEC	3	3	0	0	3
PRACTICAL								
3	CE1807	Project Work	EEC	20	0	0	20	10
Total				**26**	**6**	**0**	**20**	**16**

COURSE CREDITS – SEMESTER WISE

Branch	I	II	III	IV	V	VI	VII	VIII	TOTAL
Civil	**24**	**24**	**23**	**24**	**22**	**22**	**20**	**16**	**175**

LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE - I

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	CE1001	Remote Sensing	PEC	3	3	0	0	3
2	CE1002	Geographic Information System	PEC	3	3	0	0	3
3	CE1003	Geo informatics Applications for Civil Engineers	PEC	3	3	0	0	3
4	CE1004	Advanced Surveying Techniques	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE - II

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	CE1005	Air Pollution and Control Engineering	PEC	3	3	0	0	3
2	CE1006	Environmental and Social Impact Assessment	PEC	3	3	0	0	3
3	CE1007	Industrial Wastewater Treatment	PEC	3	3	0	0	3
4	CE1008	Municipal Solid Waste Management	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE - III

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	CE1009	Pavement Engineering	PEC	3	3	0	0	3
2	CE1010	Traffic Engineering and Management	PEC	3	3	0	0	3
3	CE1011	Transportation Planning and Systems	PEC	3	3	0	0	3
4	CE1012	Urban Planning and Development	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE – IV

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	CE1013	Hydrology and Water Resources Engineering	PEC	3	3	0	0	3
2	CE1014	Integrated Water Resources Management	PEC	3	3	0	0	3
3	CE1015	Groundwater Engineering	PEC	3	3	0	0	3
4	CE1016	Water Resources Systems Engineering	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE - V

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	CE1017	Design of Plate and Shell Structures	PEC	3	3	0	0	3
2	CE1018	Prestressed Concrete Structures	PEC	3	3	0	0	3
3	CE1019	Industrial Structures	PEC	3	3	0	0	3
4	CE1020	Maintenance, Repair and Rehabilitation of Structures	PEC	3	3	0	0	3
5	CE1021	Powerplant Structures	PEC	3	3	0	0	3
6	CE1022	Prefabricated Structures	PEC	3	3	0	0	3
7	CE1023	Tall Structures	PEC	3	3	0	0	3
8	CE1024	Aseismic Design of Structures	PEC	3	3	0	0	3
9	CE 1025	Disaster management	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE - VI

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	CE1026	Geo-Environmental Engineering	PEC	3	3	0	0	3
2	CE1027	Ground Improvement Techniques	PEC	3	3	0	0	3
3	CE1028	Soil Dynamics and Machine Foundations	PEC	3	3	0	0	3
4	CE1029	Rock Mechanics	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE - VII

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	CE1030	Coastal Engineering	PEC	3	3	0	0	3
2	CE1031	Coastal Zone Management	PEC	3	3	0	0	3
3	CE1032	Global Climate Change	PEC	3	3	0	0	3
4	CE1033	Climate Change and Vulnerability Assessment	PEC	3	3	0	0	3

LIST OF OPEN ELECTIVES

OPEN ELECTIVE - I

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	OME103	Energy Conservation in Thermal and Electrical Utilities	OEC	3	3	0	0	3
2	OCH103	Environment and Agriculture	OEC	3	3	0	0	3
3	OEE102	Renewable Energy Sources	OEC	3	3	0	0	3
4	OEI101	Sensors and Transducers	OEC	3	3	0	0	3
5	OME107	Vibration and Noise Control	OEC	3	3	0	0	3

OPEN ELECTIVE - II

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	OCH104	Textile effluent treatments	OEC	3	3	0	0	3
2	OEI102	Robotics	OEC	3	3	0	0	3
3	OME104	Industrial Safety Engineering	OEC	3	3	0	0	3
4	OCS101	Introduction to C Programming	OEC	3	3	0	0	3
5	OME106	Testing of Materials	OEC	3	3	0	0	3

AUDIT COURSE

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	AD1001	Constitution of India	AC	2	2	0	0	0
2	AD1002	Value Education	AC	2	2	0	0	0
3	AD1003	Pedagogy Studies	AC	2	2	0	0	0
4	AD1004	Stress Management by Yoga	AC	2	2	0	0	0
5	AD1005	Personality Development Through Life Enlightenment Skills	AC	2	2	0	0	0
6	AD1006	Unnat Bharat Abhiyan	AC	2	2	0	0	0
7	AD1007	Essence of Indian Knowledge Tradition	AC	2	2	0	0	0
8	AD1008	Sanga Tamil Literature Appreciation	AC	2	2	0	0	0

LIST OF OPEN ELECTIVES OFFERED TO OTHER DEPARTMENTS

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	OCE101	Air Pollution and Control	OEC	3	3	0	0	3
2	OCE102	Introduction to Geographic Information System	OEC	3	3	0	0	3
3	OCE103	Environmental impact assessment	OEC	3	3	0	0	3
4	OCE104	Green Building Design	OEC	3	3	0	0	3

VALUE ADDED COURSES

S.No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	CVA001	Construction Technology	2	0	0	2
2	CVA002	AUTOCAD	1	0	2	2
3	CVA003	Structural Analysis and Design	1	0	2	2
4	CVA004	3D's MAX	1	0	2	2
5	CVA005	STAAD PRO Analysis and Design	1	0	2	2
6	CVA006	Project Management using Primavera	1	0	2	2
7	CVA007	TEKLA Structures	1	0	2	2
8	CVA008	E TABS Software	1	0	2	2
9	CVA009	Building Modelling using 3D Revit Architecture	1	0	2	2
10	CVA010	Advanced Field Surveying	1	0	2	2
11	CVA011	Building information modelling and MS Project	2	0	0	2
12	CVA012	Practical Valuation	2	0	0	2
13	CVA013	Vastu in Construction	2	0	0	2
14	CVA014	Automation in Construction	2	0	0	2
15	CVA015	Green Building Concepts	2	0	0	2
16	CVA016	Interior Design	2	0	0	2
17	CVA017	In-Situ Soil testing and instrumentation	2	0	0	2
18	CVA018	Architectural Acoustics	2	0	0	2
19	CVA019	Smart Cities	2	0	0	2
20	CVA020	Forensic Civil Engineering	2	0	0	2

HS1101	COMMUNICATIVE ENGLISH	L	T	P	C
	(Common for 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 – critical reading – finding key information in a given text – shifting facts from opinions - Writing - autobiographical writing - developing hints. Listening- short texts- short formal and informal conversations. Speaking- basics in speaking - introducing oneself - exchanging personal information- speaking on given topics & situations Language development– voices- Wh- Questions- asking and answering-yes or no questions– parts of speech. Vocabulary development-- prefixes- suffixes- articles - Polite Expressions.		CO1
UNIT II	**GENERAL READING AND FREE WRITING**	**9**
Reading: Short narratives and descriptions from newspapers (including dialogues and conversations ; Reading Comprehension Texts with varied question types - Writing – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –. Listening **-** long texts - TED talks - extensive speech on current affairs and discussions Speaking – describing a simple process – asking and answering questions - Language development – prepositions, clauses. Vocabulary development- guessing meanings of words in context – use of sequence words.		CO2
UNIT III	**GRAMMAR AND LANGUAGE DEVELOPMENT**	**9**
Reading- short texts and longer passages (close reading) & making a critical analysis of the given text Writing – types of paragraph and writing essays – rearrangement of jumbled sentences. Listening: Listening to ted talks and long speeches for comprehension. Speaking- role plays - asking about routine actions and expressing opinions. Language development- degrees of comparison- pronouns- Direct vs. Indirect Questions. Vocabulary development – idioms and phrases- cause & effect expressions, adverbs.		CO3
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-e-mails-conventions of personal email- Listening: Listening comprehension (IELTS, TOEFL and others). Speaking -Speaking about friends/places/hobbies - Language development- Tenses- simple present-simple past- present continuous and past continuous- conditionals – if, unless, in case, when and others Vocabulary development- synonyms-antonyms- Single word substitutes- Collocations.		CO4
UNIT V	**EXTENDED WRITING**	**9**
Reading: Reading for comparisons and contrast and other deeper levels of meaning –Writing- brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing- Listening - popular speeches and presentations - Speaking - impromptu speeches & debates Language development-modal verbs- present/ past perfect tense - Vocabulary development-Phrasal verbs- fixed and semi-fixed expressions.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Board of Editors. Using English A Course book for Undergraduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad: 2020
2. Sanjay Kumar & Pushp Lata Communication Skills Second Edition, Oxford University Press: 2015.
3. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

REFERENCE BOOKS

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 Face 2 Face (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 Rajeevan Geeta Basic Communication Skills, Foundation Books: 2013
6. John Eastwood et al : Be Grammar Ready: The Ultimate Guide to English Grammar, Oxford University Press: 2020. .

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
CO2	Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
CO3	Read different genres of texts adopting various reading strategies.
CO4	Listen/view and comprehend different spoken discourses/excerpts in different accents
CO5	Identify topics and formulate questions for productive inquiry

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	2	3	-	-	-	-	1
CO2	-	1	-	2	-	-	-	-	-	3	-	-	1	1	1
CO3	-	2	-	3	-	-	-	-	-	2	-	-	1	1	1
CO4	-	-	-	-	-	-	-	-	2	2	-	-	1	-	1
CO5	-	2	1	1	2	-	2	-	-	3	-	-	1	1	1

MA1102	ENGINEERING MATHEMATICS –I	L	T	P	C
	(Common for all branches of B.E. / B. Tech Programmes)	4	0	0	4

OBJECTIVES

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus.
- The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
- Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering.
- This is a foundation course of Single Variable and multivariable calculus plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I	MATRICES	12
Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms		CO1
UNIT II	**CALCULUS OF ONE VARIABLE**	**12**
Limit of a function - Continuity - Derivatives - Differentiation rules – Interval of increasing and decreasing functions – Maxima and Minima - Intervals of concavity and convexity.		CO2
UNIT III	**CALCULUS OF SEVERAL VARIABLES**	**12**
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.		CO3
UNIT IV	**INTEGRAL CALCULUS**	**12**
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.		CO4
UNIT V	**MULTIPLE INTEGRALS**	**12**
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Change of variables from Cartesian to polar in double integrals-Triple integrals – Volume of solids		CO5
		TOTAL : 60 PERIODS

TEXT BOOKS

1. Grewal B.S., Higher Engineering Mathematics‖, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendental", Cengage Learning, 7th Edition, New Delhi,2015. [For Units I & III - Sections 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.2 - 7.4 and 7.8].

REFERENCE BOOKS

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. T. Veerarajan. Engineering Mathematics – I, McGraw Hill Education; First edition 2017.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Have a clear idea of matrix algebra pertaining Eigenvalues and Eigenvectors in addition dealing with quadratic forms.
CO2	Understand the concept of limit of a function and apply the same to deal with continuity and derivative of a given function. Apply differentiation to solve maxima and minima problems, which are related to real world problems.
CO3	Have the idea of extension of a function of one variable to several variables. Multivariable functions of real variables are inevitable in engineering.
CO4	Understand the concept of integration through fundamental theorem of calculus. Also acquire skills to evaluate the integrals using the techniques of substitution, partial fraction and integration by parts along with the knowledge of improper integrals.
CO5	Do double and triple integration so that they can handle integrals of higher order which are applied in engineering field.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	2	3	-	-	3	2	3	3	1	2	1
CO2	3	3	3	2	2	1	-	-	-	-	1	2	1	-	1
CO3	3	3	3	2	2	1	-	-	-	-	1	2	2	1	1
CO4	3	3	3	2	2	1	-	-	-	-	1	2	1	1	1
CO5	3	3	3	2	1	1	-	-	-	-	1	2	2	2	2

PH1103	ENGINEERING PHYSICS	L	T	P	C
	(Common for all branches of B.E. / B. Tech Programmes)	3	0	0	3

OBJECTIVES

- To make the students to understand about the elastic property and stress strain diagram.
- To educate the students about principle of laser and its role in optical fibers and its applications as sensors and communication.
- To teach the students about the heat transfer through solids and liquids.
- To educate the students about the quantum concepts and its use to explain black body radiation, Compton effect, tunnelling electron microscopy and its applications.
- To make the students to understand the importance of various crystal structures and various growth techniques.

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 - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment – Practical applications of modulus of elasticity-I-shaped girders - stress due to bending in beams.		**CO1**

UNIT II	LASER AND FIBER OPTICS	9
Lasers : population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Nd-YAG Laser-Semiconductor lasers: homojunction and heterojunction – Industrial and medical applications of Laser– Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – losses associated with optical fibers – Fabrication of Optical fiber-Double crucible method-fibre optic sensors: pressure and displacement-Industrial and medical applications of optical fiber- Endoscopy-Fiber optic communication system.		**CO2**

UNIT III	THERMAL PHYSICS	9
Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity –Rectilinear flow of heat- Lee's disc method: theory and experiment - conduction through compound media (series and parallel)-Radial flow of heat– thermal insulation – applications: heat exchangers, refrigerators, oven, Induction furnace and solar water heaters.		**CO3**

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 – Electron microscope-tunnelling (qualitative) - scanning tunnelling microscope-Applications of electron microscopy.		**CO4**

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 coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures – Graphite structure-crystal imperfections: point defects, line defects – Burger vectors, stacking faults – growth of single crystals: solution and melt growth techniques-Epitaxial growth-Applications of Single crystal (Qualitative).		**CO5**

TOTAL : 45 PERIODS

TEXT BOOKS

1. Bhattacharya, D.K. & Poonam, T. “Engineering Physics”. Oxford University Press, 2019.
2. Gaur, R.K. & Gupta, S.L. “Engineering Physics”. Dhanpat Rai Publishers, 2017.
3. Pandey, B.K. & Chaturvedi, S. “Engineering Physics”. Cengage Learning India, 2019.

REFERENCE BOOKS

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, 2019.
3. Tipler, P.A. & Mosca, G. “Physics for Scientists and Engineers with Modern Physics’. W.H.Freeman, 2007.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Gain knowledge on the basics of properties of matter and its applications,
CO2	Acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics.
CO3	Have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers.
CO4	Get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
CO5	Understand the basics of crystals, their structures and different crystal growth techniques.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	2	2	1	3	2	1	2	1	2	2
CO2	3	3	3	2	3	2	2	1	2	2	2	1	2	3	2
CO3	3	3	2	2	2	1	2	1	2	1	1	2	2	1	2
CO4	3	3	2	2	2	1	1	1	1	1	1	3	2	2	1
CO5	3	3	3	3	2	1	2	1	3	1	1	3	3	2	2

CY1104	ENGINEERING CHEMISTRY	L	T	P	C
	(Common for all branches of B.E. / B. Tech Programmes)	3	0	0	3

OBJECTIVES

- Principles of water characterization and treatment for industrial purposes.
- Principles and applications of surface chemistry and catalysis.
- Phase rule and various types of alloys.
- Various types of fuels, applications and combustion.
- Conventional and non–conventional energy sources and energy storage device.

UNIT I	WATER AND ITS TREATMENT	9
Hardness of water – Types – Expression of hardness – Units – Estimation of hardness by EDTA method – Numerical problems on EDTA method – Boiler troubles (scale and sludge, caustic embrittlement , boiler corrosion, priming and foaming) – Treatment of boiler feed water – Internal treatment (carbonate, phosphate, colloidal, sodium aluminate and calgon conditioning) – External treatment – Ion exchange process, Zeolite process – Desalination of brackish water by reverse Osmosis.		CO1

UNIT II	SURFACE CHEMISTRY AND CATALYSIS	9
Surface chemistry: Types of adsorption – Adsorption of gases on solids – Adsorption of solute from solutions – Adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – Kinetics of uni-molecular surface reactions – Adsorption in chromatography – Applications of adsorption in pollution abatement using PAC. **Catalysis**: Catalyst – Types of catalysis – Criteria – Contact theory – Catalytic poisoning and catalytic promoters – Industrial applications of catalysts – Catalytic convertor – Auto catalysis – Enzyme catalysis – Michaelis-Menten equation.		CO2

UNIT III	PHASE RULE AND ALLOYS	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**: Introduction – Definition – Properties of alloys – Significance of alloying – Functions and effect of alloying elements – Nichrome, Alnico, Stainless steel (18/8) – Heat treatment of steel – Non-ferrous alloys – Brass and bronze.		CO3

UNIT IV	FUELS AND COMBUSTION	9
Fuels: Introduction – classification of fuels – Comparison of solid, liquid, gaseous fuels – Coal – Analysis of coal (proximate and ultimate). – Carbonization – Manufacture of metallurgical coke (Otto Hoffmann method) – Petroleum – Cracking – Manufacture of synthetic petrol (Bergius process, Fischer Tropsch Process) – Knocking – Octane number – Diesel oil – Cetane number – Compressed natural gas (CNG) – Liquefied petroleum gases (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 – Flue gas analysis by Orsat Method.		CO4

UNIT V	NON–CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES	9
Nuclear energy – Fission and fusion reactions – Differences – Chain reactions – Nuclear reactors – Classification of reactors – Light water nuclear reactor for power generation – Breeder reactor – Solar energy conversion – Solar cells – Wind energy – Fuel cells – Hydrogen-oxygen fuel cell . Batteries – Types of batteries - Alkaline batteries – Lead-acid, Nickel-cadmium and Lithium batteries.		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. P.C.Jain, Monica Jain, "Engineering Chemistry" 17th Ed. Dhanpat Rai Pub. Co., New Delhi,(2015).
2. S.S. Dara, S.S. Umare, "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2020).
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India (P) Ltd. New Delhi, (2018).
4. P. Kannan, A. Ravikrishnan, "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company (P) Ltd. Chennai, (2009).

REFERENCE BOOKS

1. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar "Engineering Chemistry" Tata McGraw–Hill Pub.Co.Ltd, New Delhi (2008).
3. Prasanta Rath, "Engineering Chemistry", Cengage Learning India (P) Ltd., Delhi, (2015).
4. Shikha Agarwal, "Engineering Chemistry–Fundamentals and Applications", Cambridge University Press, Delhi, (2015).
5. A. Pahari, B. Chauhan, "Engineering Chemistry", Firewall Media., New Delhi., (2010).
6. Sheik Mideen., Engineering Chemistry, Airwalk Publications, Chennai (2018).

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Able to understand impurities in industrial water, boiler troubles, internal and external treatment methods of purifying water.
CO2	Able to understand concepts of absorption, adsorption, adsorption isotherms, application of adsorption for pollution abatement, catalysis and enzyme kinetics.
CO3	Able to recognize significance of alloying, functions of alloying elements and types of alloys, uses of alloys. They should be acquainted with phase rule and reduced phase and its applications in alloying.
CO4	Able to identify various types of fuels, properties, uses and analysis of fuels. They should be able to understand combustion of fuels, method of preparation of bio-diesel, synthetic petrol.
CO5	Able to understand conventional, non–conventional energy sources, nuclear fission and fusion, power generation by nuclear reactor, wind, solar energy and preparation, uses of various batteries.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	3	2	2	2	2	2	2	1	2
CO2	3	3	2	2	2	2	2	1	1	1	1	2	2	1	1
CO3	3	3	3	3	3	2	2	1	2	2	2	2	2	1	2
CO4	3	3	3	2	2	3	3	2	2	3	2	2	3	1	2
CO5	3	2	3	3	3	3	3	2	2	2	2	2	3	2	3

GE1105	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
	(Common for all branches of B.E. / B. Tech Programmes)	3	0	0	3

OBJECTIVES

- To know the basics of algorithmic problem solving
- To write simple python programs
- To develop python program by using control structures and functions
- To use python predefined data structures
- To write file-based program

UNIT I	ALGORITHMIC PROBLEM SOLVING	9
Algorithms, Building blocks of algorithms: statements, state, control flow, functions, Notation: pseudo code, flow chart, programming language, Algorithmic problem solving: Basic algorithms, flowcharts and pseudocode for sequential, decision processing and iterative processing strategies, Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.		**CO1**

UNIT II	INTRODUCTION TO PYTHON	9
Python Introduction, Technical Strength of Python, Python interpreter and interactive mode, Introduction to colab , pycharm and jupyter idle(s) ,Values and types: int, float, boolean, string, and list; Built-in data types, variables, Literals, Constants, statements, Operators: Assignment, Arithmetic, Relational, Logical, Bitwise operators and their precedence, Expressions, tuple assignment, Accepting input from Console, printing statements, Simple Python programs.		**CO2**

UNIT III	CONTROL FLOW, FUNCTIONS AND STRINGS	9
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: while, for; Loop manipulation using pass, break, continue, and else; Modules and Functions: function definition and use, flow of execution, parameters and arguments, local and global scope, return values, function composition, recursion. Strings: string slices, immutability, string functions and methods, string module; Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.		**CO3**

UNIT IV	LISTS, TUPLES, DICTIONARIES	9
Lists: Defining list and list slicing, list operations, list slices, list methods, list loop, list Manipulation, mutability, aliasing, cloning lists, list parameters, lists as arrays. Tuples: tuple assignment, tuple as return value, tuple Manipulation; Dictionaries: operations and methods; advanced list processing – list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.		**CO4**

UNIT V	FILES, MODULES, PACKAGES	9
Files and exception: Concept of Files, Text Files; File opening in various modes and closing of a file, Format Operators, Reading from a file, Writing onto a file, File functions- open(), close(), read(),readline(), readlines(),write(), writelines(),tell(),seek(), Command Line arguments; Errors and exceptions: handling exceptions; modules, packages; introduction to numpy, matplotlib. Illustrative programs: word count, copy a file.		**CO5**

TOTAL : 45 PERIODS

TEXT BOOKS

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist ", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)
2. Guido van Rossum and Fred L. Drake Jr, — An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. Reema Thareja, Python Programming: Using Problem Solving Approach, Oxford University Press, 2019.

REFERENCE BOOKS

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

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop algorithmic solutions to simple computational problems
CO2	Develop simple console application in python
CO3	Develop python program by applying control structure and decompose program into functions.
CO4	Represent compound data using python lists, tuples, and dictionaries.
CO5	Read and write data from/to files in Python.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	2	3
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	2	3
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	2	3
CO4	3	3	3	3	2	-	-	-	-	2	2	2	3	2	3
CO5	3	3	3	3	2	-	-	-	-	2	2	2	3	2	3

GE1106	ENGINEERING GRAPHICS	L	T	P	C
	(Common for all branches of B.E. / 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.

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. 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		**CO1**
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.		**CO2**
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.		**CO3**
UNIT IV	**PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OFSURFACES**	**6+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.		**CO4**
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.		**CO5**
		TOTAL : 90 PERIODS

TEXT BOOKS

1. Natarajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, Twenty Ninth Edition 2016
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2011.

REFERENCE BOOKS

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2019.
2. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2018.
4. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Comput er Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the fundamentals and standards of Engineering graphics
CO2	Perform freehand sketching of basic geometrical constructions and multiple views of objects
CO3	Understand the concept of orthographic projections of lines and plane surfaces
CO4	Draw the projections of section of solids and development of surfaces
CO5	Visualize and to project isometric and perspective sections of simple solids

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)											PROGRAM SPECIFIC OUTCOMES (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	1	-	-	3	3	2	3	2	2	-
CO2	3	1	2	2	1	1	-	-	3	3	2	3	2	2	-
CO3	3	1	1	3	1	1	-	-	3	3	2	3	2	2	-
CO4	3	1	1	3	1	1	-	-	3	3	2	3	2	2	-
CO5	3	1	2	3	1	1	-	-	3	3	2	3	2	2	-

GE1107	PYTHON PROGRAMMING LABORATORY	L	T	P	C
	(Common for all branches of B.E. / B. Tech Programmes)	0	0	4	2

OBJECTIVES

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, and dictionaries.
- Read and write data from/to files in Python.

LIST OF EXPERIMENTS

1. Write an algorithm and draw flowchart illustrating mail merge concept.	**CO1**
2. Write an algorithm, draw flowchart and write pseudo code for a real life or scientific or technical problems	
3. Scientific problem-solving using decision making and looping. • Armstrong number, palindrome of a number, Perfect number.	
4. Simple programming for one dimensional and two-dimensional arrays. • Transpose, addition, multiplication, scalar, determinant of a matrix	
5. Program to explore string functions and recursive functions.	**CO2**
6. Utilizing 'Functions' in Python • Find mean, median, mode for the given set of numbers in a list. • Write a function dups to find all duplicates in the list. • Write a function unique to find all the unique elements of a list. • Write function to compute gcd, lcm of two numbers.	
7. Demonstrate the use of Dictionaries and tuples with sample programs.	
8. Implement Searching Operations: Linear and Binary Search.	
9. To sort the 'n' numbers using: Selection, Merge sort and Insertion Sort.	
10. Find the most frequent words in a text of file using command line arguments.	**CO3**
11. Demonstrate Exceptions in Python.	
12. Applications**:** Implementing GUI using turtle, pygame.	

TOTAL: 60 PERIODS

REFERENCE BOOKS

1. Reema Thareja, Python Programming: Using Problem Solving Approach, Oxford University Press, 2019
2. Allen B. Downey , " Think Python: How to Think Like a Computer Scientist", Second Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
3. Shroff "Learning Python: Powerful Object-Oriented Programming; Fifth edition, 2013.
4. David M.Baezly "Python Essential Reference". Addison-Wesley Professional; Fourth edition, 2009.
5. David M. Baezly "Python Cookbook" O'Reilly Media; Third edition (June 1, 2013)

WEB REFERENCES

1. http://www.edx.org

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Develop simple console applications through python with control structure and functions
CO2	Use python built in data structures like lists, tuples, and dictionaries for representing compound data.
CO3	Read and write data from/to files in Python and applications of python.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	2	2	2	3	2	3
CO2	3	3	3	3	2	-	-	-	-	2	2	2	3	2	3
CO3	3	3	3	3	2	-	-	-	-	2	2	2	3	2	3

BS1108	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
	(Common for all branches of B.E. / B. Tech Programmes)	0	0	4	2

OBJECTIVES

The students will be trained to perform experiments to study the following.

- The Properties of Matter
- The Optical properties, Characteristics of Lasers & Optical Fibre
- Electrical & Thermal properties of Materials
- Enable the students to enhance accuracy in experimental measurements.
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric analysis
- Instrumental method of analysis such as potentiometry, conductometry and pHmetry

LIST OF EXPERIMENTS – PHYSICS

(A minimum of 5 experiments to be performed from the given list)

1. Determination of Young's modulus of the material of the given beam by Non-uniform bending method.
2. Determination of rigidity modulus of the material of the given wire using torsion pendulum.
3. Determination of wavelength of mercury spectra using Spectrometer and grating.
4. Determination of dispersive power of prism using Spectrometer.
5. (a) Determination of wavelength and particle size using a laser.
   (b) Determination of numerical aperture and acceptance angle of an optical fibre.
   (c) Determination of width of the groove of compact disc using laser.
6. Determination of Young's modulus of the material of the given beam by uniform bending method.
7. Determination of energy band gap of the semiconductor.
8. Determination of coefficient of thermal conductivity of the given bad conductor using Lee's disc.

DEMONSTRATION EXPERIMENT

1. Determination of thickness of a thin sheet / wire – Air wedge method

LIST OF EXPERIMENTS - CHEMISTRY

(A minimum of 6 experiments to be performed from the given list)

1. Estimation of HCl using Na2CO3 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. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
10. Conductometric titration of strong acid vs strong base.

DEMONSTRATION EXPERIMENTS

1. Estimation of iron content of the water sample using spectrophotometer (1,10- Phenanthroline / thiocyanate method).
2. Estimation of sodium and potassium present in water using flame photometer.

COURSE OUTCOMES **Upon completion of the course, the students should be**	
CO1	Able to understand the concept about the basic properties of matter like stress, strain and types of moduli. Able to understand the procedure to estimate the amount of dissolved oxygen present in the water.
CO2	Able to understand the concept of optics like reflection, refraction, diffraction by using spectrometer grating. Able to understand the concept about measuring the conductance of strong acid and strong base and mixture of acids by using conductivity meter.
CO3	Able to understand the thermal properties of solids and to calculate thermal conductivity of a bad conductor. Able to understand the principle and procedure involved in the amount of chloride present in the given sample of water.
CO4	Able to understand the concept of microscope and its applications in determining the moduli. Able to understand the concept of determining the emf values by using potentiometer.
CO5	Able to calculate the particle size of poly crystalline solids. Able to understand the concept of determining the pH value and strength of a given acid sample by using pH meter.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	2	2	1	1	1	3	2	2	3	2	1	2
CO2	3	1	2	1	1	1	1	1	2	1	1	2	2	1	2
CO3	3	1	2	1	2	2	2	1	2	1	1	1	2	1	2
CO4	3	2	1	1	2	1	1	1	2	1	1	2	2	2	1
CO5	3	2	1	1	1	2	2	1	2	1	2	1	2	2	1

HS1201	PROFESSIONAL ENGLISH	L	T	P	C
	(Common for 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 specialization.

UNIT I	INTRODUCTION TO PROFESSIONAL ENGLISH	9
Listening: Listening to technical talks with comprehension tasks - Speaking – conversation methods in real life occurrences using expressions of different emotions and imperative usages - Reading – reading short technical texts from journals- newspapers- Writing- purpose statements – extended definitions – writing instructions – checklists-recommendations- Vocabulary Development- technical vocabulary Language Development – tenses- subject verb agreement - compound words.		**CO1**

UNIT II	READING AND STUDY SKILLS	9
Listening-Listening Comprehension of a discussion on a technical topic of common interest by three or four participants (real life as well as online videos). -Speaking – describing a process- Reading: Practice in chunking and speed reading - Paragraphing- Writing- interpreting charts, graphs- Vocabulary Development: Important foreign expressions in Use, homonyms, homophones, homographs- easily confused words Language Development- impersonal passive voice, numerical adjectives.		**CO2**

UNIT III	TECHNICAL WRITING AND GRAMMAR	9
Listening – listening to conversation – effective use of words and their sound aspects, stress, intonation & pronunciation - Speaking – mechanics of presentations -Reading: Reading longer texts for detailed understanding. (GRE/IELTS practice tests); Writing-Describing a process, use of sequence words- Vocabulary Development- sequence words- Informal vocabulary and formal substitutes-Misspelled words. Language Development- embedded sentences and Ellipsis.		**CO3**

UNIT IV	REPORT WRITING	9
Listening – Model debates & documentaries and making notes. Speaking – expressing agreement/disagreement, assertiveness in expressing opinions-Reading: Technical reports, advertisements and minutes of meeting - 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.		**CO4**

UNIT V	GROUP DISCUSSION AND JOB APPLICATIONS	9
Listening: Extensive Listening. (radio plays, rendering of poems, audio books and others) Speaking –participating in a group discussion - Reading: Extensive Reading (short stories, novels, poetry and others)– Writing reports- minutes of a meeting- accident and survey- Writing a letter/ sending an email to the Editor - cause and effect sentences -Vocabulary Development- verbal analogies. Language Development- reported speech.		**CO5**

TOTAL : 45 PERIODS

TEXT BOOKS

1. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2020.
2. Barun K Mitra, Effective Technical Communication Oxford University Press : 2006.
3. Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

REFERENCE BOOKS

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. Caroline Meyer & Bringi dev, Communicating for Results Oxford University Press: 2021.
7. Aruna Koneru, Professional Speaking Skills, Oxford University Press :2015.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
CO2	Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
CO3	Read different genres of texts adopting various reading strategies.
CO4	Listen/view and comprehend different spoken discourses/excerpts in different accents
CO5	Identify topics and formulate questions for productive inquiry

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	-	-	-	-	-	2	3	-	-	1	-	2
CO2	-	1	-	2	-	-	-	-	-	3	-	-	1	-	2
CO3	-	2	-	3	-	-	-	-	-	2	-	-	1	-	2
CO4	-	-	-	-	-	-	-	-	2	2	-	-	1	-	2
CO5	-	2	1	1	2	-	2	-	-	3	-	-	1	-	2

MA1202	ENGINEERING MATHEMATICS - II	L	T	P	C
(Common for all branches of B.E. / B. Tech Programmes Except AI-DS & AI-ML)		4	0	0	4

OBJECTIVES

- ❖ This course is designed to cover topics such as Differential Equation, Vector Calculus, Complex Analysis and Laplace Transform.
- ❖ The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines

UNIT I	ORDINARY DIFFERENTIAL EQUATIONS	12
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		CO1
UNIT II	**VECTOR CALCULUS**	**12**
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		CO2
UNIT III	**COMPLEX VARIABLES**	**12**
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, $1/Z$ - Bilinear transformation		CO3
UNIT IV	**COMPLEX INTEGRATION**	**12**
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 semi circular contour(excluding poles on the real line)		CO4
UNIT V	**LAPLACE TRANSFORMS**	**12**
Existence conditions – Transforms of elementary functions –Basic properties – Transform of unit step function and unit impulse function - Shifting theorems - transforms of derivatives and integrals –– Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients		CO5
		TOTAL : 60 PERIODS

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

REFERENCE BOOKS

1. G 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. T. Veerarajan. Engineering Mathematics – II, McGraw Hill Education; First edition 2017.

COURSE OUTCOMES

Upon completion of the course,

CO1	The students will be imbibed with techniques in solving ordinary differential equations that arises in most of the engineering problems
CO2	The students will be acquainted with the concepts of vector calculus like Gradient, Divergence, Curl, Directional derivative, Irrotational vector and Solenoidal vector. The course gives an understanding of Vector integration, needed for problems in all engineering disciplines.
CO3	The students will develop an understanding of the standard techniques of complex variable and mapping so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.
CO4	The student will be exposed to the concept of Cauchy's integral theorem, Taylor and Laurent expansions, Singular points, Application of residue theorem to evaluate complex integrals.
CO5	Students will understand the purpose of using transforms to create new domain which can give easier ways to handle the problem that is being investigated.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1	0	0	0	0	1	2	2	1	2
CO2	3	3	3	1	1	1	0	0	0	0	2	1	1	1	1
CO3	3	3	3	2	1	1	0	1	0	0	1	1	2	1	2
CO4	3	3	3	1	0	0	0	0	0	0	1	0	1	2	2
CO5	3	3	3	1	0	0	0	0	0	0	1	0	2	1	1

PH1252	PHYSICS FOR CIVIL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- 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.		**CO1**

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 absorptions-absorbing materials-noise and its measurements, sound insulation and its measurements, impact of noise in multi-storeyed buildings.		**CO2**

UNIT III	LIGHTING DESIGNS	9
Radiation quantities–spectral quantities– photometry: cosines law, inverse square law. Vision–photobic, mesophic, scotopic visions - Vision Defects (near-sightedness, farsightedness, Presbyobia, astigmatism, higher order defects(aberrations)) - Colour–luminous efficiency function- Visual field glare, colour- day light calculations-daylight design of windows, measurement of day-light and use of models and artificial skies, principles of artificial lighting, supplementary artificial lighting – lighting for different buildings.		**CO3**

UNIT IV	NEW ENGINEERING MATERIALS	9
Composites- definition and classification-Fibre reinforced plastics (FRP) and fibre 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- Polymer nanocomposites in construction.		**CO4**

UNIT V	HAZARDS	9
Seismology and Seismic waves-Earth quake ground motion-Basic concepts and estimation techniques- site effects- Cyclone and flood hazards-Fire hazards and fire protection, fire-proofing of materials, fire safety regulations and firefighting equipment –Prevention and safety measures - Disaster Management: Fundamental concept of Disaster Management, government, NGOs and peoples participation disaster management		**CO5**

TOTAL : 45 PERIODS

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.

REFERENCE BOOKS

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.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Knowledge on the thermal performance of buildings,
CO2	Knowledge on the acoustic properties of buildings,
CO3	Knowledge on various lighting designs for buildings,
CO4	Knowledge on the properties and performance of engineering materials,
CO5	Knowledge on the hazards of buildings and disaster management.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	2	3	3	3	3	3	1	-	2
CO2	3	3	3	3	2	3	2	3	2	2	3	2	1	-	2
CO3	3	3	3	3	3	2	2	3	3	3	2	3	1	-	2
CO4	3	2	2	2	2	2	3	2	2	3	3	3	1	-	2
CO5	2	2	3	3	2	3	2	3	3	3	3	3	1	-	2

GE1204	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
(Common for all branches of B.E. / B. Tech Programmes)		3	0	0	3

OBJECTIVES

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

UNIT I	ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY	9

Definition, scope and importance of environment – Need for public awareness – Role of Individual in Environmental protection – Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Food chains, food webs and ecological pyramids – Ecological succession – Types, characteristic features, structure and function of forest, grass land, desert and aquatic (ponds, lakes, rivers, oceans, estuaries) ecosystem. Biodiversity – Definition – Genetic, species and ecosystem diversity – 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 wild life, human-wildlife conflicts – Wildlife protection act and forest conservation act –Endangered and endemic species – Conservation of biodiversity – In-situ and ex–situ conservation of biodiversity. **CO1**

UNIT II	ENVIRONMENTAL POLLUTION	9

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management: causes, effects and control measures of municipal solid wastes – Problems of e-waste – Role of an individual in prevention of pollution – Pollution case studies – Disaster management – Floods, earthquake, cyclone, tsunami and landslides – Field study of local polluted site – Urban / Rural / Industrial / Agricultural. **CO2**

UNIT III	NATURAL RESOURCES	9

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, floods, drought, conflicts over 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 – 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 – Field study of local area to document environmental assets – River / Forest / Grassland / Hill / Mountain. **CO3**

UNIT IV	SOCIAL ISSUES AND THE ENVIRONMENT	9
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 – Climate change – Global warming – Acid rain, Ozone layer depletion –Nuclear accidents and holocaust – Case studies – Wasteland reclamation – Consumerism and waste products – Principles of Green Chemistry – Environment protection act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife protection Act – Forest conservation act – Enforcement machinery involved in environmental legislation– Central and state pollution control boards– National Green Tribunal – Public awareness.		**CO4**
UNIT V	**HUMAN POPULATION AND THE ENVIRONMENT**	**9**
Population growth – Variation among nations – Population explosion – Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – COVID 19 – Women and child welfare – Role of information technology in environment and human health – Case studies.		**CO5**
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2014).
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, (2004).
3. Dr. A. Sheik Mideen and S.Izzat Fathima, "Environmental Science and Engineering", Airwalk Publications, Chennai, (2018).

REFERENCE BOOKS

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, (2007).
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press (I) Pvt, Ltd, Hydrabad, (2015).
3. G. Tyler Miller,Scott E. Spoolman, "Environmental Science", Cengage Learning India Pvt.Ltd,Delhi, (2014).
4. R. Rajagopalan, 'Environmental Studies-From Crisis to Cure', Oxford University Press, (2005).
5. Anubha Kaushik , C.P. Kaushik, "Perspectives in Environmental Studies", New Age International Pvt. Ltd, New Delhi, (2004).
6. Frank R. Spellman, "Handbook of Environmental Engineering", CRC Press, (2015).

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Obtain knowledge about environment, ecosystems and biodiversity.
CO2	Take measures to control environmental pollution.
CO3	Gain knowledge about natural resources and energy sources.
CO4	Find and implement scientific, technological, economic and political solutions to environmental problems.
CO5	Understand the impact of environment on human population.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	3	3	3	2	2	2	3	3	1	1
CO2	3	2	3	3	2	3	3	3	3	2	2	3	2	1	3
CO3	3	3	2	2	3	3	2	2	1	2	1	3	1	2	1
CO4	3	3	3	3	1	2	3	3	2	2	2	2	2	3	3
CO5	3	2	3	2	3	3	3	2	2	2	2	3	1	2	1

BE1253	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To explain the basic laws used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics.
- To impart knowledge of communication.

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.		**CO1**
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.		**CO2**
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.		**CO3**
UNIT IV	**DIGITAL ELECTRONICS**	**9**
Binary Number System – Boolean Algebra theorems– Logic Gates, Digital circuits – Combinational circuits- Half adder, Full Adder, Half Subtractor, Full Subtractor, Multiplexer/ Demultiplexer, Introduction to sequential Circuits– Flip-Flops – Registers and Counters.		**CO4**
UNIT V	**FUNDAMENTALS OF COMMUNICATION ENGINEERING**	**9**
Introduction – Elements of Communication Systems– Need for Modulation, Principles of Amplitude and Frequency Modulations- Communication Systems: TV, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).		**CO5**
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Mittle N., “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
2. Sedha R.S., “Applied Electronics”, S. Chand & Co., 2006.

REFERENCE BOOKS

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, 2006.
2. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press 2005.
3. Mehta V K, “Principles of Electronics”, S.Chand & Company Ltd, 1994.
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, 2002.
5. Premkumar N, “Basic Electrical Engineering”, Anuradha Publishers, 2003.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Ability to understand the basic laws used in Electrical circuits and principle of measuring Instruments.
CO2	Ability to identify the electrical components explain the characteristics of electrical machines.
CO3	Ability to identify semiconductor devices and its applications.
CO4	Understand the design principles of digital electronics circuits.
CO5	Able to impart the knowledge of various communication systems.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	1	1	1	1	1	1	1	3	2	2
CO2	3	3	1	1	1	1	1	1	1	1	1	2	3	2	2
CO3	3	3	3	1	3	3	2	1	2	2	3	3	3	2	2
CO4	3	3	3	2	1	2	2	2	2	2	3	3	3	2	2
CO5	3	3	2	1	2	1	1	1	1	2	2	3	3	2	2

GE1206	ENGINEERING MECHANICS	L	T	P	C
	(Common to Civil and Mechanical Engineering)	3	1	0	4

OBJECTIVES

- To develop capacity to predict the effect of force.
- To develop motion in the course of carrying out the design functions of Engineering.

UNIT I	STATICS OF PARTICLES	9+3
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.		CO1
UNIT II	**EQUILIBRIUM OF RIGID BODIES**	**9+3**
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.		CO2
UNIT III	**PROPERTIES OF SURFACES AND SOLIDS**	**9+3**
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.		CO3
UNIT IV	**DYNAMICS OF PARTICLES**	**9+3**
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.		CO4
UNIT V	**FRICTION AND RIGID BODY DYNAMICS**	**9+3**
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		CO5
		TOTAL : 45 + 15 PERIODS

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. Vela Murali, "Engineering Mechanics", Oxford University Press(2010).

REFERENCE BOOKS

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 Education2010.
3. Irving H. Shames and Krishna Mohana Rao. G., “Engineering Mechanics – Statics and Dynamics”, 4th Edition, Pearson Education2006.
4. Meriam J.L. and Kraige L.G., “ Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2”, Third Edition, John Wiley &Sons,1993.
5. Rajasekaran S and Sankarasubramanian G., “Engineering Mechanics Statics and Dynamics”, 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	illustrate the vectorial and scalar representation of forces and moments
CO2	analyse the rigid body in equilibrium
CO3	evaluate the properties of surfaces and solids
CO4	calculate dynamic forces exerted in rigid body
CO5	determine the friction and the effects by the laws of friction

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	-	1	2	1	-	2	3	2	2	3	2	-
CO2	3	3	2	-	1	2	1	-	2	3	2	2	3	2	-
CO3	3	3	1	-	1	2	1	-	2	3	2	2	3	2	-
CO4	3	3	1	-	1	2	1	-	2	3	2	2	3	2	-
CO5	3	3	1	-	1	2	1	-	2	3	2	2	3	2	-

GE 1207	ENGINEERING PRACTICES LABORATORY	L	P	T	C
	(Common for all branches of B.E. / B. Tech Programmes)	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

LIST OF EXPERIMENTS

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE **13**

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.

CO1

II MECHANICAL ENGINEERING PRACTICE **18**

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.

CO2

GROUP B (ELECTRICAL & ELECTRONICS)	
III ELECTRICAL ENGINEERING PRACTICE 13 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.	**CO3**
5. Measurement of energy using single phase energy meter. 6. Measurement of resistance to earth of an electrical equipment.	**CO4**
IV ELECTRONICS ENGINEERING PRACTICE 16 1. Study of electronic components and equipment's – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR. 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. Measurement of ripple factor of HWR and FWR.	**CO5**
TOTAL: 60 PERIODS	

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Quantity required
	CIVIL	
1.	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	**15 sets**
2.	Carpentry vice (fitted to work bench)	**15 Nos**
3.	Standard woodworking tools 15 Sets.	**15 Sets.**
4.	Models of industrial trusses, door joints, furniture joints	**5 each**
5.	**Power Tools:** (a) Rotary Hammer (b) Demolition Hammer (c) Circular Saw (d) Planer (e) Hand Drilling Machine (f) Jigsaw	**2 Nos**
	MECHANICAL	
1.	Arc welding transformer with cables and holders.	**5 Nos**
2.	Welding booth with exhaust facility.	**5 Nos**
3.	Welding accessories like welding shield, chipping hammer, wire brush, etc.	**5 Sets**
4.	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	**2 Nos**

5.	Centre lathe.	**2 Nos**
6.	Hearth furnace, anvil and smithy tools.	**2 Sets**
7.	Moulding table, foundry tools.	**2 Sets**
8.	Power Tool: Angle Grinder.	**2 Nos**
9.	**Study-purpose items:** centrifugal pump, air-conditioner.	**1 each**
	ELECTRICAL	
1.	Assorted electrical components for house wiring.	**15 Sets**
2.	Electrical measuring instruments.	**10 Sets**
3.	**Study purpose items:** Iron box, fan and regulator, emergency lamp.	**1 each**
4.	Megger (250V/500V).	**1 No.**
5.	**Power Tools:** (a) Range Finder (b) Digital Live-wire detector	**2 Nos**
	ELECTRONICS	
1.	Soldering guns 10 Nos.	**10 Nos.**
2.	Assorted electronic components for making circuits 50 Nos.	**50 Nos.**
3.	Small PCBs.	**10 Nos.**
4.	Multimeters	**10 Nos.**
5.	**Study purpose items:** Telephone, FM radio, low-voltage power supply	**1 each**

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Fabricate carpentry components and pipe connections including plumbing works. Use welding equipment's to join the structures.
CO2	Carry out the basic machining operations Make the models using sheet metal works
CO3	Carry out basic home electrical works and appliances.
CO4	Measure the electrical quantities
CO5	Elaborate on the components, gates, soldering practices

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	3	-	-	3	-	-	-	-	-	3	1	-	-
CO2	3	2	3	-	-	3	-	-	-	-	-	3	1	-	-
CO3	3	1	2	-	-	2	-	-	-	-	-	3	1	-	-
C04	3	1	3	-	-	3	-	-	-	-	-	3	1	-	-
C05	3	2	2	-	-	2	-	-	-	-	-	3	1	-	-

CE1208	COMPUTER AIDED DRAFTING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To understand the regulations as per National Building Code and to identify the functional requirements of buildings.
- To make the students learn the various elements of Residential / Institutional / Workshop buildings
- To impart fundamental knowledge on AutoCAD software.
- To enable the student to develop the drafting skills in drawing plan, section and elevation of various types of buildings using AutoCAD software as per National Building Code.

LIST OF EXPERIMENTS

1. Introduction to building Components and Their Functions	**CO1**
2. Introduction to CAD (Computer Aided Drafting) software, General commands and their practices.	
3. Elevation and cross section of Partly Panelled and Glazed Window	
4. Elevation and cross section of Framed and Panelled Double Leaf Door	
5. Plan and Sectional Elevation of Dog legged staircase	**CO2**
6. Plan, Section and Elevation of Building with Load Bearing Wall	
7. Plan, Section and Elevation -A Single Bed Room House with R.C.C Roof	
8. Plan, Section and Elevation – Storied residential building with Dog legged staircase	
9. Plan, Section and Elevation of Framed office building	
10. Plan, Section and Elevation of an Industrial building	

TOTAL : 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To Develop drafting skills in drawing building components like Doors, windows and staircase using AutoCAD software
CO2	To Develop drafting skills in drawing plan, section and elevation of various types of buildings using AutoCAD software

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	3	3	3	-	-	2	1	-	3	3	3	2
CO2	3	-	-	3	3	3	-	-	2	1	-	3	3	3	2

MA1301	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
	(Common to CIVIL, EEE, EIE, MECH and BIO)	4	0	0	4

OBJECTIVES

- To introduce the basic concepts of Partial differential equation and to find its solutions.
- To introduce Fourier series analysis which is vital to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques to solve heat and wave flow problems in engineering.
- To familiarize the student with Fourier transform techniques used in solving various practical engineering problems.
- To introduce the effective mathematical tools for the solutions of difference equations that model several physical processes and to develop transform techniques for discrete time systems.

UNIT I	PARTIAL DIFFERENTIAL EQUATIONS	12
Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations (except $f(x^m z^k p, y^n z^k q) = 0$) – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types		CO1
UNIT II	**FOURIER SERIES**	**12**
Dirichlet's conditions -Necessary and sufficient condition for existence of Fourier series – General Fourier series – Odd and even functions – Half range sine series –Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.		CO2
UNIT III	**APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**	**12**
Classification of PDE – Method of separation of variables – Fourier Series Solutions of one-dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.		CO3
UNIT IV	**FOURIER TRANSFORMS**	**12**
Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.		CO4
UNIT V	**Z – TRANSFORMS AND DIFFERENCE EQUATIONS**	**12**
Z-transforms – Elementary properties – Inverse Z-transform (using partial fraction and residues) –Initial and final value theorems – Convolution theorem – Formation of difference equations – Solution of difference equations using Z – transform		CO5
		TOTAL : 60 PERIODS

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
3. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.

REFERENCE BOOKS

1. Dass, H.K., and Er.RajnishVerma, “Higher Engineering Mathematics”, S.Chand Private Ltd.,2011.
2. Peter V.O’Neil, “Advanced Engineering Mathematics”, 7th Edition, Cengage learning,2012
3. James, G., “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, 2012.
4. Ramana. B.V., “Higher Engineering Mathematics”, McGraw Hill Education Pvt. Ltd, New Delhi,2016.
5. Wylie, R.C. and Barrett, L.C., “Advanced Engineering Mathematics “Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand how to solve the partial differential equations and apply these concepts in the field of engineering.
CO2	Learn Fourier series analysis which plays a vital role in the application of electrical engineering, vibration analysis, acoustics, optics, signal and image processing.
CO3	Appreciate the physical significance of Fourier series techniques in solving one and two-dimensional heat flow problems and one-dimensional wave equations and this concept is applied in the fields like elasticity, heat transfer, quantum mechanics and also extensively in physical phenomenon.
CO4	Understand the mathematical principles on transforms and gain the ability to formulate and solve some of the physical problems like designing electrical circuits, signal processing, signal analysis ,image processing etc.
CO5	Learn to use the effective mathematical tools like Z- transform for the solving difference equations in discrete time signals etc.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	1	2	0	2	1	2	0	3	1	1
CO2	3	3	2	2	1	2	1	0	1	0	2	0	3	2	1
CO3	3	3	2	2	0	1	0	0	1	0	2	0	3	1	1
CO4	3	2	1	2	1	0	1	1	0	0	3	0	2	2	2
CO5	3	3	2	2	1	0	1	0	2	1	2	0	3	1	2

CE1302	ENGINEERING GEOLOGY AND CONSTRUCTION MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES

- The students will be able to understand the importance of geological knowledge such as earth, earthquake, volcanism and to apply this knowledge in projects such as dams, tunnels, bridges, roads, airport and harbor.
- To introduce students to various materials commonly used in civil engineering construction and their properties.

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.		CO1
UNIT II	**MINEROLOGY AND PETROLOGY**	**9**
Physical , Chemical and Optical Properties of minerals – Crystal System Physical Properties of Quartz group, Feldspar group, Pyroxene - hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals. Classification of rocks, Introduction to Index and 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 – Test on rocks- Rock Mass Rating (RMR), Rock Quality Designation (RQD), Geological Strength Index (GSI), Q system for rock mass classification.		CO2
UNIT III	**STRUCTURAL GEOLOGY AND APPLICATION OF GEOLOGICAL INVESTIGATIONS**	**9**
Geological maps – Attitude of rocks –Study of Geological Structures – folds, faults and joints – relevance to civil engineering. 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- Tsunami – causes and mitigation. Case studies from India.		CO3
UNIT IV	**CONSTRUCTION MATERIALS**	**9**
Introduction, Types, Properties, Testing and Applications of -Bricks – stones – sand – cement – concrete – steel – timber.		CO4
UNIT V	**MODERN CONSTRUCTION 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.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Venkat Reddy. D. Engineering Geology, Vikas Publishing House Pvt. Lt, 2010.
2. Parbin Singh. A "Text book of Engineering and General Geology", Katson publishing house, Ludhiana 2013.

3. Rajput. R.K., "Engineering Materials", S. Chand and Company Ltd., 2008.
4. Duggal.S.K., "Building Materials", 4th Edition, New Age International, 2008.

REFERENCE BOOKS

1. Blyth F.G.H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2017.
2. Bell .F.G.. "Fundamentals of Engineering Geology", B.S. Publications. Hyderabad 2011.
3. Varghese.P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2012.
4. Gambhir. M.L., & Neha Jamwal., "Building Materials, products, properties and systems", Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 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.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Acquire the knowledge of the topographical formation, interior earth, gradational activities and weathering and also the theory of plate tectonics which answers the reason for the occurrence of earthquake, landslides in an area.
CO2	Interpret the minerals and Rocks & assess its physical, chemical and mechanical properties.
CO3	Determine geological structures, its exploration and its relevance on Civil Engineering Projects.
CO4	Gain knowledge on the properties and tests to be conducted for various construction materials.
CO5	Introduce the knowledge of modern materials

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	2	-	2	-	-	3	-	-	3	3	-	3
CO2	2	-	-	2	-	2	-	-	2	-	-	2	3	-	3
CO3	3	-	2	2	-	2	-	-	3	-	-	3	3	-	3
CO4	3	-	2	1	-	2	-	-	2	-	-	2	2	-	2
CO5	3	-	2	1	-	2	-	-	2	-	-	2	2	-	2

CE1303	STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the fundamental concepts of Stress in simple and complex states.
- To know the mechanism of load transfer in beams and the induced stresses due to simple
- bending and unsymmetrical bending
- To determine the deformation in determinate beams
- To know the basic concepts of analysis of indeterminate beams

UNIT I	SIMPLE AND COMPOUND STRESSES	9
Stresses in simple and compound bars – Thermal stresses – Elastic constants - Thin cylindrical and spherical shells – Biaxial state of stress – Principal stresses and principal planes – Mohr's circle of stresses - Torsion on circular shafts.		CO1
UNIT II	**BENDING OF BEAMS**	**9**
Types of beams and transverse loadings– Shear force and bending moment for Simply supported, cantilever and over-hanging beams - Theory of simple bending – Bending stress distribution –Shear stress distribution		CO2
UNIT III	**DEFLECTION OF BEAMS**	**9**
Double Integration method – Macaulay's method – Area moment method – Conjugate beam method - Strain energy method for determinate beams.		CO3
UNIT IV	**INDETERMINATE BEAMS**	**9**
Propped Cantilever and Fixed Beams – Fixed end moments reactions, slope and deflection for standard cases of loading –– Continuous beams – support reactions and moments – Theorem of three moments – Shear Force and Bending Moment Diagrams.		CO4
UNIT V	**UNSYMMETRICAL BENDING AND THEORIES OF FAILURE**	**9**
Unsymmetrical bending of beams - shear centre - Thick cylinders - Theories of failure – Principal stress, principal strain, shear stress, strain energy and distortion energy theories – application problems.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Vazirani.V.N, Ratwani.M.M, Duggal .S.K Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1, Khanna Publishers, New Delhi 2014.
2. Rajput.R.K. Strength of Materials, S.Chand& Company Ltd., New Delhi 2014.

REFERENCE BOOKS

1. Irwing H.Shames, James M.Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 2002
2. Beer. F.P. &Johnston.E.R."Mechanics of Materials", Tata McGraw Hill, Sixth Edition, New Delhi 2010.
3. James M.Gere., Mechanics of Materials, Thomas Canada Ltd., Canada, 2006.
4. Egor. P.Popov, Engineering Mechanics of Solids, Prentice Hall of India, Second Edition New Delhi 2015.

COURSE OUTCOMES

Upon completion of the course, students will be able to	
CO1	Understand the concepts of stress and strain, principal stresses and principal planes.
CO2	Determine Shear force and bending moment in beams and understand concept of theory of simple bending.
CO3	Calculate the deflection of beams by different methods and selection of method for determining slope or deflection.
CO4	Analyze propped cantilever, fixed beams and continuous beams for external loadings and support settlements.
CO5	Determine the stresses due to Unsymmetrical bending of beams, locate the shear center, and study the various theories of failure

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	3	3	-	1	1	-	-	2	3	3
CO2	-	2	-	2	2	3	-	-	-	-	-	-	3	2	2
CO3	-	3	3	3	2	3	-	-	-	-	2	-	2	3	3
CO4	-	3	2	2	2	-	-	2	-	-	2	1	2	2	1
CO5	-	-	3	3	-	-	-	2	-	-	2	1	2	2	1

CE1304	CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart knowledge to the students on the properties of materials for concrete by suitable tests, mix design for concrete and special concretes

UNIT I	CONSTITUENT MATERIALS	9
Cement - Different types - Chemical composition and Properties – Hydration of cement - Tests on cement - IS Specifications - Aggregates – Classification - Mechanical properties and tests as per BIS - Grading requirements – Water - Quality of water for use in concrete.		CO1
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 - Effects on concrete properties.		CO2
UNIT III	**FRESH AND HARDENED PROPERTIES OF CONCRETE**	**9**
Workability - Tests for workability of concrete - Segregation and Bleeding - Determination of strength Properties of Hardened concrete - Compressive strength – split tensile strength - Flexural strength - Stress-strain curve for concrete - Modulus of elasticity – durability of concrete – water absorption – permeability – corrosion test – acid resistance.		CO3
UNIT IV	**CONCRETE MIX DESIGN**	**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 – ACI Method of Mix Design - Mix Design Examples		CO4
UNIT V	**SPECIAL CONCRETES**	**9**
Light weight concretes - foam concrete- self compacting concrete – vacuum concrete - High strength concrete - Fibre reinforced concrete – Ferrocement - Ready mix concrete – SIFCON - Shotcrete – Polymer concrete - High performance concrete - Geopolymer Concrete		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003
3. Bhavikatti.S.S, " Concrete Technology", I.K.International Publishing House Pvt. Ltd., New Delhi, 2015
4. Santhakumar. A.R., "Concrete Technology", Oxford University Press India, 2006.

REFERENCE BOOKS

1. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London, 1995
2. Gambhir, M.L; "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2007
3. IS10262-2009 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998.
4. Job Thomas, "Concrete Technology", Cengage Learning India Pvt. Ltd., Delhi, 2015
5. Kumar P Mehta., Paulo J M Monterio., "Concrete - Microstructure, Properties and Materials", McGraw Hill Education (India) Private Limited, New Delhi, 2016.

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	The various requirements of cement, aggregates and water for making concrete
CO2	The effect of admixtures on properties of concrete
CO3	The properties of concrete at fresh and hardened state
CO4	The concept and procedure of mix design as per IS method
CO5	The importance and application of special concretes.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	2	1	-	3	3	3	1	-	1	3	1	2	1
CO2	2	1	3	1	-	3	3	3	1	-	1	3	3	3	3
CO3	2	1	3	1	1	2	3	3	1	-	1	3	2	2	1
CO4	2	1	3	1	-	2	3	3	1	-	1	3	2	2	2
CO5	2	1	1	1	1	3	3	3	1	-	1	3	2	2	3

CE1305	FLUID MECHANICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the basic concepts of fluid statics, kinematics and dynamics and enable them to solve practical problems.
- To study about flow through pipes and pipe networks and boundary layer concepts.
- To understand the application of Dimensional analysis in similitude and model study with respect to engineering problems.

UNIT I	FLUID PROPERTIES AND STATICS	10
Scope of fluid mechanics - Definitions of a fluid - Methods of analysis – Continuum hypothesis - System and Control volume approach – Fluid properties - Fluid statics – Manometry (Simple manometer, Piezometer, U-tube manometer, Differential Manometer: U-Tube Differential manometer, Inverted U-tube differential Manometer) – Forces on plane and curved surfaces - Buoyancy and floatation - Stability of floating bodies.		CO1
UNIT II	**BASIC CONCEPTS OF FLUID FLOW**	**10**
Kinematics - Classification of flows - Streamline, streak-line and path-lines - Stream function and velocity potentials - Flow nets; Dynamics - Application of control volume to continuity, energy and momentum - Euler's equation of motion along a stream line - Bernoulli's equation - Applications to velocity and discharge measurements - Linear momentum equation – Application to Pipe bends - Moment-of momentum equation.		CO2
UNIT III	**DIMENSIONAL ANALYSIS AND MODEL STUDIES**	**7**
Fundamental dimensions - Dimensional homogeneity - Rayleigh's method and Buckingham Pi theorem - Dimensionless parameters - Similitude and model studies - Distorted and undistorted models.		CO3
UNIT IV	**INCOMPRESSIBLE VISCOUS FLOW**	**10**
Reynolds experiment - Laminar flow in pipes and between parallel plates - Development of laminar and turbulent flows in pipes - Darcy-Weisbach equation - Moody diagram - Major and minor losses of flow in pipes - Pipes in series and parallel – Equivalent pipes.		CO4
UNIT V	**BOUNDARY LAYERS**	**9**
Definition of boundary layers - Laminar and turbulent boundary layers - Displacement, momentum and energy thickness - Momentum integral equation - Applications.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Streeter, V.L. Wylie, E. B. and Bedford K.W, Fluid Mechanics. (9th Ed.) Tata McGraw Hill, New Delhi, 2002.
2. Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House New Delhi. 2003 (22nd edition, 2019)

REFERENCE BOOKS

1. Bansal R K, "Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi, 2018.
2. Rajput, R K, "A text book of Fluid Mechanics", S Chand & Co., New Delhi, 2007(Reprint 2019).
3. Subramanya, K, "Fluid Mechanics and Hydraulic Machines Problems and Solutions" Tata McGraw Hill Publishing Company Ltd, New Delhi, 2010.

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Demonstrate the difference between solid and fluid, its properties and behaviour in static conditions.
CO2	Apply the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.
CO3	Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies.
CO4	Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel.
CO5	Explain the concept of boundary layer and its application to find the drag force excreted by the fluid on the flat solid surface.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	3	3	3	-	-	2	1	-	3	3	3	3
CO2	3	-	-	3	3	3	-	-	2	1	-	3	3	3	3
CO3	3	-	-	3	3	3	-	-	2	1	-	3	3	3	3
CO4	3	-	-	3	3	3	-	-	2	1	-	3	3	3	3
CO5	3	-	-	3	3	3	-	-	2	1	-	3	3	3	3

CE1306	SURVEYING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the fundamentals and various methods of plane and geodetic surveying for solve the real world problems.
- To introduce the concepts of Control Surveying.
- The student is also exposed to the Modern Surveying.
- To learn the various applications of Civil Engineering Surveys.

UNIT - I	FUNDAMENTALS OF CONVENTIONAL SURVEYING	9
Classifications and basic principles of surveying – Equipment and accessories for ranging and chaining – Basic principles Compass surveying - Plane Table Surveying accessories and methods - Levels and staves - Methods of levelling - Booking - Reduction – Curvature and refraction correction – Contouring.		**CO1**
UNIT - II	**THEODOLITE SURVEYING AND COMPUTATIONS**	**9**
Horizontal and vertical angle measurements by Theodolite – Heights and distances– Tacheometric surveying – Trigonometric levelling - Computation of cross sectional areas and volumes – Earthwork calculations - Mass haul diagrams.		**CO2**
UNIT - III	**CONTROL SURVEYING AND ADJUSTMENT**	**9**
Horizontal and vertical control- Methods – Triangulation - Traversing - Gale‘s table - Trilateration - Concepts of measurements and errors – error propagation and linearization – adjustment methods – least square methods – angles, lengths and levelling network.		**CO3**
UNIT - IV	**ROUTE AND HYDROGRAPHIC SURVEYING**	**9**
Route Surveying - Reconnaissance - Route surveys for highways, railways and waterways - Simple curves – Compound and reverse curves – Transition curves - Setting out different methods of simple curve - Vertical curves - Hydrographic surveying – Tides - MSL - Sounding methods - Three-point problem – Determination of depth and position using multi-beam sounder and GPS		**CO4**
UNIT - V	**MODERN SURVEYING**	**9**
Total Station: Digital Theodolite, EDM, Electronic field book - Advantages – Parts and accessories - working principle – Observables – Errors - COGO functions – Field procedure and applications. GPS: Advantages - System components – Signal structure – Selective availability and Anti-spoofing – receiver components and antenna – Planning and data acquisition – Data processing - Errors in GPS – Field procedure and applications.		**CO5**
		TOTAL : 45 PERIODS

TEXT BOOKS

1. T.P. Kanetkar and S.V.Kulkarni, Surveying and Levelling, Parts1 & 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. S.S.Bhavikatti, Surveying Theory and Practice, I.K.International Publishing House Pvt. Ltd, New Delhi, 2010

REFERENCE BOOKS

1. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.

2. James M.Anderson and Edward M. Mikhail, Surveying Theory and Practice, Tata McGraw Hill Education Private Limited, New Delhi, 2012
3. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004
4. S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice‘ Hall of India 2004
5. K.R. Arora, Surveying Vol I & II, Standard Book house , Twelfth Edition. 2013

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Introduce the rudiments of various surveying and its principles.
CO2	Imparts concepts of Theodolite Surveying and computation of area and volume calculation.
CO3	Understand the procedure for establishing horizontal and vertical control and its adjustment procedure.
CO4	Initiate the knowledge in Route surveying, Hydrographic surveying
CO5	Introduce the basics of Electronic Surveying

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	1	2	2	1	1	2	1	1	1	1	2	2
CO2	3	2	2	1	2	2	1	1	2	1	1	1	2	2	2
CO3	3	2	1	1	3	1	1	1	1	1	1	2	2	1	2
CO4	1	2	2	1	3	2	1	1	2	1	1	2	3	3	2
CO5	3	2	2	1	3	2	1	1	3	1	1	2	2	2	1

CE1307	STRENGTH OF MATERIALS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To make the students understand the mechanical properties of materials when subjected to different types of loading viz., tension, compression, torsion and bending.
- To know the impact strength and the hardness number of the given material.

EXERCISES

1. Tension test on mild steel & RTS rods.
2. Torsion test on metals.
3. Hardness Test on metals.
   - Rockwell Hardness Test
   - Brinell Harness Test
4. Compression test on helical spring.
5. Double shear Test on metal.
6. Impact test on metal specimen.
   - Izod Test
   - Charpy Test
7. Deflection test on metal beam.
8. Compression test on wood.

TOTAL : 45 PERIODS

REFERENCE BOOKS

1. Bansal, R.K., “A Text Book of Strength of Materials”, Laxmi Publications (P) Ltd., New Delhi, 2010.
2. IS1786-2008 (Fourth Revision, Reaffirmed 2013), ‘High strength deformed bars and wires for concrete reinforcement – Specification’, 2008.
3. James M. Gere and Stephen P. Timoshenko, “Mechanics of Materials, (3rd edition), McGraw Hill Book Company, Singapore, 2002.
4. Rattan SS, “Strength of Material”, McGraw Hill Educational Private Limited, India, 2011.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	Description of Equipment	Quantity
1	UTM of minimum 400 kN capacity	1
2	Torsion testing machine	1
3	Hardness testing machine (Rockwell and Brinell)	1 (Each)

4	Impact testing machine	1
5	Beam deflection test apparatus	1
6	Extensometer	1
7	Compressometer	1
8	Dial gauges	Few

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Acquire required knowledge on torsion and tension test on mild steel rod.
CO2	Acquire required knowledge on hardness of different metals.
CO3	Acquire required knowledge on stiffness characteristics of open and closed coil spring.
CO4	Acquire required knowledge about double shear test on metal and impact test on metal.
CO5	Acquire required knowledge on compressive strength of wood and deflection characteristics on steel beam.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	3	-	2	-	1	2	-	-	3	3	3	-
CO2	3	2	-	3	-	2	-	1	2	-	-	3	3	3	-
CO3	3	2	-	3	-	2	-	1	2	-	-	3	3	3	-
CO4	3	2	-	3	-	2	-	1	2	-	-	3	3	3	-
CO5	3	2	-	3	-	2	-	1	2	-	-	3	3	3	-

CE1308	SURVEYING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To familiarize with the various surveying instruments and methods.

EXERCISES

1. Finding Pace Value of Surveyor using Chaining and Ranging.
2. Mapping of Building with cross staff and without cross staff using Offset.
3. Mapping and Area Calculation by using Chain Surveying.
4. Setting out works – Foundation marking using tapes single Room and Double Room.
5. Computation of Included Angle after adjustment of Local Attraction.
6. Mapping and Area Calculation by using Compass Surveying.
7. Plane Table Surveying (Radiation and Intersection Method)
8. Fly leveling using dumpy level.
9. Transfer of Bench Mark using Check Levelling.
10. Observation of Angles by method of Repetition.
11. Observation of Angles by method of Reiteration.
12. Determination of elevation of an object using single plane method when base is accessible.
13. Determination of elevation of an object using single plane method when base is inaccessible.
14. Determination of Tacheometric Constants.
15. Heights and distances by stadia Tacheometry.
16. Heights and distances by Tangential Tacheometry.

TOTAL : 45 PERIODS

REFERENCE BOOKS

1. T.P.Kanetkar and S.V.Kulkarni, Surveying and Levelling, Parts1 & 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, Tata McGraw Hill Education Private Limited, New Delhi, 2012
4. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No	Description of Equipment	Quantity
1	Chain	6
2	Cross Staff	6
3	Ranging rod	6
4	Metal arrows	6
5	Metallic tape	6
6	Prismatic Compass with stand	3
7	Surveyor Compass with stand	1

8	Dumpy level with aluminum stand and accessories	6	
9	Aluminum Leveling staff	6	
10	Theodolite with aluminum stand and accessories	6	

COURSE OUTCOMES

Upon completion of the course, students will be

CO1	Use conventional surveying tools such as chain/tape, compass, plane table in the field of civil engineering applications.
CO2	Prepare planimetric map
CO3	Gain knowledge on Height determination by levelling
CO4	Imparts knowledge in computation of Distance and Elevation using horizontal and vertical angles
CO5	Establish horizontal and vertical control points.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	3	1	-	-	-	-	-	1	2	1	-	2
CO2	3	3	1	3	-	1	-	-	-	1	-	3	1	-	2
CO3	3	1	1	3	1	-	-	-	-	-	1	2	1	-	2
CO4	3	1	1	3	1	-	-	-	-	-	1	2	1	-	2
CO5	3	3	1	3	-	1	-	-	-	1	-	3	1	-	2

MA1455	NUMERICAL METHODS	L	T	P	C
		4	0	0	4

OBJECTIVES

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life
- To acquaint the student with understanding of numerical techniques of differentiation and
- integration this plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations

UNIT I	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	12
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 - Eigenvalues of a matrix by Power method.		CO1
UNIT II	**INTERPOLATION AND APPROXIMATION**	**12**
Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton's forward and backward difference formulae.		CO2
UNIT III	**NUMERICAL DIFFERENTIATION ANDINTEGRATION**	**12**
Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule and 3/8 rule – Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.		CO3
UNIT IV	**INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS**	**12**
Single step methods - Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations-Multistep methods-Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.		CO4
UNIT V	**BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS**	**12**
Finite difference methods for solving second order two - point linear boundary value problems – Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.		CO5
		TOTAL : 60 PERIODS

TEXT BOOKS

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 10th Edition, Cengage Learning, 2017.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi,2015.

REFERENCE BOOKS

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia,New

Delhi,2007.

2. Gerald. C. F. and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia,7th Edition, New Delhi, 2007.
3. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2nd Edition, Prentice Hall,1992.
4. Sankara Rao.K.,"Numerical Methods for Scientists and Engineers", PrenticeHallofIndiaPvt. Ltd, 4th Edition, New Delhi,2018.
5. Sastry, S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5th Edition, 2015.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Solve algebraic, transcendental equation and system of linear equations compute eigenvalues numerically.
CO2	Interpolate using standard methods like finite difference methods and cubic splines
CO3	Apply Numerical differentiation and integration for the observed data
CO4	Have an insight of finding the numerical solution of first order differential equation by Standard single step methods and multi-step methods.
CO5	Understand the finite difference solution of second order ordinary differential equation and get the solution of the standard engineering partial differential equation by explicit method and implicit method

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	2	2	1	0	0	0	0	0	2	2	1	1
CO2	3	2	3	1	2	1	0	0	0	0	1	2	1	2	0
CO3	3	2	2	1	2	1	0	0	0	0	1	2	2	1	1
CO4	3	3	3	2	2	1	0	0	0	0	0	2	1	2	1
CO5	3	3	2	1	2	1	0	0	0	0	0	2	2	1	0

CE1402	WATER SUPPLY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To equip the students with the principles and design of water treatment and distribution

UNIT I	SOURCES OF WATER	9
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.		CO1
UNIT II	**CONVEYANCE FROM THE SOURCE**	**9**
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.		CO2
UNIT III	**WATER TREATMENT**	**9**
Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, flash mixers, Coagulation and flocculation –Clarifloccuator- - sedimentation - filtration - Disinfection – Ground water treatment – aerators, Iron and Manganese removal – Hardness - Softening - Residue Management – Construction, Operation and Maintenance aspects.		CO3
UNIT IV	**ADVANCED WATER TREATMENT**	**9**
Adsorption - Desalination - R.O. Plant – demineralization – Adsorption - Ion exchange– Membrane Systems – RO Reject Management - Iron and Manganese removal - Defluoridation - Construction and Operation & Maintenance aspects – Recent advances.		CO4
UNIT V	**WATER DISTRIBUTION AND SUPPLY**	**9**
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.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Garg, S.K. Environmental Engineering, Vol.IKhanna 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, 2014.

REFERENCE BOOKS

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.

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Create an insight into the structure of drinking water supply systems, including water transport, treatment and distribution
CO2	Attain the knowledge in various unit operations and processes in water treatment
CO3	To design the various functional units in water treatment
CO4	To understand water quality criteria and standards, and their relation to public health
CO5	To design and evaluate water supply project alternatives on basis of chosen criteria

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	1	1	1	3	-	-	2	-	-	-	1	-	1
CO2	-	-	1	1	1	2	-	-	1	-	-	-	1	-	1
CO3	-	-	3	1	1	3	-	-	3	-	-	-	3	-	2
CO4	-	-	1	1	1	1	-	-	1	-	-	-	1	-	1
CO5	-	-	3	1	1	1	-	-	1	-	-	-	3	-	1

CE1403	HIGHWAY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To give an overview on the basics of highway engineering and to impart the various process and methods involved in the planning, development, design, construction and Maintenance of highways.

UNIT - I	HIGHWAY PLANNING AND ALIGNMENT	9
History of road development in India – Classification of highways – Institutions for Highway planning, design and construction at different levels – factors influencing highway alignment – Road ecology - Engineering surveys for alignment, objectives, conventional and modern methods.		CO1
UNIT - II	**GEOMETRIC DESIGN OF HIGHWAYS**	**9**
Typical cross sections of Urban and Rural roads –– Cross sectional elements – Horizontal curves, super elevation, transition curves, widening of curves – Sight distances – Vertical curves, gradients, hairpin bends – Lateral and vertical clearance at underpasses – IRC standards-Road signs and safety. Urban utility services.		CO2
UNIT - III	**DESIGN OF FLEXIBLE AND RIGID PAVEMENTS**	**9**
Design principles – pavement components and their role - Design practice for flexible and rigid pavements (IRC methods only).		CO3
UNIT - IV	**HIGHWAY MATERIALS, CONSTRUCTION AND MAINTENANCE**	**9**
Highway construction materials, properties, testing methods – Construction practice of flexible and concrete pavements including modern materials and methods, Highway drainage – Special considerations for hilly roads; Evaluation and Maintenance of pavements.		CO4
UNIT - V	**HIGHWAY ECONOMICS AND FINANCE**	**9**
Introduction, Highway User Benefits, Highway Costs, Vehicle Operation Costs, Economic analysis, Highway projects under Public-Private Sector Participation, Bidding process, Highway finance.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Veeraragavan. A, Khanna.K and Justo.C.E.G. Highway Engineering, Nem Chand & Bros Publishers, 2014
2. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering,Scitech Publications (India), Chennai, 2010
3. C.Venkatramaiah., Transportation Engineering-Highway Engineering, Universities Press (India) Private Limited, Hyderabad, 2015
4. Subhash C Saxena, Textbook of Highway and Traffic Engineering. CBS Publishers, 2017.
5. R.Srinivasa Kumar., Textbook of Highway Engineering Universities Press (India) Private Limited, Hyderabad, 2011

REFERENCE BOOKS

1. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHI Learning Pvt. Ltd., 2005
2. Kadiyali. L. R. Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi, 1997.

3. Indian Road Congress (IRC), Guidelines and Special Publications on Planning and Design of Highways.
4. Sharma.S.K Principles , Practices and Design of Highway Engineering, S.Chand and Company Ltd.1995

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the concepts and standards adopted in Planning, Design and construction of Highways and its related infrastructures.
CO2	Apply the knowledge of science and engineering fundamentals in designing the geometrics for an efficient Highway network and design concepts.
CO3	Designing various types of pavements to meet specified needs of safety, efficiency and long-time sustainability by adopting various design standards.
CO4	Select appropriate methods for construction, evaluation and maintenance of roadways.
CO5	Understand the bidding processes and types of highway projects and analyze the economic, financial aspects of the highway projects

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	2	2	3	1	3	1	1	1	1	3	2	2
CO2	3	2	3	1	1	1	1	1	1	1	1	2	3	3	2
CO3	2	3	3	2	2	1	2	3	2	1	2	3	3	3	2
CO4	2	3	2	2	2	3	3	3	1	1	3	3	3	3	3
CO5	1	2	1	1	2	3	1	3	2	1	3	3	2	2	3

CE1404	APPLIED HYDRAULIC ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the concept of open channel flow characteristics.
- To understand the concept of hydraulic jumps and surges.
- To study the concepts of turbo machinery.

UNIT I	UNIFORM FLOW	10
Definition and differences between pipe flow and open channel flow - Types of Flow – Properties of open channel - Fundamental equations - Sub-critical, Super-critical and Critical flow – Velocity distribution in open channel - Steady uniform flow: Chezy equation, Manning equation – Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.		CO1
UNIT II	**VARIED FLOW**	**9**
Dynamic equations of gradually varied - Water surface flow profile classifications: Hydraulic Slope, Hydraulic Curve - Profile determination by Numerical method: Direct step method and Standard step method – Change in Grades.		CO2
UNIT III	**RAPIDLY VARIED FLOWS**	**8**
Application of the momentum equation for RVF - Hydraulic jumps - Types – Energy dissipation – Positive and Negative surges.		CO3
UNIT IV	**TURBINES**	**9**
Turbines - Classification - Impulse turbine – Pelton wheel - Reaction turbines – Francis turbine - Kaplan turbine - Draft tube - Cavitation - Performance of turbine - Specific speed - Runaway speed.		CO4
UNIT V	**PUMPS**	**9**
Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitations in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip – Indicator diagrams and its variations - Air vessels - Savings in work done.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Modi, P.N, and Seth S.M.," Hydraulic and Fluid Mechanics", Standard Book House, 2012.
2. Jain A. K. "Fluid Mechanics including Hydraulic Machines", Khanna Publishers, 1998.

REFERENCE BOOKS

1. Ven Te Chow, Open Channel Hydraulics, McGraw Hill, New York, 2009.
2. Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2000.
3. Chandramouli P N, Applied Hydraulic Engineering, Yes Dee Publisher, 2017

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Describe the basics of open channel flows, its classifications and analysis of uniform flow in steady state conditions with specific energy concept and its application
CO2	Analyse steady gradually varied flow, water surface profiles and its length calculation using direct and standard step methods with change in water surface profiles due to change in grades.

CO3	Derive the relationship among the sequent depths of steady rapidly varied flow and estimating energy loss in hydraulic jump with exposure to positive and negative surges.
CO4	Design turbines and explain the working principle
CO5	Differentiate pumps and explain the working principle with characteristic curves and design centrifugal and reciprocating pumps.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	1	2	2	2	2	1	1	3	1	2	2
CO2	3	3	2	3	2	2	2	2	2	1	1	3	1	2	2
CO3	3	3	2	3	1	2	2	2	2	1	1	3	1	2	3
CO4	3	3	2	3	1	2	2	2	2	1	1	3	1	2	3
CO5	3	3	2	3	1	2	2	2	2	1	1	3	1	2	3

CE1405	STRUCTURAL ANALYSIS – I	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the students classical methods such that Slope deflection and Moment distribution method in analysing indeterminate structures.
- To introduce the students matrix methods such as Flexibility method and stiffness method in analysing indeterminate structures.

UNIT I	STRAIN ENERGY METHOD	9
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).		CO1
UNIT II	**SLOPE DEFLECTION METHOD**	**9**
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.		CO2
UNIT III	**MOMENT DISTRIBUTION METHOD**	**9**
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.		CO3
UNIT IV	**FLEXIBLITY METHOD**	**9**
Primary structures - Compatibility conditions – Formation flexibility matrices - Analysis of indeterminate pin- jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach.		CO4
UNIT V	**STIFFNESS METHOD**	**9**
Restrained structure –Formation of stiffness matrices - equilibrium condition - Analysis of Continuous Beams, Pin-jointed plane frames and rigid frames by direct stiffness method.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Bhavikatti, S.S,Structural Analysis,Vol.1,& 2, Vikas Publishing House Pvt.Ltd., NewDelhi-4,2014.
2. Bhavikatti, S.S, Matrix Method of Structural Analysis, I. K. International Publishing House Pvt.Ltd.,New Delhi-4, 2014.
3. Vazrani.V.N And Ratwani, M.M, Analysis of Structures, Vol.II, Khanna Publishers, 2015.
4. Pandit G.S.and Gupta S.P., Structural Analysis–A Matrix Approach, Tata McGraw Hill Publishing Company Ltd.,2006

REFERENCE BOOKS

1. Punmia. B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi, 2004.
2. Hibbeler, R.C., Structural Analysis, VII Edition, Prentice Hall, 2012.
3. Reddy.C.S,“Basic Structural Analysis”, Tata McGraw Hill Publishing Company,2005.
4. Rajasekaran.S, &G.Sankarasubramanian., “Computational Structural Mechanics”, PHI
5. Learning Pvt. Ltd, 2015

6. Negi L.S.and Jangid R.S.,Structural Analysis, Tata McGraw Hill Publishing Co.Ltd.2004.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Analyse the continuous beams, pin-jointed indeterminate plane frames and rigid plane frames by strain energy method
CO2	Analyse the continuous beams and rigid frames by slope defection method
CO3	Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.
CO4	Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method.
CO5	Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	1	1	-	-	2	3	1	2	3	2	2
CO2	3	3	3	2	1	1	-	-	2	3	1	2	3	2	2
CO3	3	2	1	2	1	1	-	-	2	3	1	2	3	2	2
CO4	3	3	2	2	1	1	-	-	2	3	1	2	3	2	2
CO5	3	3	2	2	1	1	-	-	2	3	1	2	3	2	2

CE1406	GEOTECHNICAL ENGINEERING - I	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification.
- To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils.
- To impart knowledge of design of both finite and infinite slopes.

UNIT I	SOIL CLASSIFICATION AND COMPACTION	9
History – formation and types of soil – composition - Index properties – clay mineralogy structural arrangement of grains – description – Classification – BIS – US – Phase relationship – Compaction – theory – laboratory and field technology – field Compaction method – factors influencing compaction.		CO1
UNIT II	**EFFECTIVE STRESS AND PERMEABILITY**	**9**
Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena– Permeability interaction – Hydraulic conductivity – Darcy's law – Determination of Hydraulic Conductivity – 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's equation – Introduction to flow nets – Simple problems. (Sheet pile and Wier)		CO2
UNIT III	**STRESS DISTRIBUTION AND SETTLEMENT**	**9**
Stress distribution in homogeneous and isotropic medium – Boussinesq theory – (Point load, Line load and UDL) - Use of New marks influence chart –Components of settlement — Immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – Computation of rate of settlement. - √t and log t methods– e-log p relationship- consolidation settlement calculation - Normally Consolidated clays – Over Consolidated clays.		CO3
UNIT IV	**SHEAR STRENGTH OF SOIL**	**9**
Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – Measurement of shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Cyclic mobility – Liquefaction.		CO4
UNIT V	**SLOPE STABILITY**	**9**
Stability Analysis - Infinite slopes and finite slopes – Total stress analysis for saturated clay – Friction circle method – Use of stability number – Method of slices – Fellenius and Bishop's method - Slope protection measures.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2015
2. Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Ltd. International Publisher New Delhi (India) 2006
3. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 2005

REFERENCE BOOKS

1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2006

2. Coduto, D.P., “Geotechnical Engineering – Principles and Practices”, Prentice Hall of India Pvt.Ltd. New Delhi, 2010
3. Das, B.M., “Principles of Geotechnical Engineering”. Brooks / Coles / Thompson Learning Singapore, 8th Edition, 2013
4. Arora, K.R., “Soil Mechanics and Foundation Engineering”, Standard Publishers and Distributors, New Delhi, 7th Edition, 2017(Reprint)
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
8. Venkatramaiah.C., “Geotechnical Engineering”, New Age International Pvt. Ltd., New Delhi, 2017

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Demonstrate an ability to identify various types of soils and its properties, familiarize with compaction, formulate and solve engineering Problems
CO2	Show the basic understanding of flow through soil medium and its impact of engineering solution
CO3	Understand about the basic concept of stress distribution in loaded soil medium and soil settlement due to consolidation
CO4	Show the understanding of shear strength of soils and its impact of engineering solutions to the loaded soil medium and also will be aware of contemporary issues on shear strength of soils, and
CO5	Demonstrate an ability to design both finite and infinite slopes, component and process as per needs and specifications.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	1	1	2	1	2	3	2	1	3
CO2	3	3	2	2	2	1	1	1	2	1	2	3	2	1	3
CO3	3	3	2	2	2	1	1	1	2	1	2	3	2	1	3
CO4	3	3	2	2	2	1	1	1	2	1	2	3	2	1	3
CO5	3	3	2	2	2	1	1	1	2	1	2	3	2	1	3

CE1407	ADVANCED SURVEYING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To familiarize with the various surveying instruments and methods in field.
- To impart Hands on experience of basics of Total Station.
- To impart Hands on experience of basics of GPS.
- To acquire practical knowledge in the field of Remote Sensing
- To impart Hands on experience of basics of cartography and GIS.

EXERCISES

1. Contour Mapping using Grid Levelling.
2. Contour Mapping using Radial Levelling.
3. Longitudinal and Cross Sectional Levelling- Cut and fill volume calculation.
4. Curve Setting By Deflection Angle Method and Two theodolite method.
5. Traverse Using Total Station.
6. Use of GPS to determine latitude and longitude.
7. Traverse Using GPS.
8. Preparation of Base Map from Survey of India Topo sheets
9. Data Input – Onscreen Digitisation – Creation of Point, Line and Polygon layers
10. Projection, Reprojection and Coordinate Transformation of Maps
11. Preparation of Land use/land cover map using Satellite Data.
12. Attribute data input and Measurement of Distance, Area
13. Data Conversion – Vector to Raster and Raster to Vector

TOTAL : 45 PERIODS

REFERENCE BOOKS

1. J. Uren and W.F. Price, Surveying for Engineers, Palgrave macmillan, Fifth Edition, 2010.
2. Dr.B.C.Punmia, Ashok K.Jain and Arun K Jain, Surveying Vol.I & II, Lakshmi Publications Pvt Ltd, New Delhi,17th Edition,2016.
3. W. Schofield and M. Breach, Elesevier, Engineering Surveying, Sixth Edition, 2007.
4. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
5. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004
6. S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice‘ Hall of India 2004
7. K.R. Arora, Surveying Vol I & II, Standard Book house , Eleventh Edition. 2013
8. T.P.Kanetkar and S.V.Kulkarni, Surveying and Levelling, Parts1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 24th Reprint,2015.
9. Lillesand T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, VI edition of John Wiley & Sons-2015.
10. John R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective, 4th Edition, 2015.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No	Description of Equipment	Quantity
1	Dumpy level with aluminum stand and accessories	6
2	Aluminum Leveling staff	6
3	Theodolite with aluminum stand and accessories	6
4	Theodolite with aluminum stand and accessories	3
5	Hand Held GPS	3
6	Open Source GIS	-

COURSE OUTCOMES

Upon completion of the course, students will be

CO1	To prepare a Contour map using various methods.
CO2	To establish horizontal and vertical control points using Total Station
CO3	To establish horizontal and vertical control points using GPS.
CO4	To input the data in the GIS and prepare the Map Layout Design process.
CO5	To understand the concepts of Map Projection in GIS.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	3	1	1	1	1	1	1	1	2	2	1	3
CO2	3	3	1	3	2	1	1	1	1	1	1	3	2	1	3
CO3	3	1	1	3	1	1	1	1	1	1	1	2	2	1	3
CO4	3	1	1	3	1	1	1	1	1	1	1	2	2	1	3
CO5	3	3	1	3	2	1	1	1	1	1	1	3	2	1	3

CE1408	HYDRAULIC ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To provide hands on experience in calibration of flow meters, performance characteristics of pumps and turbines.

EXERCISES

A. MEASUREMENT OF FLOW PROPERTY

1. Determination of coefficient of discharge of orifice.
2. Flow measurement in pipe using orificemeter
3. Flow measurement in pipe using venturimeter
4. Flow measurement in open channel using notches
5. Verification of Bernoulli's theorem

B. MEASUREMENT OF LOSSES IN PIPES

6. Determination of minor losses in pipes
7. Determination of frictional loss in pipes

C. DETERMINATION OF METACENTRIC HEIGHT

8. Determination of metacentric height of a floating body

D. TURBINE CHARACTERISTICS

9. Performance test on Pelton wheel turbine
10. Performance test on Francis turbine
11. Study of impact of jet on vanes

E. PUMP CHARACTERISTICS

12. Performance test on multi-stage centrifugal pump
13. Performance test on reciprocating pump
14. Performance test on submersible pump.

TOTAL : 45 PERIODS

REFERENCE BOOKS

1. Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2015.
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Book House. New Delhi, 2017.
3. Subramanya K, Fluid Mechanics and Hydraulic Machines, Tata McGraw Hill Edu. Pvt. Ltd, 2011

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No	Description of Equipment	Quantity
1	Closed Circuit Bernoulli's theorem – Verification Apparatus	1 No
2	Closed Circuit Flow through Notch Apparatus	1 No
3	Closed Circuit Hydraulic Flume	1 No
4	Closed Circuit Flow through Orifice & Mouth Piece Apparatus	1 No

5	Closed Circuit Apparatus for Determination of Losses in pipeline due to sudden contraction, Enlargement Bends and Elbow	1 No
6	Variable Speed Reciprocating Pump	1 No
7	Constant Speed Centrifugal Pump	1 No
8	Triple Closed Circuit Gear Oil Pump test rig	1 No
9	Triple Open Circuit Deep Well Submergible Pump-Test Rig	1 No
10	Triple Open Circuit Pelton Wheel Turbine Test Rig	1 No
11	Triple Open Circuit Francis Turbine Test Rig	1 No
12	Triple Open Circuit Kaplan Turbine Test Rig	1 No
13	Pipe Friction Apparatus	1 No
14	Orificemeter	1 No
15	Venturimeter	1 No
16	Rotameter	1 No
17	Pitot Tube Test Setup	1 No
18	Triple Apparatus for determination of Metacentric Height	1 No

COURSE OUTCOMES

Upon completion of the course, students will be

CO1	Apply Bernoulli equation for calibration of flow measuring devices.
CO2	Measure friction factor in pipes and compare with Moody diagram
CO3	Determine the performance characteristics of rotodynamic pumps.
CO4	Determine the performance characteristics of positive displacement pumps.
CO5	Determine the performance characteristics of turbines.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	3	1	2	2	2	2	1	1	2	2	1	1
CO2	3	2	1	3	1	2	2	2	2	1	1	2	3	1	1
CO3	3	3	2	3	1	2	2	2	3	1	1	2	3	2	1
CO4	3	3	2	3	1	2	2	2	3	1	1	2	3	2	1
CO5	3	3	2	3	1	2	2	2	3	1	1	2	3	2	1

HS1410	PROFESSIONAL SKILLS LAB	L	T	P	C
	(Common to AI & DS, CIVIL, CHEMICAL , CSE, EEE & EIE)	0	0	2	1

OBJECTIVES

- ❖ Enhance the Employability and Career Skills of students
- ❖ Orient the students towards grooming as a professional
- ❖ Make them Employable Graduates
- ❖ Develop their confidence and help them attend interviews successfully.

LIST OF EXPERIMENTS

UNIT I	**6**
Introduction to Soft Skills- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Making an Oral Presentation–Planning and preparing a model presentation; Organizing the presentation to suit the audience and context; Connecting with the audience during presentation; Projecting a positive image while speaking; Emphasis on effective body language-General awareness of Current Affairs.	**CO1**
UNIT II	**6**
Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice—– Making a Power Point Presentation -- Structure and format; Covering elements of an effective presentation; Body language dynamics. Making an Oral Presentation–Planning and preparing a model presentation; Organizing the presentation to suit the audience and context; Connecting with the audience during presentation; Projecting a positive image while speaking; Emphasis on effective body language	**CO2**
UNIT III	**6**
Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -– questioning and clarifying –GD strategies- Structure and dynamics of a GD; Techniques of effective participation in group discussion; Preparing for group discussion; Accepting others' views / ideas; Arguing against others' views or ideas, etc	**CO3**
UNIT IV	**6**
Basics of public speaking; Preparing for a speech; Features of a good speech; Speaking with a microphone. (Famous speeches may be played as model speeches for learning the art of public speaking). Interview etiquette – dress code – body language – attending job interviews–telephone/skype interview -one to one interview &panel interview –Job Interviews: purpose and process; How to prepare for an interview; Language and style to be used in an interview; Types of interview questions and how to answer them.	**CO4**
UNIT V	**6**
Recognizing differences between groups and teams- managing time managing stress-networking professionally- respecting social protocols understanding career management-developing a long- term career plan making career changes	**CO5**
TOTAL : 30 PERIODS	

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

1. One Server
2. 30 Desktop Computers
3. One Hand Mike

4. One LCD Projector

REFERENCE BOOKS

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
4. S. Hariharan et al. Soft Skills. MJP Publishers: Chennai, 2010
5. Interact English Lab Manual for Undergraduate Students, Orient BalckSwan: Hyderabad, 2016.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Make effective presentations
CO2	Participate confidently in Group Discussions
CO3	Attend job interviews and be successful in them.
CO4	Develop adequate Soft Skills required for the workplace
CO5	Develop their speaking skills to enable them speak fluently in real contexts

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	0	2	0	2	1	0	0	0	2	3	0	0	1	0	3
CO2	0	2	0	2	0	0	0	0	2	3	0	0	1	0	3
CO3	0	0	0	0	0	0	0	0	2	2	0	0	1	0	2
CO4	0	0	0	0	0	0	0	0	2	2	0	2	1	0	2
CO5	0	2	1	1	2	0	2	0	2	3	0	2	1	0	2

CE1501	STRUCTURAL ANALYSIS – II	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the method of drawing influence lines and its uses in various applications like beams and plane trusses.
- To analyse the arches and suspension bridges.
- Also to learn Plastic analysis of beams and rigid frames.

UNIT I	INFLUENCE LINES FOR DETERMINATE BEAMS	9
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 plane frames.		CO1
UNIT II	**INFLUENCE LINES FOR INDETERMINATE BEAMS**	**9**
Muller Breslau's principle– Influence line for Shearing force, Bending Moment and support reaction components of propped cantilever, continuous beams (Redundancy restricted to one), and fixed beams.		CO2
UNIT III	**ARCHES**	**9**
Arches - Types of arches – Analysis of three hinged, two hinged and fixed arches - Parabolic and circular arches – Settlement and temperature effects.		CO3
UNIT IV	**CABLES AND SUSPENSION BRIDGES**	**9**
Equilibrium of cable – length of cable - anchorage of suspension cables – stiffening girders - cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders.		CO4
UNIT V	**PLASTIC ANALYSIS**	**9**
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.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Bhavikatti,S.S, Structural Analysis,Vol.1 & 2, Vikas Publishing House Pvt.Ltd.,New Delhi - 4, 2014.
2. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, Theory of structures, Laxmi, Publications, 2004.
3. Vazrani.V.N and Ratwani,M.M, Analysis of Structures, Vol.II, Khanna Publishers, 2015.

REFERENCE BOOKS

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, PHIL earning Pvt. Ltd.,2011.
4. Prakash Rao D.S., Structural Analysis, Universities Press, 1996.

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	To understand the method of drawing influence lines and its uses in various applications in statically determinate beams and pin jointed plane frames
CO2	To understand the method of drawing influence lines and its uses in various applications in statically indeterminate beams
CO3	To understand the various forms of arches and the methods of analysis of the types of arches
CO4	To have the knowledge on advanced methods of analysis of structures including cable and suspension bridges
CO5	To analyse and design various indeterminate beams and frames by plastic analysis

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	2	2	1	1	3	2	-	2	3	2	2
CO2	3	3	3	2	2	2	1	1	3	2	-	2	3	2	2
CO3	3	3	3	2	2	2	1	1	3	2	-	2	3	2	2
CO4	3	3	3	2	2	2	1	1	3	2	-	2	3	2	2
CO5	3	3	3	2	2	2	1	1	3	2	-	2	3	2	2

CE1502	GEOTECHNICAL ENGINEERING II	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart knowledge to plan and execute a detail site investigation programme, to select geotechnical design parameters and type of foundations. Also, to familiarize the students for the geotechnical design of different type of foundations and retaining walls.

UNIT I	SITE INVESTIGATION AND SELECTION OF FOUNDATION	9
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 - Selection of foundation based on soil condition- Bore log report.		CO1
UNIT II	**SHALLOW FOUNDATION**	**9**
Introduction – 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.		CO2
UNIT III	**FOOTINGS AND RAFTS**	**9**
Types of Isolated footing, Combined footing, Mat foundation – Contact pressure and settlement distribution – Proportioning of foundations for conventional rigid behaviour – Minimum depth for rigid behaviour – Applications – Floating foundation – Special foundations – Seismic force consideration – Codal provision		CO3
UNIT IV	**DEEP FOUNDATION**	**9**
Deep foundation- Basics of Caisson and Well Foundation-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 Hiley's) – Capacity from insitu tests (SPT, SCPT) – Negative skin friction – Uplift capacity- Group capacity by different methods (Feld's rule, Converse – Labarre 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 – Codal provision.		CO4
UNIT V	**RETAINING WALLS**	**9**
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 Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls – Codal provision.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributers Ltd., New Delhi, 2015.
2. Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", New Age International

(P) Ltd, New Delhi,2006.

3. Punmia, B.C., “Soil Mechanics and Foundations”, Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition 2017.

REFERENCE BOOKS

1. Arora, K.R., “Soil Mechanics and Foundation Engineering”, Standard Publishers and Distributors, New Delhi, 7th Edition, 2017 (Reprint).
2. Das, B.M. “Principles of Foundation Engineering” (Eigth edition), Thompson Asia Pvt. Ltd., Singapore, 2013.
3. Kaniraj, S.R. “Design aids in Soil Mechanics and Foundation Engineering”, Tata McGraw Hill publishing company Ltd., New Delhi, 2002.
4. Varghese, P.C.,”Foundation Engineering”, Prentice Hall of India Private Limited, New Delhi, 2005.
5. Joseph E bowles, “Foundation Analysis and design”, McGraw Hill Education, 5th Edition, 28th August 2015.
6. Relevant IS Codes

COURSE OUTCOMES

Upon completion of the course, students will be

CO1	Planning and executing a detailed site investigation to select geotechnical design parameters and type of foundation
CO2	Gaining knowledge on bearing capacity of soil and testing methods for settlement in shallow foundation
CO3	Designing combined footings and raft foundations, its component or process as per the needs and specifications
CO4	Designing deep foundations, determining the load carrying capacity and settlement of pile foundation
CO5	Determining earth pressure on retaining walls and analysis for stability

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	2	1	1	1	1	2	3	2	1	3
CO2	3	3	3	3	1	2	1	1	1	1	2	3	2	1	3
CO3	3	3	3	3	1	2	1	1	1	1	2	3	2	1	3
CO4	3	3	3	3	1	2	1	1	1	1	2	3	2	1	3
CO5	3	3	3	3	1	2	1	1	1	1	2	3	2	1	3

CE1503	RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the students about planning, design, construction and maintenance and design principles of Railways, Airport and Harbour.

UNIT I	RAILWAY PLANNING	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.		CO1
UNIT II	**RAILWAY CONSTRUCTION AND MAINTENANCE**	**8**
Earthwork – Stabilization of track on poor soil - Tunneling Methods, drainage and ventilation – Calculation of Materials required for track laying - Construction and maintenance of tracks – Signalling - Railway Station and yards and passenger amenities		CO2
UNIT III	**AIRPORT PLANNING**	**9**
Air transport characteristics-airport classification-air port planning: objectives, components, layout characteristics, socio-economic characteristics of the Catchment area, airport site selection-Orientation of Runways and correction factors as ICAO stipulations, typical Airport Layouts, parking and Circulation Area.		CO3
UNIT IV	**AIRPORT DESIGN**	**9**
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.		CO4
UNIT V	**HARBOUR ENGINEERING**	**9**
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		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering, Scitech Publications (India), Chennai, 2010
2. C.Venkatramaiah., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels.,Universities Press (India) Private Limited, Hyderabad, 2015.
3. Vazirani.V.N and Chandola.S.P, “Transportation Engineering-Vol.II”, Khanna Publishers,New Delhi, 2015.
4. Mundrey J S, Railway Track Engineering, McGraw Hill Education (India) Private Ltd, NewDelhi, 2013.

REFERENCE BOOKS

1. Saxena Subhash, C.and Satyapal Arora, ACourse in Railway Engineering, Dhanapat Rai and Sons, Delhi, 1998
2. Khanna.S.K. Arora.M.G and Jain.S.S, Airport Planning and Design, Nemachand and Bros, Roorkee, 1994

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Understand the concepts and elements in Planning, Design and construction of Railways.
CO2	Select appropriate methods for construction and maintenance of Railway tracks and other infrastructures
CO3	Understand the concepts and elements in Planning and selection of site for Airport.
CO4	Design the Runway length and evaluate the orientation of runways
CO5	Understand the terminologies, infrastructures in Harbour Engineering and Coastal regulations.

MAPPING OF COs WITH POs AND PSOs

Cos	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	1	3	3	-	-	-	3	2	2
CO2	-	-	3	-	2	2	-	-	-	-	-	2	3	3	3
CO3	-	3	3	2	3	-	-	-	3	2	1	2	3	3	2
CO4	3	3	-	2	2	2	-	3	1	2	-	2	2	2	3
CO5	3	2	3	3	-	-	-	-	-	2	1	-	3	3	3

CE1504	WASTEWATER ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- The objectives of this course is to help students develop the ability to apply basic understanding of physical, chemical, and biological phenomena for successful design, operation and maintenance of sewage treatment plants.

UNIT I	PLANNING AND DESIGN OF SEWERAGE SYSTEMS	9
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 - Rain Water harvesting.		**CO1**
UNIT II	**PRIMARY TREATMENT OF SEWAGE**	**9**
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.		**CO2**
UNIT III	**SECONDARY TREATMENT OF SEWAGE**	**9**
Objectives – Selection of Treatment Methods – Principles, Functions, - 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.		**CO3**
UNIT IV	**DISPOSAL OF SEWAGE**	**9**
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.		**CO4**
UNIT V	**SLUDGE TREATMENT AND DISPOSAL**	**9**
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.		**CO5**
		TOTAL : 45 PERIODS

TEXT BOOKS

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

REFERENCE BOOKS

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

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand on the characteristics and composition of sewage, ability to estimate sewage generation and design sewer system including sewage pumping stations
CO2	Select type of treatment system and able to perform basic design of the unit operations that are used in sewage treatment. knowledge of septic tank design
CO3	Gain knowledge of selection of treatment process and biological treatment process
CO4	Acquire knowledge of advance treatment technology and reuse of sewage
CO5	Understand the, self-purification of streams and sludge and septage disposal methods.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	2	2	-	1	1	3	2	3	3	1	-	3	3
CO2	3	-	3	2	2	3	-	3	2	3	-	2	3	3	3
CO3	3	2	3	2	-	2	-	1	2	3	-	2	3	2	3
CO4	2	-	3	2	3	-	-	1	2	3	2	3	3	2	3
CO5	2	3	3	2	2	-	-	3	3	3	2	3	3	3	3

CE1505	DESIGN OF REINFORCED CONCRETE ELEMENTS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the different types of philosophies related to design of basic structural elements such as slab, beam, column and footing which form part of any structural system with reference to Indian standard code of practice.

UNIT I	DESIGN CONCEPTS AND DESIGN OF BEAMS FOR FLEXURE	9
Design concepts - Concept of elastic method, ultimate load method and limit state method– Advantages of Limit State method over other methods –Design of rectangular beam section by working stress method – Limit state method of design of singly reinforced, doubly reinforced and flanged beams - use of design aids for flexure		CO1
UNIT II	**LIMIT STATE DESIGN OF BEAMS FOR SHEAR, TORSION AND SERVICEABILITY**	**9**
Limit state design of RC beams for shear and torsion - Design of RC beams for combined bending, shear and torsion – Use of design aids - Design requirement for bond and anchorage as per IS code – Detailing of reinforcement – Concept of Serviceability - Serviceability requirements for deflection.		CO2
UNIT III	**LIMIT STATE DESIGN OF SLABS AND STAIRCASE**	**9**
Behaviour of one way and two way slabs - Design of one way simply supported, cantilever and Continuous slabs - Design of two-way slabs for various edge conditions - Torsion reinforcement at corners - Design of flat slabs - Types of staircases - Design of dog-legged staircase.		CO3
UNIT IV	**LIMIT STATE DESIGN OF COLUMNS**	**9**
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		CO4
UNIT V	**LIMIT STATE DESIGN OF FOOTINGS**	**9**
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.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. B.C. Punmia. Ashok K. Jain and Arun K. Jain, Limit State design of Reinforced Concrete, Laxmi Publications (P) Ltd., New Delhi, 2016.
2. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India Pvt Limited, 2017

REFERENCE BOOKS

1. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design (Third Edition), Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2017.
2. N. Subramanian, Design of Reinforced Concrete Structures, Oxford University Press, New Delhi, 2014.
3. P.C. Varghese, Limit State Design of Reinforced Concrete, Prentice Hall of India, Pvt. Ltd., New Delhi, Second Edition, 2008.

4. S.N. Sinha, Reinforced Concrete Design, Tata McGraw-Hill, New Delhi, 2002

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Explain the various design concepts and design a beam under flexure and draw the reinforcement details.
CO2	Design the beam under shear and torsion, Calculate the anchorage and development length and check the serviceability requirements for RC structural elements.
CO3	Design a RC slab and staircase and draw the reinforcement details.
CO4	Design columns for axial, uniaxial and biaxial eccentric loadings.
CO5	Design of footing by limit state method.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	-	3	1	1	3	3	3	3	3	3	3
CO2	3	3	2	3	-	3	1	1	3	3	3	3	3	3	3
CO3	3	3	2	3	-	3	1	1	3	3	3	3	3	3	3
CO4	3	3	2	3	-	3	1	1	3	3	3	3	3	3	3
CO5	3	3	2	3	-	3	1	1	3	3	3	3	3	3	3

CE1507	ENVIRONMENTAL ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- This subject includes the list of experiments to be conducted for characterization of water and municipal sewage. At the end of the course, the student is expected to be aware of the procedure for quantifying quality parameters for water and sewage.

EXERCISES

1. Determination of pH by using pH Meter
2. Determination of Turbidity using Turbidity Meter
3. Determination of Conductivity
4. Determination of Total Hardness
5. Determination of Alkalinity and Acidity
6. Determination of Chlorides
7. Determination of Sulphates
8. Determination of Iron and fluoride
9. Determination of Available Chlorine in bleaching powder
10. Determination of Residual chlorine
11. Determination of MPN index of given water sample
12. Coagulation and Precipitation process for treating wastewater
13. Determination of Phosphates
14. Determination of suspended, Volatile, Fixed and Settleable solids in wastewater
15. Determination of Dissolved Oxygen for the given sample
16. Determination Chemical Oxygen Demand in Wastewater
17. Determination of BOD for the given sample
18. Determination of SVI of Biological sludge and microscopic examination
19. Determination of Concentration of Metal ions using Flame Photometer (Study)
20. Determination of various elements using Atomic Absorption Spectroscopy (Study).

TOTAL : 60 PERIODS

REFERENCE BOOKS

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
5. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers,New Delhi, 2015

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No	Description of Equipment	Quantity
1	Turbidity Meter	1
2	Flame Photometer	1

3	COD Digeter	1
4	Jar Test Apparatus	2
5	Dissolved Oxygen Meter	1
6	Atomic Absorption Spectroscopy	1
7	BOD Analyser	1
8	Ion Selective Electrode-Fluoride, Calcium, Nitrate	1
9	UV-Spectrophotometer	1
10	Gas Chromotography NETEL Model:9100	1

COURSE OUTCOMES

Upon completion of the course, students will be

CO1	Quantify the pollutant concentration in water and wastewater
CO2	Suggest the type of treatment required and amount of dosage required for the treatment
CO3	Examine the conditions for the growth of micro-organisms
CO4	Suggest the type of treatment required to reduce e-coli in water
CO5	Compare the analysis of treated water among different treatments

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	3	-	3	-	-	1	-	-	1	-	-	3	-	2
CO2	-	1	-	1	-	-	3	-	-	1	-	-	1	-	3
CO3	-	3	-	3	-	-	1	-	-	1	-	-	3	-	3
CO4	-	1	-	1	-	-	3	-	-	1	-	-	1	-	3
CO5	-	1	-	1	-	-	1	-	-	1	-	-	1	-	3

CE1508	SOIL MECHANICS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To develop skills for testing the index and engineering properties of soil
- To characterize and classify the soil based on its properties

EXERCISES

1. DETERMINATION OF INDEX PROPERTIES

a. Specific gravity of soil

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

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

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 in 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

TOTAL : 45 PERIODS

REFERENCE BOOKS

1. Soil Engineering Laboratory Instruction Manual" published by Engineering College Co-operative Society, Anna University, Chennai, 2010.
2. Saibaba Reddy, E. Ramasastri, K. "Measurement of Engineering Properties of Soils", New age International (P) limited publishers, New Delhi, 2008.
3. Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1951. Digitized 2008.
4. IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of Indian Standards, New Delhi.
5. Braja M.Das., "Soil Mechanics: Laboratory Manual", Oxford University Press, eighth edition, 2012.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No	Description of Equipment	Quantity
1	Density Bottles	3
2	Sieves	2 sets
3	Hydrometer	2 sets
4	Liquid and Plastic limit apparatus	2 sets
5	Shrinkage limit apparatus	3 sets
6	Proctor Compaction apparatus	2 sets
7	UTM of minimum of 20kN capacity	1
8	Direct Shear apparatus	1
9	Thermometer	2
10	Sand replacement method accessories	2
11	Core cutter method accessories	2
12	Tri-axial Shear apparatus	1
13	Three Gang Consolidation test device	1
14	Relative Density apparatus	1
15	Vane Shear apparatus	1
16	Weighing machine – 10 kg capacity	1
17	Weighing machine – 1kg capacity	1
18	Constant Head Permeability apparatus accessories	1 set
19	Falling Head Permeability apparatus accessories	1 set
20	California Bearing Ratio Testing Machine & accessories	1 set

COURSE OUTCOMES

Upon completion of the course, students will be

CO1	Conducting tests to determine the index properties of soils (coarse and fine)
CO2	Classifying soil based on index properties of soils (coarse and fine)
CO3	Determining the insitu density and compaction characteristics
CO4	Conducting tests to determine the compressibility, permeability and shear strength of soils, and
CO5	Characterizing the soil based on its properties

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	3	1	-	-	-	-	-	1	2	2	-	3
CO2	3	3	1	3	-	1	-	-	-	1	-	3	2	-	3
CO3	3	1	1	3	1	-	-	-	-	-	1	2	2	-	3
CO4	3	1	1	3	1	-	-	-	-	-	1	2	2	-	3
CO5	3	3	1	3	-	1	-	-	-	1	-	3	2	-	3

CE1601	IRRIGATION ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the needs and mode of irrigation.
- To study about minimizing water losses and on farm development works.
- To learn the concepts involved in elementary hydraulic design of different structures and its maintenance.
- To learn about Irrigation water management.

UNIT I	PRINCIPLES OF IRRIGATION	9
Need for irrigation – Advantages and ill effects – Development of irrigation – National Water Policy – Tamil Nadu scenario - Physical properties of soil that influence soil moisture characteristics – Concept of soil water potential and its components - Retention of water in soils - Concept of available water – Movement of water into and within the soils – Measurement of soil moisture content.		CO1
UNIT II	**CROP WATER REQUIREMENT**	**9**
Necessity and importance– Crop and crop seasons in India –Duty, Delta, Base Period– Factors affecting Duty-Irrigation efficiencies– Consumptive use of water-Irrigation requirements of crops - Standards for irrigation water		CO2
UNIT III	**DIVERSION AND IMPOUNDING STRUCTURES**	**9**
Head works –Weirs and Barrages –Types of impounding structures - Factors affecting, location of dams -Forces on a dam -Design of Gravity dams; Earth dams, Arch dams – Spillways - Energy dissipaters		CO3
UNIT IV	**CANAL IRRIGATION**	**9**
Classification of canals- Alignment of canals – Design of irrigation canals– Regime theories - Canal Head works – Canal regulators - Canal drops – Cross drainage works – Canal Outlets, Escapes –Lining and maintenance of canals – Other methods of Irrigation: Surface, Subsurface – Merits and Demerits.		CO4
UNIT V	**IRRIGATION WATER MANAGEMENT**	**9**
Modernization techniques – Rehabilitation – Command Area Development - Systems of rice intensification - Water delivery systems - Participatory Irrigation Management – Farmers' organization and turn over – Water users' associations - Economic aspects of irrigation.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Sharma, R.K., and Sharma, T.K., "Irrigation Engineering", S. Chand and Company, New Delhi, 2008.
2. Garg, S.K., "Irrigation Engineering," Laxmi Publications, New Delhi, 2008.

REFERENCE BOOKS

1. Arora, K.R., "Irrigation, Water Power and Water Resources Engineering", Standard Publishers Distributors, New Delhi, 2009.
2. Basak, N.N., "Irrigation Engineering", Tata McGraw-Hill Publishing Co, New Delhi, 2008.
3. Punmia, B.C., "Irrigation and Water Power Engineering", Laxmi Publishers, New Delhi, 2008.

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Describe the national water policy structure and soil plant water characteristics
CO2	Describe the basics of requirements and estimation of crop water
CO3	Design the various types of hydraulic structure includes dams, spillways and dissipaters
CO4	Design the components of irrigation canal includes canal drops and cross
CO5	Apply the concepts of Irrigation water management, water user association for participatory irrigation management

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	2		2	-	3	-	3	-	2	3	2	-
CO2	-	1	3	-	2	-	-	3	2	-	2	2	3	3	-
CO3	3	3	-	3		3	-	-	-	-	3	-	3	3	2
CO4	3	3	-	-	-	3	-	-	-	-	3	-	3	3	2
CO5	-	1	-	2	2	3	-	1	3	3	3	-	3	2	2

CE1602	CONSTRUCTION MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To make the students to learn about planning of construction projects, scheduling procedures and techniques, cost and quality control projects and use of project information as decision making tool.

UNIT I	CONSTRUCTION PLANNING	9
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.		CO1
UNIT II	**SCHEDULING PROCEDURES AND TECHNIQUES**	**9**
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 precedence's -Use of Advanced Scheduling Techniques-Scheduling with uncertain durations-Crashing and time/cost tradeoffs -Improving the Scheduling process – Introduction to application software.		CO2
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.		CO3
UNIT IV	**QUALITY CONTROL AND SAFETY IN CONSTRUCTION**	**9**
Quality and safety Concerns in Construction-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 in Construction.		CO4
UNIT V	**ORGANIZATION AND PROJECT INFORMATION SYSTEM**	**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.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 2014
2. Srinath,L.S., "Pert and CPM Principles and Applications", Affiliated East West Press, 2001.
3. Albert Lester, Project Management, Planning and Control, 7th Edition, Butterworth-Heinemann, USA , 2017.

REFERENCE BOOKS

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

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Acquire basic concepts of construction planning.
CO2	Schedule the construction activities using critical path method.
CO3	Forecast and control the cost in a construction using various tools.
CO4	Recognize the various quality control tool required in the construction Industry.
CO5	Explain the different databases that can be maintained in a construction industry using computers.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	3	1	-	-	-	3	-	3	2	-
CO2	-	3	3	-	3	-	1	-	-	-	3	-	3	2	3
CO3	-	3	-	-	3	-	1	-	-	-	3	-	-	2	-
CO4	3	-	-	-	3	1	1	-	-	-	2	-	-	-	-
CO5	1	2	3	-	3	1	1	-	-	-	2	-	-	3	-

CE1603	DESIGN OF STEEL STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections.
- To provide the students the tools necessary for designing structural systems such as roof trusses and gantry girders as per provisions of current code (IS 800 - 2007) of practice.

UNIT I	INTRODUCTION AND ALLOWABLE STRESS DESIGN	9
Structural steel types – Mechanical Properties of structural steel- Indian structural steel products- Steps involved in the Deign 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 deign of Angle Tension and Compression Members and estimation of axial load carrying capacity.		**CO1**

UNIT II	CONNECTIONS	9
Design of Simple and eccentric Bolted and welded connections - Types of failure and efficiency of joint – prying action - Introduction to HSFG bolts		**CO2**

UNIT III	TENSION MEMBERS	9
Tension Members - Types of Tension members and sections –Behavior 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.		**CO3**

UNIT IV	COMPRESSION MEMBERS	9
Types of compression members and sections–Behavior 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.		**CO4**

UNIT V	FLEXURAL MEMBERS	9
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 defection 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.		**CO5**

TOTAL : 45 PERIODS

TEXT BOOKS

1. Duggal S.K., Design of Steel Structures, Tata McGraw Hill, Publishing Co. Ltd., New Delhi,

2010

2. Bhavikatti S.S, Design of Steel Structures, Ik International Publishing House, New Delhi, 2017.

REFERENCE BOOKS

1. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India Pvt Limited, 2013
2. Jack C. McCormac and Stephen F Csernak, Structural Steel Design, Pearson Education Limited, 2013.
3. Sarwar Alam Raz, Structural Design in Steel, New Age International Publishers, 2014
4. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Familiarize with the aspects of structural behavior of steel structures, Design philosophies
CO2	Understand the design problems in bolted, riveted and welded connections
CO3	Analyze and design most suitable section for tension members and tension splices
CO4	Analyze and design most suitable section for compression members and column bases
CO5	Undertake design problems on beams – laterally supported and unsupported. and to analyze and design roof trusses and industrial trusses

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	1	1	-	-	-	3	3	2
CO2	3	3	3	2	-	-	-	2	1	-	-	-	3	3	2
CO3	3	3	3	2	-	-	-	2	1	-	-	-	3	3	2
CO4	3	3	3	2	-	-	-	2	1	-	-	-	3	3	2
CO5	3	3	3	2	-	-	-	2	1	-	-	-	3	3	2

CE1607	CONSTRUCTION MATERIALS AND HIGHWAY ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To learn the principles and procedures of testing Construction Materials and Highway materials and to get hands on experience by conducting the tests and evolving inferences.

EXERCISES

I.TESTS ON CEMENT AND AGGREGATES

a. Consistency and setting time
b. Specific Gravity
c. Gradation of Aggregate
d. Crushing Strength
e. Abrasion Value
f. Impact Value
g. Water Absorption
h. Flakiness and Elongation Indices

II .TESTS ON FRESH CONCRETE

a. Slump cone test
b. Flow table
c. Compaction factor
d. Vee bee test.

III.TESTS ON HARDENED CONCRETE

a. Compressive strength - Cube & Cylinder
b. Flexure test
c. Modulus of Elasticity

IV .TESTS ON BITUMEN

a. Penetration
b. Softening Point
c. Ductility
d. Flash and fire points.
e. Viscosity
f. Density

V. TESTS ON BITUMINOUS MIXES

a. Determination of Binder Content
b. Marshall Stability and Flow values

TOTAL : 60 PERIODS

REFERENCE BOOKS

1. IS 4031 (Part 1) – 1996 – Indian Standard Method for determination of fineness by drysieving.
2. IS 2386 (Part 1 to Part 6) – 1963 – Indian Standard methods for test for aggregate for concrete

3. IS 383 – 1970 Indian Standard specification for coarse and fine aggregates from natural sources for concrete.
4. Highway Materials and Pavement Testing, Nem Chand and Bros., Roorkee, Revised Fifth Edition, 2009
5. Methods for testing tar and bituminous materials, IS 1201–1978 to IS 1220– 1978, Bureau of Indian Standards
6. Methods of test for aggregates, IS 2386 – 1978, Bureau of Indian Standards
7. Mix Design Methods Asphalt Institute Manual Series No. 2, Sixth Edition,1997, Lexington, KY, USA.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No	Description of Equipment	Quantity
1.	Concrete cube moulds	6
2.	Concrete cylinder moulds	3
3.	Concrete Prism moulds	3
4.	Sieves	2 sets
5.	Concrete Mixer	1
6.	Slump cone	3
7.	Flow table	1
8.	Vibrator	1
9.	Trovels and planers	1 set
10.	UTM – 400 kN capacity	1
11.	Vee Bee Consistometer	1
12.	Aggregate impact testing machine	1
13.	Blains Apparatus	1
14.	Los - Angeles abrasion testing machine	1
15.	Length gauge	2
16.	Thickness gauge	2
17.	Compressometer	1
18.	Marshall Stability Apparatus	1
19.	Penetrometer	1
20.	Tar Viscometer	1
21.	Ring and Ball Apparatus	1
22.	Ductility Testing Machine	1
23.	Centrifuge Extractor - (Motorized)	1
24.	Flash & Fire Point Apparatus	1
25.	Vicat apparatus	3
26.	Mortor cubes	6

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	To do tests on Aggregates and cement as per IS codes of practice
CO2	To do tests on fresh concrete as per IS codes of practice
CO3	To do tests on hardened as per IS codes of practice
CO4	To do tests on bitumen as per IS codes of practice
CO5	To gain knowledge on bituminous design mix

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	1	1	2	2	2	1	1	2	2	2	-	2
CO2	3	2	1	1	1	1	3	2	1	1	2	3	3	-	3
CO3	3	2	2	1	1	2	3	2	1	1	2	3	3	-	3
CO4	3	1	1	1	1	2	3	2	1	1	2	2	2	-	2
CO5	2	1	2	1	1	2	2	1	1	1	1	1	3	-	2

CE1608	IRRIGATION AND ENVIRONMENTAL ENGINEERING DRAWING	L	T	P	C
		0	0	4	2

OBJECTIVES

- 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.

EXERCISES

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 **10**

Design and Drawing of flash mixer, clari-flocculator – Rapid sand filter – Pressure sand filter- Service reservoirs – House service connection for water supply and drainage.

2. SEWAGE TREATMENT & DISPOSAL **20**

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

TOTAL : 60 PERIODS

REFERENCE BOOKS

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.
5. Qasim,S.R., Motley, E.M and Zhu.G. "Water works Engineering – Planning, Design and Operation", Prentice Hall, New Delhi, 2009.
6. Qasim, S. R. "Wastewater Treatment Plants, Planning, Design & Operation", CRC Press, New York, 2010

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No	Description of Equipment	Quantity
	NA	

COURSE OUTCOMES

Upon completion of the course, students will be

CO1	Design and draw tank surplus weir and tank sluice with tower head, earth dam and its profile
CO2	Design and draw -Aqueducts – Syphon aqueduct (Type III) – Canal drop (Notch Type)
CO3	Design and draw - Direct Sluice - Canal regulator
CO4	Design and draw flash mixer, flocculator, clarifier – Rapid sand filter – Service reservoirs – Pumping station – House service connection for water supply and drainage.
CO5	Design and draw screen chamber - Grit channel - Primary clarifier - Activated sludge process – Aeration tank – Trickling filter – Sludge digester – Sludge drying beds – Septic tanks and disposal arrangements.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	3	-	-	-	-	-	-	-	-	3	1	2
CO2	3	1	3	3	-	-	-	-	-	-	-	-	3	1	2
CO3	3	1	3	3	-	-	-	-	-	-	-	-	3	1	2
CO4	3	1	3	3	-	-	-	-	-	-	-	-	3	1	2
CO5	3	1	3	3	-	-	-	-	-	-	-	-	3	1	2

CE1701	ESTIMATION, COSTING AND VALUATION ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart knowledge in estimation, tender practices, contract procedures, and valuation of Civil Engineering works.

UNIT I	QUANTITY ESTIMATION	9
Philosophy – Purpose – Methods of estimation – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, Septic tank, roads and retaining wall		CO1
UNIT II	**RATE ANALYSIS AND COSTING**	**9**
Standard Data – Observed Data – Schedule of rates – Market rates – Assessment of Man Hours and Machineries for common civil works – Rate Analysis – Cost Estimates using Computer softwares.		CO2
UNIT III	**SPECIFICATIONS, REPORTS AND TENDERS**	**9**
Specifications – Detailed and general specifications – 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.		CO3
UNIT IV	**CONTRACTS**	**9**
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		CO4
UNIT V	**VALUATION**	**9**
Definitions – Various types of valuations – Valuation methods – Valuation of land – Buildings – Valuation of plant and machineries - Calculation of Standard rent – Mortgage – Lease.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

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

REFERENCE BOOKS

1. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD
2. Tamil Nadu Transparencies in Tenders Act, 2000
3. Standard Databook for analysis and rates
4. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Explain the basic concept of quantity estimation for building, roads, canals and hydraulic structures by manual and software packages

CO2	Acquire the knowledge to calculate rate analysis and man-hours required for the common civil works by manual and software packages
CO3	Develop the specification for the materials used in construction, online and offline tender procedures and tender document preparation and report preparation.
CO4	Acquire the knowledge of construction contracts and contract document preparation.
CO5	Identify the valuation for building, land and plant and machineries, calculation of rent, mortgage and lease.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	2	2	1	3	2	1	2	1	2	2
CO2	3	3	3	2	3	2	2	1	2	2	2	1	2	3	2
CO3	3	3	2	2	2	1	2	1	2	1	1	2	2	1	2
CO4	3	3	2	2	2	1	1	1	1	1	1	3	2	2	1
CO5	3	3	3	3	2	1	2	1	3	1	1	3	3	2	2

CE1702	STRUCTURAL DESIGN AND DRAWING	L	T	P	C
		3	0	2	4

Objectives

- To provide the students a solid background on the principles of structural engineering design. They can able to design and detail various special structures like Retaining walls, Flat slabs, water tanks, Plate girder and Gantry girder

Course Outcomes (CO)

CO1	Design and draw retaining walls
CO2	Design and draw flat slabs and solid slab bridge
CO3	Design and draw Rcc and steel water tanks
CO4	Design and draw plate and Gantry girders
CO5	Design and draw steel Truss 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 – 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	**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.

UNIT - V	**INDUSTRIAL STRUCTURES**	**9+6**

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

Total Periods:	**75**

DESIGN AND DRAWING EXERCISES FOR PRACTICAL COMPONENT
1. Rectangular Column and Footing
2. Combined footing with Two columns
3. RCC one way &Two way Slab and beam system
4.Underground Rectangular Water Tank
5.Elevated circular water Tank
6.Built up column, column base and Foundation
7.Framed Connections and Detailing

8.Plate Girder - welded

Text Books:

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

Reference Books:

1. Krishnamurthy D,Structural Design and Drawing VolI,IIandIII,CBS Publishers, 2010.
2. Shah V L and Veena Gore,Limit State Design of Steel Structures
3. IS 800-2007,Structures Publications, 2009.
4. IS 456(2000) Indian Standard Plain and Reinforced Concrete-Code of Practice, Bureau of Indian Standards, New Delhi.
5. SP34 Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi.
6. IS 800 (2007) Indian Standard General Construction In Steel—Code of Practice, Bureau of Indian Standards, New Delhi.
7. 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.
8. 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.
9. 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.
10. 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.
11. 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.
12. 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.
13. IS 804 (2008) Indian Standard Specification for Rectangular Pressed Steel Tanks, Code of Practice, Bureau of Indian Standards, New Delhi.
14. 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.
15. IRC 112-2011, Code of Practice for Concrete Road Bridges, The Indian Roads Congress,New Delhi.
16. IRC 6-2014, Standard Specifications and Code of Practice for Road Bridges Section: II-Loads and Stresses, The Indian Roads Congress, New Delhi.

CE1708	DESIGN PROJECT	L	T	P	C
		0	0	4	2

OBJECTIVES

- The objective of this course is to impart and improve the design capability of the student. This course conceives purely a design problem in any one of the disciplines of Civil Engineering; e.g., Design of an RC structure, Design of a waste water treatment plant, Design of a foundation system, Design of traffic intersection etc. The design problem can be allotted to either an individual student or a group of students comprising of not more than four. At the end of the course the group should submit a complete report on the design problem consisting of the data given, the design calculations, specifications if any and complete set of drawings which follow the design.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Design any of the Civil Engineering structure
CO2	Interpret data, and synthesis the information to provide valid conclusions.
CO3	Apply appropriate techniques, modern Engineering tools to engineering activities.
CO4	Communicate effectively, manage the team or partner
CO5	Apply ethical principles and commit to professional ethics and responsibilities.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	2	1	3	2	2	3	2	2	1	3
CO2	3	3	2	2	3	2	1	3	2	2	3	2	2	1	3
CO3	3	3	2	2	3	2	1	2	2	3	3	2	1	1	3
CO4	3	3	2	2	3	2	1	2	2	3	3	2	1	1	3
CO5	3	3	2	2	3	2	1	2	2	3	3	2	1	1	3

CE1807	PROJECT WORK	L	T	P	C
		0	0	20	10

OBJECTIVES

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

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.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Take up any challenging practical problems in Civil Engineering
CO2	Solve the problem from its identification and through literature reviews
CO3	Apply appropriate techniques, modern Engineering tools to solve the problems
CO4	Solve the problem in context with societal and environmental need
CO5	Prepare project reports, presentations and to face interviews

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1	3	2	2	3	2	2	2	3
CO2	3	3	2	2	2	2	1	3	2	2	3	2	2	2	3
CO3	3	3	2	2	2	2	1	3	2	3	3	2	2	2	3
CO4	3	3	2	2	2	2	1	3	2	3	3	2	2	2	3
CO5	3	3	2	2	2	2	1	3	2	3	3	2	2	2	3

CE1001	REMOTE SENSING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To make the students to understand the concepts, components and source of remote Sensing.
- To gain knowledge about different types of remote sensing platforms and sensors
- To explain the concept of satellite image interpretation
- To understand the applications of remote sensing in Civil Engineering

UNIT I	REMOTE SENSING AND ELECTROMAGNETIC RADIATION	9
Definition – components of RS – History of Remote Sensing – Merits and demerits of data collation between conventional and remote sensing methods - Electromagnetic Spectrum – Radiation principles - Wave theory, Planck's law, Wien's Displacement Law, Stefan's Boltzmann law, Kirchoff's law – Radiation sources: active & passive - Radiation Quantities		CO1
UNIT II	**EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL**	**9**
Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows – Energy balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance – Spectroradiometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation, soil and water – solid surface scattering in microwave region.		CO2
UNIT III	**ORBITS AND PLATFORMS**	**9**
Motions of planets and satellites – Newton's law of gravitation - Gravitational field and potential - Escape velocity - Kepler's law of planetary motion - Orbit elements and types – Orbital perturbations and maneuvers – Types of remote sensing platforms - Ground based, Airborne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Legrange Orbit.		CO3
UNIT IV	**SENSING TECHNIQUES**	**9**
Classification of remote sensors – Resolution concept : spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors – microwave sensors – Calibration of sensors - High Resolution Sensors - LIDAR , UAV –Orbital and sensor characteristics of live Indian earth observation satellites		CO4
UNIT V	**DATA INTERPRETATION AND CIVIL ENGINEERING APPLICATIONS**	**9**
Photographic and digital products – Types, levels and open source satellite data products –- selection and procurement of data– Visual interpretation: basic elements and interpretation keys – Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification – Civil Engineering applications: highway and railway alignments, site selection for dams, town and regional planning		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Thomas M.Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York, 2009.
2. George Joseph and C Jeganathan, Fundamentals of Remote Sensing, Universities Press (India) Private limited, Hyderabad, 2018

REFERENCE BOOKS

3. Janza, F.Z., Blue H.M. and Johnson,J.E. Manual of Remote Sensing. Vol.I, American Society of Photogrametry, Virginia, USA, 2002.
4. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press, 1995
5. Paul Curran P.J. Principles of Remote Sensing. Longman, RLBS, 2003.
6. Introduction to Physics and Techniques of Remote Sensing , Charles Elachi and Jacob Van Zyl, 2006 Edition II, Wiley Publication.
7. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, 2011

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the concepts and laws related to remote sensing
CO2	Understand the interaction of electromagnetic radiation with atmosphere and earth material
CO3	Acquire knowledge about satellite orbits and different types of satellites
CO4	Understand the different types of remote sensors
CO5	Gain knowledge about the concepts of interpretation of satellite imagery and civil engineering applications

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	1	-	-	1	2	2
CO2	-	-	-	-	-	-	-	-	-	3	-	-	2	3	2
CO3	2	-	-	-	-	3	3	-	-	-	-	-	2	1	2
CO4	2	-	2	-	-	-	-	-	-	-	1	2	2	2	1
CO5	2	3	2	3	3	2	3	3	1	-	-	-	3	2	2

CE1002	GEOGRAPHIC INFORMATION SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the fundamentals and components of Geographic Information System
- To provide details of spatial data structures and input, management and output processes.

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.		CO1
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.		CO2
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		CO3
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		CO4
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.		CO5
		TOTAL : 45 PERIODS

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 BOOKS

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

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Have basic idea about the fundamentals of GIS.
CO2	Understand the types of data models.
CO3	Get knowledge about data input and topology.

CO4	Gain knowledge on data quality and standards.
CO5	Understand data management functions and data output

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	1	-	2	1	-	-	-	-	-	-	1	2	2
CO2	2	1	2	2	3	1	-	-	-	-	-	-	2	3	2
CO3	2	1	2	2	3	1	-	-	-	-	-	-	2	1	2
CO4	2	1	2	-	3	1	-	-	-	-	-	-	2	2	1
CO5	2	-	2	-	3	1	-	-	-	-	-	-	3	2	2

CE1003	GEOINFORMATICS APPLICATIONS FOR CIVIL ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To solve the Civil Engineering problems with the help of Geoinformatics technique.

UNIT I	MAP PRODUCTION CONCEPTS	9
Maps - uses — Types of Maps – Map Scales – Map projections — Map co-ordinate systems – Elements of a map - Map Layout principles – Map Design fundamentals – symbols and conventional signs - colours and patterns in symbolization – map lettering - map production – map printing– colours and visualization – map reproduction - Map generalization – geometric transformations – bilinear and affine transformations.		CO1
UNIT II	**GIS AND SPATIAL DATA**	**9**
Data – Information – Primary and Secondary data sources – GIS - Components of a GIS – Hardware, Software, Data, People, Methods - Types of data – Spatial, Attribute data – scales/ levels of measurements - spatial data models - Raster vs Vector Models - Raster Data Structures - TIN and GRID data models.		CO2
UNIT III	**RASTER AND VECTOR DATA ANALYSIS**	**9**
Raster Data analysis: Query Analysis – Local, Focal and Zonal Operations – Cost-Distance Analysis - Least Cost Path – Vector data analysis – attribute data analysis - query, calculations – Integrated data analysis - Reclassification, Aggregation, Overlay analysis: Point-in-polygon, Line1in-Polygon, Polygon-on-Polygon: Clip, Erase, Identity, Union, Intersection – Proximity Analysis: Buffering		CO3
UNIT IV	**NETWORK ANALYSIS**	**9**
Network – Introduction - Network Data Model – Elements of Network - Building a Network database - Geocoding – Address Matching - Shortest Path in a Network – Time and Distance Based shortest path analysis – Driving Directions – Closest Facility Analysis – Catchment / Service Area Analysis-Location-Allocation Analysis.		CO4
UNIT V	**MODELLING AND APPLICATIONS**	**9**
Land Information studies - Building information system – Digital Infrastructure management - Watershed modelling for sustainable development - modelling of reservoir siltation – soil degradation assessment - Highway alignment studies – Intelligent transportation systems – Solid Waste management - Air quality monitoring - Disaster management.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. C.P. Lo Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Second edition, PHI Learning Private Limited, Delhi, 2014.
2. Jonathan E. Campbell, Michael Shin, Essential of Geographic Information System, Saylor Foundation, 2011.

REFERENCE BOOKS

1. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, “An Introduction to Geographical Information Systems, Pearson Education, 2nd Edition, 2007.
2. Michael N. DeMers, Fundamentals of geographic information systems, Wiley,2009
3. John Peter Wilson, The handbook of geographic information science, Blackwell Pub.,2008
4. Harvey J.Miller, Shih-Lung Shaw, Geographic Information System for Transportation-

Principle and Applications, Oxford University Press,2001.

5. Kang-Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, 2nd Edition, 2011.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the concepts of map making process.
CO2	Gain knowledge on spatial data and Geographic Information System
CO3	Impart the required skills for analyzing the spatial data useful modelling the real world problems
CO4	Impart the required skills for analyzing the spatial data useful modelling transportation networks and resource transport.
CO5	Gain knowledge on the applicability of Geoinfomatics technology on diverse Civil Engineering Problems

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	2	2	1	3	2	1	2	1	2	2
CO2	3	3	3	2	3	2	2	1	2	2	2	1	2	3	2
CO3	3	3	2	2	2	1	2	1	2	1	1	2	2	1	2
CO4	3	3	2	2	2	1	1	1	1	1	1	3	2	2	1
CO5	3	3	3	3	2	1	2	1	3	1	1	3	3	2	2

CE1004	ADVANCED SURVEYING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the working of Total Station and GPS and solve the surveying problems.

UNIT I	FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES	9
Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying. Classification-applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies		CO1
UNIT II	**DISTANCE AND ATMOSPHERIC CORRECTION**	**9**
Refractive index (RI) - factors affecting RI-Computation of group for light and near infrared waves at standard and ambient conditions-Computation of RI for microwaves at ambient condition - Reference refractive index- Real time application of first velocity correction. Measurement of atmospheric parameters- Mean refractive index- Second velocity correction - Total atmospheric correction- Use of temperature and pressure transducers.		CO2
UNIT III	**ELECTRO OPTICAL AND MICRO WAVE SYSTEM**	**9**
Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system. Care and maintenance of Total Station instruments – Traversing and Trilateration-COGO functions, offsets and stake out-land survey applications.		CO3
UNIT IV	**GPS SATELLITE SYSTEM**	**9**
Basic concepts of GPS - Historical perspective and development - applications - Geoid and Ellipsoid- satellite orbital motion - Keplerian motion – Kepler‘s Law - Perturbing forces – Geodetic satellite - Doppler effect - Positioning concept –GNSS, IRNSS and GAGAN - Different segments - space, control and user segments - satellite configuration – GPS signal structure – Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - GPS receivers.		CO4
UNIT V	**GPS DATA PROCESSING**	**9**
GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation – downloading the data RINEX Format – Differential data processing – software modules -solutions of cycle slips, ambiguities, Concepts of rapid, static methods with GPS - semi Kinematic and pure Kinematic methods -satellite geometry & accuracy measures - applications- long baseline processing- use of different softwares.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 4th Edition,1996.
2. Satheesh Gopi, rasathishkumar, N.madhu, — Advanced Surveying , Total Station GPS and Remote Sensing — Pearson education , 2nd Edition,2017. isbn: 978-81317 00679

REFERENCE BOOKS

1. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1983.
3. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin,3rd

Edition,2016.

4. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 4th Edition, 2015.
5. Seeber G, Satellite Geodesy, Walter De Gruyter, Berlin,2nd Edition,2003.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Learn the fundamentals of Total station.
CO2	Provides knowledge about electromagnetic waves and its usage in Total station and GPS.
CO3	Understand the measuring and working principle of electro optical and Microwave Total station and GPS
CO4	Learn the basic concepts of GPS
CO5	Gains knowledge about Total station and GPS data downloading and processing

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	3	2	1	2	2	2	1	3	2	1	2	1	2	1
CO2	1	2	2	2	1	2	2	1	2	2	2	1	2	3	2
CO3	1	2	1	1	2	1	2	1	2	1	1	2	2	1	2
CO4	1	1	1	1	3	1	1	1	1	1	1	3	2	2	2
CO5	1	3	1	1	3	1	2	1	3	1	1	3	3	2	3

CE1005	AIR POLLUTION AND CONTROL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.

UNIT I	AIR QUALITY	9
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.		CO1
UNIT II	**ATMOSPHERIC DISPERSION OF AIR POLLUTANT**	**9**
Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise		CO2
UNIT III	**CONTROL OF PARTICULATE POLLUTANTS**	**9**
Gas Particle Interaction – Working principle, Design and performance equations of Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations- Factors affecting Selection of Control Equipment.		CO3
UNIT IV	**CONTROL OF GASEOUS POLLUTANTS**	**9**
Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring – Operational Considerations- Factors affecting Selection of Control Equipment –CO2 capturing.		CO4
UNIT V	**INDOOR AIR QUALITY**	**9**
Sources types and control of indoor air pollutants, sick building syndrome types –Sources and Effects of Noise Pollution – Measurement – Standards–Control and Preventive measures.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, Air Pollution Control Engineering, Tokyo, 2004.
2. Noel de Nevers, Air Pollution Control Engineering, Mc Graw Hill, New York, 1995.
3. Anjaneyulu. Y, “Air Pollution and Control Technologies‟ , Allied Publishers (P) Ltd., India 2002

REFERENCE BOOKS

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

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the chemistry of atmosphere, characterize the air pollutants ,know

	the effects of air pollution, identify the criteria air pollutants and know about NAAQS
CO2	Apply the knowledge of mathematics ,science and engineering fundamentals to understand the concept of meteorology, air pollution dispersion and Gaussian plume dispersion model
CO3	Select suitable method and design the particulate pollutant control equipment
CO4	Select appropriate method for control of gaseous pollutant by due consideration of sources of emission
CO5	Understand the source of indoor air pollution, effects and control methods as well as to identify the source of noise ,and select suitable method for measuring and control of noise pollution

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	2	3
CO2	2	1	-	-	-	-	-	-	-	-	-	-	1	2	3
CO3	3	2	-	-	-	1	-	-	-	-	-	-	2	3	3
CO4	3	2	-	-	-	1	-	-	-	-	-	-	2	3	3
CO5	3	2	-	-	-	1	-	-	-	-	-	-	2	3	3

CE1006	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 social impacts of developmental projects

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.		CO1
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, flora and fauna - Matrices – Networks – Checklist Methods - Mathematical models for Impact prediction.		CO2
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 – Public Hearing-Environmental Clearance		CO3
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		CO4
UNIT V	**CASE STUDIES**	**9**
EIA case studies pertaining to Infrastructure Projects – Roads and Bridges – Mass Rapid Transport Systems - Airports - Dams and Irrigation projects - Power plants.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

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, Riki Therivel “Methods of Environmental Impact Assessment”, Routledge Publishers,2009.

REFERENCE BOOKS

1. Becker H. A., Frank Vanclay,“The International handbook of social impact assessment” conceptual and 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 Science New York, 1998.
4. Ministry of Environment and Forests EIA Notification and Sectoral Guides, Government of India, New Delhi, 2010.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Carry out scoping and screening of developmental projects for environmental and social

	assessments
CO2	Explain different methodologies for environmental impact prediction and assessment
CO3	Plan environmental impact assessments and environmental management plans
CO4	Evaluate environmental impact assessment reports
CO5	Mitigate the environmental and social impacts of developmental projects

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	-	2	2	1	3	2	1	2	1	2	2
CO2	3	2	-	-	-	2	2	1	2	2	2	1	2	3	2
CO3	3	2	-	-	-	1	2	1	2	1	1	2	2	1	2
CO4	3	2	-	-	-	1	1	1	1	1	1	3	2	2	1
CO5	3	2	-	-	-	1	2	1	3	1	1	3	3	2	2

CE1007	INDUSTRIAL WASTEWATER TREATMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart knowledge on composition treatment and effective disposal of industrial effluents

UNIT I	SOURCES OF POLLUTANTS	9
Sources of Pollution - Physical, Chemical, Organic & Biological properties of Industrial Wastes - Difference between industrial & municipal waste waters - Effects of industrial effluents on sewers and Natural water Bodies.		CO1
UNIT II	**PRIMARY TREATMENT OF POLLUTANTS**	**9**
Pre & Primary Treatment - Equalization, Proportioning, Neutralization, Oil separation by Floating-Waste Reduction-Volume Reduction-Strength Reduction.		CO2
UNIT III	**WASTE TREATMENT METHODS**	**9**
Waste Treatment Methods - Nitrification and De-nitrification-Phosphorous removal -Heavy metal removal - Membrane Separation Process - Air Stripping and Absorption Processes - Special Treatment Methods - Disposal of Treated Waste Water.		CO3
UNIT IV	**CHARACTERISTICS AND COMPOSITION OF INDUSTRIAL WASTEWATER**	**9**
Characteristics and Composition of waste water and Manufacturing Processes of Industries like Sugar, Characteristics and Composition of Industries like Food processing Industries, Tanneries - Joint Treatment of Raw Industries waste water and Domestic Sewage.		CO4
UNIT V	**OIL REFINERS, PHARMACEUTICAL PLANTS**	**9**
Characteristics and Composition of Industries like Textiles, and other Mineral Processing Industries – Steel, and Petroleum Refineries – Common Effluent Treatment Plants(CETP) – Location, Design, Operation and Maintenance Problems – Economical aspects.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Handbook of Industrial Waste Disposal by Richard A. Conway Richard Ross– Van Nostrand publisher (1980)
2. Eckenfelder, W.W., “Industrial Water Pollution Control”, McGraw-Hill
3. Metcalf & Eddy, “Wastewater engineering Treatment disposal reuse”, Tata McGraw Hill

REFERENCE BOOKS

1. Industrial Waste Treatment: Contemporary Practice and Vision for the Future by Nelson Leonard Nemerow, Nemerow – Butterworth Weinemann publisher (2006)
2. Wastewater Treatment by M. N. Rao and A. K. Datta–Oxford I. B. H publishers
3. C.G. Gurnham –Principles of Industrial Waste Engineering.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Distinguish between the quality of domestic and industrial water requirements and Wastewater quantity generation
CO2	Understand the industrial process, water utilization and waste water generation
CO3	Impart knowledge on selection of treatment methods for industrial wastewater
CO4	Acquire the knowledge on operational problems of common effluent treatment plants.

CO5	Gain knowledge on different techniques and approaches for minimizing the generation and application of Physio chemical and biological treatment methods for recovery, reuse and disposal of industrial wastewater.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	3	3	-	2	-	3	2	1	2	-	2	2
CO2	3	1	-	3	3	-	2	-	3	2	1	2	-	2	2
CO3	3	1	-	3	3	-	2	-	3	2	1	2	-	2	2
CO4	3	1	-	3	3	-	2	-	3	2	1	2	-	2	2
CO5	3	1	-	3	3	-	2	-	3	2	1	2	-	2	2

CE1008	MUNICIPAL SOLID WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste

UNIT I	SOURCES AND CHARACTERISTICS	9
Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – l solid waste (M&H) rules – integrated solidwaste management-Public awareness; Role of NGO" s- Public Private participation.		CO1
UNIT II	**ON-SITE STORAGE AND PROCESSING**	**9**
On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and environmental aspects of open storage – waste segregation and storage – case studies under Indian conditions – source reduction of waste – Reduction, Reuse and Recycling of plastic waste –Construction and Demolishing waste.		CO2
UNIT III	**COLLECTION AND TRANSFER**	**9**
Methods of Residential and commercial waste collection – Collection vehicles – Manpower – Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems- solving		CO3
UNIT IV	**OFF-SITE PROCESSING**	**9**
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.		CO4
UNIT V	**DISPOSAL**	**9**
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 capping –Biomining.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Cherry P M, Solid and Hazardous Waste Management, CBS publishers and distributors Pvt Ltd, 2018
2. Rao M.N, Razia Sultana, Sri Harsha Kota, solid and hazardous waste management – Science and Engineering , Butterworth-Heinemann, 2016

REFERENCE BOOKS

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, “Integrated Solid Waste Management, Mc-Graw Hill India, First edition, 2015.
2. CPHEEO, “Manual on Municipal Solid waste management,Vol I, II and III, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi, 2016.
3. William A. Worrell, P. Aarne Vesilind, Christian Ludwig, Solid Waste Engineering - A Global Perspective, 3rd Edition, Cengage Learning, 2017.
4. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and "Environmental Resources Management, Hazardous waste Management", Mc-Graw Hill International edition, New York,2010.
5. John Pitchtel,Waste Management Practices, CRC Press,Taylor and Francis Group,2014.

6. Gary C. Young, Municipal Solid Waste to Energy.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Gain knowledge on the basics of properties of matter and its applications,
CO2	Acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics.
CO3	Have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers.
CO4	Get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
CO5	Understand the basics of crystals, their structures and different crystal growth techniques.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	2	2	1	3	2	1	2	1	2	2
CO2	3	3	3	2	3	2	2	1	2	2	2	1	2	3	2
CO3	3	3	2	2	2	1	2	1	2	1	1	2	2	1	2
CO4	3	3	2	2	2	1	1	1	1	1	1	3	2	2	1
CO5	3	3	3	3	2	1	2	1	3	1	1	3	3	2	2

CE1009	PAVEMENT ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- Student gains knowledge on various IRC guidelines for designing rigid and flexible pavements.
- Further, the student will be in a position to assess quality and evaluate the serviceability conditions of pavements

UNIT I	PAVEMENT TYPES AND STRESS DISTRIBUTION	9
Introduction – Pavement as layered structure – Pavement types rigid and flexible. Resilient modulus - Stress and deflections in pavements under repeated loading.		CO1
UNIT II	**DESIGN OF FLEXIBLE PAVEMENTS**	**9**
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.		CO2
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.		CO3
UNIT IV	**PAVEMENT CONSTRUCTION, EVALUATION AND MAINTENANCE**	**9**
Construction of pavements – Construction Equipments-Methods of construction. 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).		CO4
UNIT V	**STABILIZATION OF PAVEMENTS**	**9**
Stabilization with special reference to highway pavements – Choice of stabilizers – Testing and field control - Stabilization for rural roads in India – Use of Geosynthetics in roads.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, “Highway Engineering”, New Chand and Brothers, Revised 10th Edition, 2014.
2. Yoder, R.J. and Witchak M.W. “Principles of Pavement Design”, John Wiley 2000.
3. R.Srinivasa Kumar., “Pavement Engineering” Universities Press (India) Private Limited, Hyderabad, 2013.
4. Prithvi Singh Kandhal,” Bituminous Road Construction in India”, PHI Learning Private Limited, New Delhi, 2016.

REFERENCE BOOKS

1. Rajib B.Mallick and Tahar El-Korchi, “Pavement Engineering Principles and Practice:, CRC Press, 2009
2. Kadiyali, L.R., “Principles and Practice of Highway Engineering”, Khanna tech. Publications, New Delhi, 2005
3. Guidelines for the Design of Flexible Pavements, IRC-37–2012, The Indian roads Congress,

New Delhi.

4. Guideline for the Design of Rigid Pavements for Highways, IRC 58-1998, The Indian Road Congress, New Delhi.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Explain concepts and standards adopted in Planning, Design and construction of Pavements.
CO2	Apply the knowledge of science and engineering fundamentals in designing flexible pavement. by adopting various design standards
CO3	Apply the standards adopted in designing rigid pavement.
CO4	Select appropriate methods for construction and evaluation of Pavements
CO5	Address the problem statement in construction of pavement and to impart knowledge in stabilization techniques.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	3	2	1	2	3	2	1	3	2	1	2	1	2	1
CO2	1	2	2	2	1	2	2	1	2	2	2	1	2	3	2
CO3	1	2	1	1	2	2	1	1	2	1	1	2	2	1	1
CO4	1	1	1	1	3	1	1	1	1	1	1	3	2	2	1
CO5	1	3	1	1	3	3	1	1	3	1	1	3	3	2	1

CE1010	TRAFFIC ENGINEERING AND MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To give an overview of Traffic engineering, various surveys to be conducted, traffic Regulation, management and traffic safety.

UNIT I	TRAFFIC CHARACTERISTICS	10
Road Characteristics – Classification – Functions and standards – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India.		CO1
UNIT II	**TRAFFIC SURVEYS**	**7**
Traffic Surveys – Speed, journey time and delay surveys – Vehicle Volume Survey – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – level of service – Concept, application and significance.		CO2
UNIT III	**TRAFFIC ENGINEERING REGULATION AND CONTROL**	**8**
Capacity of Rotary intersection and Design – Capacity of signalized intersections – Traffic signals, warrants, type – Design and coordination – Intersection channelization – Grade separation – Traffic signs and road markings.		CO3
UNIT IV	**TRAFFIC SAFETY AND ENVIRONMENT**	**10**
Road accidents – Causes, effect, prevention, and cost – street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, health effects and abatement measures.		CO4
UNIT V	**TRAFFIC MANAGEMENT**	**10**
Area Traffic Management System – One way street system, exclusive traffic lanes, tidal flow operation, staggering of work hours and road pricing – Non road pricing options _ Parking charges, Public transport, Subsidies, Vehicle License fees, Road Building, Permit system, Physical Traffic Management Transport System Management (TSM) and Transport Demand Management (TDM)- - Introduction to Intelligent Transportation Systems (ITS)- ITS Applications in Traffic Management.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Kadiyali. L.R. Traffic Engineering and Transport Planning, Khanna Publishers, Delhi,2008.
2. Khanna .K and Justo C.E.G. and Veeraragavan, A Highway Engineering, Nem Chand Bros., Roorkee, Revised 10th Edition, 2014.
3. Srinivasa Kumar, “Introduction to Traffic Engineering”, Universities Press, 2018
4. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHI Learning Pvt. Ltd., 2011

REFERENCE BOOKS

1. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
2. C. Jotin Khisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
3. Hobbs. F.D. Traffic Planning and Engineering, University of Brimingham, Peragamon Press Ltd, 1994.
4. Taylor MAP and Young W, Traffic Analysis – New Technology and New Solutions, Hargreen

Publishing Company , 1998.
5. Jason C.Yu Transportation Engineering, Introduction to Planning, Design and Operations, Elsevier, 1992.
6. Salter. R.I and Hounsell N.B, Highway Traffic Analysis and design, Macmillan Press Ltd.1996.
7. Roger P.Roess, William R.Mcshane and Elena S.Prassas, Traffic Engineering-Second Edition, Prentice Hall Publishers,, Upper Saddle River, New Jersey 1998.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the principles and standards adopted in Planning and Design of Traffic system.
CO2	Apply the knowledge of science and engineering fundamentals in conducting traffic surveys and analyze the problems.
CO3	Designing various types of control and regulatory measures to meet an efficient traffic network.
CO4	Select appropriate methods to ensure the safety of the road users and analyze the environmental issues related to traffic network.
CO5	Understand various traffic management measures in addressing the demand, pricing and ITS applications.

MAPPING OF COs WITH POs AND PSOs

Cos	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	2	-	3	-	1	-	-	3	2	-
CO2	3	-	3	3	2	2	-	-	-	1	-	2	3	3	1
CO3	-	3	3	2	3	-	-	-	3	2	2	3	3	3	1
CO4	2	3	2	1	3	-	-	3	3	3	2	3	3	3	2
CO5	-	2	1	1	2	-	1	3	3	1	1	3	2	1	1

CE1011	TRANSPORTATION PLANNING AND SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To give an exposure on overview of the principles of the bus and rail transportation planning and evaluation of the transportation projects.

UNIT I	STUDY AREA AND SURVEYS	9
Importance of planning and integrated transport facilities in urban areas – Delineation of study area and zoning – Conducting various surveys – Travel patterns, transport facilities and planning parameters.		CO1
UNIT II	**MODES**	**9**
Basics of trip generation – Trip distribution – Trip assignment and modal split models – Validation of the model.		CO2
UNIT III	**PLAN PREPARATION AND EVALUATION**	**9**
Preparation of alternative plans – Evaluation techniques – Economic and financial evaluation – Environment Impact Assessment (EIA) – Case Studies.		CO3
UNIT IV	**BUS TRANSPORTATION**	**9**
Characteristics and bus transportation in urban areas – Fare policy – Route planning – Planning of terminals – Break even point and its relevance.		CO4
UNIT V	**RAIL TRANSPORTATION**	**9**
Characteristics of suburban, IRT and RRT systems – Planning of rail terminals – Fare policy – Unified traffic and transport authority.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Michael J.Bruton, Introduction to Transportation Planning, Hutchinson, London, 1995.
2. Kadiyali. L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2008.

REFERENCE BOOKS

1. John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1990.
2. C. Jotin Khisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
3. Juan de Dios Ort zar and Luis G. Willumsen, Modelling Transport, John Wiley & Sons 2001
4. Chennai Comprehensive Traffic Study, Chennai Metropolitan Development Authority, 2007.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the concepts and surveys adopted in Transportation planning
CO2	Knowledge on modelling of trip generation assigning and distribution techniques in transportation system.
CO3	Planning and evaluating transportation projects through various case studies.
CO4	Knowledge on planning of bus transportation system in urban areas.
CO5	Planning of various rail transportation and fare policies adopted.

MAPPING OF COs WITH POs AND PSOs

Cos	PROGRAM OUTCOMES (POs)	PROGRAM SPECIFIC OUTCOMES (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	2	-	3	-	1	-	-	3	2	-
CO2	3	-	3	3	2	2	-	-	-	1	-	2	3	3	1
CO3	-	3	3	2	3	-	-	-	3	2	2	3	3	3	1
CO4	2	3	2	1	3	-	-	3	3	3	2	3	3	3	2
CO5	-	2	1	1	2	-	1	3	3	1	1	3	2	1	1

CE1012	URBAN PLANNING AND DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To enable students to have the knowledge on planning process and to introduce to the students about the regulations and laws related to Urban Planning.

UNIT I	**BASIC ISSUES**	**9**
Definition of Human settlement, Urban area, Town, City, Urbanisation, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Classification of urban areas – Trend of Urbanisation at International, National, Regional and State level.		**CO1**
UNIT II	**PLANNING PROCESS**	**9**
Principles of Planning – Types and Level of Plan, Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Surveys and Questionnaire Design.		**CO2**
UNIT III	**DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION**	**9**
Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, Development Control Rules, Transfer of Development Rights , Special Economic Zones- Development of small town and smart cities-case studies,		**CO3**
UNIT IV	**PLANNING AND DESIGN OF URBAN DEVELOPMENT PROJECT**	**9**
Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects.		**CO4**
UNIT V	**LEGISLATION, DEVELOPMENT AND MANAGEMENT OF URBAN SYSTEM**	**9**
Town and Country Planning Act, Land Acquisition and Resettlement Act etc., Urban Planning Standards and Regulations, Involvement of Public, Private, NGO, CBO and Beneficiaries.		**CO5**
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002
2. George Chadwick, A Systems view of planning, Pergamon press, Oxford 1978
3. Singh V.B, Revitalised Urban Administration in India, Kalpaz publication, Delhi, 2001
4. Edwin S.Mills and Charles M.Becker, Studies in Urban development, A World Bank publication, 1986

REFERENCE BOOKS

1. Tamil Nadu Town and Country Planning Act 1971, Government of Tamil Nadu, Chennai
2. Goel S.L., Urban Development and Management, Deep and Deep Publications, New Delhi,2002
3. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005
4. CMDA, Second Master Plan for Chennai, Chennai 2008

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the basic concepts in urban planning and development.
CO2	Knowledge on principles of planning, surveys and analysis. in developing an urban area.

CO3	Knowledge on development of regional, master plan and norms for development of smart cities.
CO4	Planning of standards, implanting and financing of Urban projects.
CO5	Understand the norms, legal aspects and stakeholders role in planning an urban area.

MAPPING OF COs WITH POs AND PSOs

Cos	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	-	-	3	-	3	-	-	3	3	-
CO2	3	3	3	3	2	-	-	-	3	-	-	-	3	-	2
CO3	3	1	2	-	-	2	-	3	-	2	-	3	3	-	2
CO4	-	1	2	3	-	2	-	3	3	2	3	3	2	2	3
CO5	-	-	-	-	-	-	1	3	3	3	-	-	-	3	2

CE1013	HYDROLOGY AND WATER RESOURCES ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the student to the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources.

UNIT I	PRECIPITATION AND ABSTRACTIONS	9
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.		CO1
UNIT II	**RUNOFF**	**9**
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		CO2
UNIT III	**FLOOD AND DROUGHT**	**9**
Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve		CO3
UNIT IV	**RESERVOIRS**	**9**
Rural Development - Ecological sustainability- -Watershed development and conservation - Ecosystem regeneration – Wastewater reuse - Sustainable livelihood - Food security		CO4
UNIT V	**GROUNDWATER AND MANAGEMENT**	**9**
Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge – Rain Water Harvesting in rural and urban areas		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Subramanya. K. "Engineering Hydrology"- Tata McGraw Hill, 2010.
2. Jayarami Reddy. P. "Hydrology", Tata McGraw Hill, 2008.
3. Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International Book Company, 1995.

REFERENCE BOOKS

1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007.
2. Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.
3. Raghunath. H.M., "Hydrology", Wiley Eastern Ltd., 1998.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Define the key drivers on water resources, hydrological processes and their integrated behaviour in catchments
CO2	Apply the knowledge of hydrological models to surface water problems including basin characteristics, runoff and Hydrograph
CO3	Explain the concept of hydrological extremes such as Flood and Drought and management

	strategies
CO4	Describe the importance of spatial analysis of rainfall and design water storage reservoirs
CO5	Apply the concepts of groundwater for water resources management

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	2	2	-	-	-	2	2	2	2
CO2	3	2	3	3	3	2	-	3	-	2	2	2	2	3	2
CO3	3	3	3	2	3	2	2	2	-	2	3	2	1	2	3
CO4	3	3	3	3	3	3	-	3	-	2	2	3	3	3	3
CO5	2	3	3	2	3	2	-	3	2	3	3	3	2	2	3

CE1014	INTEGRATED WATER RESOURCES MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the students to the interdisciplinary analysis of water and conceptual design of intervention strategies.
- To develop a knowledge-base on capacity building on IWRM.

UNIT I	**IWRM FRAMEWORK**	**9**
Definition, classification, and characteristics of systems - Scope and steps in systems engineering - Need for systems approach to water resources and irrigation. Definition – Objectives – Principles - Evolution of IWRM - IWRM relevance in water resources management – Paradigm shift : Processes and prospective outcomes		**CO1**
UNIT II	**CONTEXTUALIZING IWRM**	**9**
IWRM in Global, Regional and Local water partnership – Institutional transformation - Bureaucratic reforms - Inclusive development		**CO2**
UNIT III	**EMERGING ISSUES IN WATER MANAGEMENT**	**9**
Bellman's optimality criteria, problem formulation and solutions - Application to design and operation of reservoirs, Single and multipurpose reservoir development plans - Case studies. Emerging Issues -– Drinking water management in the context of climate change - IWRM and irrigation - Flood – Drought– Linkages between water, health and poverty		**CO3**
UNIT IV	**IWRM AND WATER RESOURCES DEVELOPMENT IN INDIA**	**9**
Rural Development - Ecological sustainability- -Watershed development and conservation - Ecosystem regeneration – Wastewater reuse - Sustainable livelihood - Food security		**CO4**
UNIT V	**ASPECTS OF INTEGRATED DEVELOPMENT**	**9**
Capacity building - Conceptual framework of IWRM – Problems and policy issues - Solutions for effective integrated water management - Case studies		**CO5**
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Mollinga P. et al. “Integrated Water Resources Management”, Water in South Asia Volume I, Sage Publications, 2006.
2. Sithamparanathan, Rangasamy, A., and Arunachalam, N., “Ecosystem Principles and Sustainable Agriculture”, Scitech Publications (India) Pvt.Lt, Chennai, 1999.

REFERENCE BOOKS

1. Cech Thomas V., Principles of Water Resources: History, Development, Management and Policy. John Wiley and Sons Inc., New York. 2003.
2. Murthy, J.V.S., “Watershed Management in India”, Wiley Eastern Ltd., New York, 1995.
3. Dalte, S.J.C., “Soil Conservation and Land Management”, International Book Distribution, India, 1986.
4. Wagner H.M., "Principles of Operations Research with Application to Management Decisions", Prentice Hall, India, New Delhi, 1993.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand objectives, principles and evolution of integrated water resources management.

CO2	Get an exposure towards well design and practical problems Have an idea of contextualizing IWRM
CO3	Gain knowledge in emerging issues in water management, flood, drought, pollution and poverty.
CO4	Understand the water resources development in India and wastewater reuse.
CO5	Gain knowledge on integrated development of water management.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	-	1	1	-	-	2	-	3	1	-	3	2	2
CO2	2	3	2	2	1	2	2	2	2	3	1	2	2	2	2
CO3	2	2	2	-	2	2	2	3	3	3	1	2	2	2	2
CO4	2	2	2	-	1	-	-	2	2	3	-	2	2	2	2
CO5	2	2	2	1	1	-	-	3	2	3	1	3	3	3	3

CE1015	GROUNDWATER ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the student to the principles of Groundwater governing Equations and Characteristics of different aquifers,
- To understand the techniques of development and management of groundwater.

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 – GECnorms - Steady state flow - Darcy's Law - Groundwater Velocity –- Dupuit Forchheimer assumption – Steady Radial Flow into a Well		CO1
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		CO2
UNIT III	**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		CO3
UNIT IV	**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		CO4
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		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

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.

REFERENCE BOOKS

1. Fitts R Charles, "Groundwater Science". Elsevier, Academic Press, 2002.
2. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand aquifer properties and its dynamics
CO2	Get an exposure towards well design and practical problems
CO3	Students will be able to understand the importance of artificial recharge and groundwater quality concepts.

CO4	Develop a model for groundwater management.
CO5	Gain knowledge on conservation of groundwater.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	1	1	2	3	-	-	1	2	2	2	2
CO2	3	3	3	-	2	2	2	1	-	-	2	2	2	3	2
CO3	2	2	2	-	3	3	2	3	-	-	2	3	3	3	3
CO4	2	2	3	-	3	2	2	2	-	-	3	2	3	3	3
CO5	2	2	2	3	3	3	2	3	3	3	2	2	3	3	3

CE1016	WATER RESOURCES SYSTEMS ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart knowledge and skills relevant to application of systems concept to water resources planning and management. Optimization technique for modeling water resources systems and advanced optimization techniques to cover the socio-technical aspects will be taught.

UNIT I	SYSTEM CONCEPTS	9
Definition, classification, and characteristics of systems - Scope and steps in systems engineering - Need for systems approach to water resources and irrigation.		CO1
UNIT II	**LINEAR PROGRAMMING**	**9**
Introduction to operations research - Linear programming, problem formulation, graphical solution, solution by simplex method - Sensitivity analysis, application to design and operation of reservoir, single and multipurpose development plans - Case studies.		CO2
UNIT III	**DYNAMIC PROGRAMMING**	**9**
Bellman's optimality criteria, problem formulation and solutions - Application to design and operation of reservoirs, Single and multipurpose reservoir development plans - Case studies.		CO3
UNIT IV	**SIMULATION**	**9**
Basic principles and concepts - Random variant and random process - Monte Carlo techniques - Model development - Inputs and outputs - Single and multipurpose reservoir simulation models – Case studies.		CO4
UNIT V	**ADVANCED OPTIMIZATION TECHNIQUES**	**9**
Integer and parametric linear programming - Goal programming models with applications Discrete differential dynamic programming and incremental dynamic programming - Linear decision rule models with application - Stochastic dynamic programming models.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Chaturvedi. M.C., "Water Resources Systems Planning and Management". Tata McGraw Hill, New Delhi, 1997.
2. Mays L.W., and Tung YK, "Hydro systems Engineering and Management". McGraw Hill Inc., New York, 1992.

REFERENCE BOOKS

1. Gupta P.K and Man Mohan, "Problems in Operations Research (Methods and solutions)". Sultan Chand and sons, New Delhi, 1995
2. Hiller F.S and Liebermann G.J., "Operations Research CBS Publications and distributions". New Delhi, 1992.
3. Goodman Alvin S., "Principles of Water Resources Planning", Prentice Hall Inc., Englewood Cliffs, New Jersey, 1995.
4. Course material, "Micro Computer Application to Systems Analysis in Irrigation Water Management", CWR, Anna University, 1992.
5. Wagner H.M., "Principles of Operations Research with Application to Management Decisions", Prentice Hall, India, New Delhi, 1993.

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Define the system concept and steps in systems approach for the water resources engineering.
CO2	Apply the knowledge of optimisation techniques such as Linear programming and simplex method for reservoir operation.
CO3	Explain single and multipurpose reservoir optimisation using dynamic programming
CO4	Develop the simulation model based on deterministic and stochastic simulation for reservoir operating policy
CO5	Apply the creative and advance optimisation techniques like goal programming, heuristic algorithm in the field of water planning and management.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	2	-	-	-	-	3	2	2	2
CO2	3	2	-	-	-	3	-	3	-	-	2	2	2	3	2
CO3	3	3	2	-	2	2	-	2	-	-	3	2	1	3	3
CO4	3	3	3	-	3	3	-	3	-	2	2	3	3	3	3
CO5	3	3	3	3	3	3	-	3	2	-	3	3	3	3	3

CE1017	DESIGN OF PLATE AND SHELL STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the design of plate and shell and spatial structures

UNIT I	THIN PLATES WITH SMALL DEFLECTION	9
Laterally loaded thin plates - Governing differential equation, various boundary conditions.		CO1
UNIT II	**RECTANGULAR PLATES**	**9**
Simply supported rectangular plates - Navier solution and Levy's method – Loading.		CO2
UNIT III	**ANALYSIS OF THIN SHELLS**	**9**
Shells of revolution – Spherical dome, Conical shell and ellipsoid of revolution – Shells of translation – Cylindrical shell and hyperbolic paraboloid - Classification of shells - Types of shells - Structural action		CO3
UNIT IV	**DESIGN OF SHELLS**	**9**
Spherical dome, conical shell and Cylindrical shell.		CO4
UNIT V	**SPACE FRAMES**	**9**
Space Frames – Configuration – Node connector- Types – General principles of design philosophy– Behaviour		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. P.C.Varghese, Design of Reinforced Concrete Shells and Folded Plates, PHI Learning Private Limited, New Delhi, 2010.
2. R.Szilard, Theory and Analysis of Plates, Prentice Hall Inc., 1995.

REFERENCE BOOKS

1. Billington D.P. Thin Shell Concrete Structures, McGraw Hill, 1995.
2. Chatterjee B.K. Theory and design of Concrete Shells, Oxford and IBH Publishing Co., New Delhi 1998.
3. N.Subramanian, Principles of Space Structures, Wheeler Publishing Co. 1999.
4. Maan Jawad, Theory and Design of Plate and Shell Structures, 1994.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Assess the strength of thin plates under different types of loads.
CO2	Analyze thin plates using Navier's method and Levy's method.
CO3	Analyze circular plates under axis - symmetric deflection.
CO4	Classify different types of shells and study their behavior.
CO5	Analyze space frame.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	1	1	1	1	2	1	1	1	2	1	2
CO2	3	2	3	1	1	1	1	1	1	1	1	1	2	1	2
CO3	3	2	3	1	1	1	1	1	1	1	1	1	2	1	2
CO4	2	2	3	1	1	1	1	1	1	1	1	1	2	1	2
CO5	2	2	3	1	1	1	1	1	1	1	1	1	2	1	2

CE1018	PRESTRESSED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the behaviour and performance of prestressed concrete structures.
- To Compare the behaviour of prestressed concrete members with that of the normal reinforced concrete structures.
- To Understand the performance of composite members.
- To learn the design of prestressed concrete structures.

UNIT I	INTRODUCTION	9
Basic concepts–Advantages–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.		CO1

UNIT II	DESIGN FOR FLEXURE AND SHEAR	9
Basic assumptions for calculating flexural stresses–Permissible stresses in steel and concrete as perI.S.1343Code–Design of sections of Type I and Type II post-tensioned and pre-tensioned beams–Check for strength limit based on I.S. 1343 Code –Layout of cables in post-tensioned beams–Location of wires in pre-tensioned beams –Design for shear based onI.S.1343Code.		CO2

UNIT III	DEFLECTION AND DESIGN OF ANCHORAGE ZONE	9
Factors influencing deflections–Short term deflections of uncracked members–Prediction of long-term deflections due to creep and shrinkage–Check for serviceability limit state of deflection. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and IS1343code–design of anchorage zone reinforcement– Check for transfer bond length in pre-tensioned beams.		CO3

UNIT IV	COMPOSITE BEAMS AND CONTINUOUS BEAMS	9
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.		CO4

UNIT V	MISCELLANEOUS STRUCTURES	9
Design of tension and compression members– Tanks, pipes and poles – Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.		CO5

TOTAL : 45 PERIODS

TEXT BOOKS

1. KrishnaRaju 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.

REFERENCE BOOKS

1. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2002.
2. Dayaratnam.P., SarahP, Prestressed Concrete Structures, Seventh Edition, Oxford and IBH,

2017.

3. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., NewDelhi,2013.
4. Sinha.N.C. And Roy.S.K. Fundamentals of Prestressed Concrete, S.Chand and Co. Ltd.,2011.
5. IS 1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, 2012

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Design a prestressed concrete beam accounting for losses.
CO2	Design for flexure and shear.
CO3	Design the anchorage zone for post tensioned members and deflection in beams.
CO4	Design composite members and continuous beams.
CO5	Design water tanks, pipes and poles.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	-	-	2	-	-	1	1	-	1	3	-	3
CO2	3	2	3	-	-	1	-	-	1	1	-	1	3	-	3
CO3	3	2	3	-	-	1	-	-	1	1	-	1	3	-	3
CO4	2	2	3	-	-	1	-	-	1	1	-	1	3	-	3
CO5	2	2	3	-	-	1	-	-	1	1	-	1	3	-	3

CE1019	INDUSTRIAL STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES

To learn the planning, layout, functional aspects of industries and design of major steel and R.C structures needed for industries.

UNIT I	PLANNING	9
Classification of industries and industrial structures – Site Planning and Selection – Exterior and interior Layout for Industries and buildings - Guidelines from factories act.		CO1
UNIT II	**FUNCTIONAL REQUIREMENTS**	**9**
Lighting – Ventilation – Noise and Vibration control – Fire safety		CO2
UNIT III	**DESIGN OF STEEL STRUCTURES**	**9**
Pre-engineered and Mill buildings – Transmission Lines Towers – plate girders. Bunkers and Silos – pipe/cable racks- Chimney.		CO3
UNIT IV	**DESIGN OF R.C. STRUCTURES**	**9**
Corbels, Brackets and Nibs - Silos and bunkers –Chimney –Cooling Towers (Principles only)		CO4
UNIT V	**PREFABRICATION**	**9**
Principles of prefabrication and pre cast construction – Prestressed precast roof trusses – Floor slabs - Wall panels- Handling and erection stresses –joints in precast structures.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Ramamrutham.S., Design of Reinforced Concrete Structures, Dhanpat Rai Publishing Company, 2007.
2. Varghese.P.C., Advanced Reinforced Concrete Design, PHI, Eastern Economy Editions, Second Edition, 2005.
3. Subramanian, N., Design of Steel Structures, Oxford University Press, 2008.

REFERENCE BOOKS

1. Henn W. Buildings for Industry, Vol.I and II, London Hill Books, 1995
2. Handbook on Functional Requirements of Industrial buildings, SP32–1986, Bureau of Indian Standards, 1990.
3. Handbook of Industrial Lighting, Stanley L.Lyons, Butterworths, London.1981
4. Koncz, J., Manual of Precast Construction Vol. I and II, Bauverlay GMBH, 1971.
5. Ramachandra and Virendra Gehlot, Design of steel structures –Vol. 2, Scientific Publishers, 2012.
6. Handbook on Precast Construction, An Indian Concrete Institute Publication, 2016.9. IS Code 15284 (Part 1): 2003 “Design and Construction for Ground Improvement – Guidelines” (Stone Column), Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Know the requirements of various industries and get an idea about the materials used and planning of various industrial components.

CO2	Acquire the functional requirements for industrial structures.
CO3	Design special steel structures like bunkers, silos, crane girders, chimneys and pre-engineered buildings.
CO4	Design special RC structures like corbels, silos, bunkers, chimneys, plates and shells.
CO5	Understand the principles of prefabrication and prestressing

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	-	-	2	1	1	-	-	-	2	3	-	2
CO2	3	2	3	-	-	2	1	1	-	-	-	1	3	-	2
CO3	3	2	3	-	-	2	1	1	-	-	-	2	3	-	2
CO4	2	2	3	-	-	2	1	1	-	-	-	2	3	-	2
CO5	2	2	3	-	-	2	1	1	-	-	-	1	3	-	2

CE1020	MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To acquire the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures

UNIT I	MAINTENANCE AND REPAIR STRATIGES	9
Maintenance, Repair and Rehabilitation - Facets of Maintenance - Importance of Maintenance - Various aspects of Inspection - Assessment procedure for evaluating a damaged structure - causes of deterioration.		CO1
UNIT II	**STRENGTH AND DURABILITY OF CONCRETE**	**9**
Quality assurance for concrete – Strength, Durability, of concrete - Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated, Corrosion - Effects of cover thickness.		CO2
UNIT III	**SPECIAL CONCRETES**	**9**
Polymer concrete - Sulphur infiltrated concrete - Fibre reinforced concrete - High strength concrete - High performance concrete - Vacuum concrete - Self compacting concrete – Geopolymer concrete - Reactive powder concrete - Concrete made with industrial wastes.		CO3
UNIT IV	**TECHNIQUES FOR REPAIR AND PROTECTION METHODS**	**9**
Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.		CO4
UNIT V	**REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES**	**9**
Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage and earthquake - Demolition techniques - Engineered demolition methods - Case studies.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Shetty.M.S. Jain A K., Concrete Technology - Theory and Practice, S.Chand and Company, Eighth Edition, 2019.
2. B.Vidivelli, Rehabilitation of Concrete Structures Standard Publishes Distribution.1st edition 2009.

REFERENCE BOOKS

1. Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.
2. Hand Book on “Repair and Rehabilitation of RCC Buildings” – Director General works CPWD ,Govt of India , New Delhi – 2002
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

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Know the importance of inspection and maintenance.
CO2	Study the Impacts of cracks, corrosion and climate on structures.

CO3	Know about High Performance concrete.
CO4	Understand the materials and techniques needed for repairs.
CO5	Know the failures of the structures and demolition techniques.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	2	1	3	2	1	2	1	2	2
CO2	3	3	3	2	3	2	2	1	2	2	2	1	2	3	2
CO3	3	3	2	2	2	1	2	1	2	1	1	2	2	1	2
CO4	3	3	2	2	2	1	1	1	1	1	1	3	2	2	1
CO5	3	3	3	3	2	1	2	1	3	1	1	3	3	2	2

CE1021	POWERPLANT STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To gain knowledge about principles, planning, layout, structural requirements and analysis of power plants.

UNIT I	FUNDAMENTALS OF POWER PLANTS	9
Introduction – Classification of Power Plants – Principles of Power Plant – Lay out of Power Plant Building – Selection of type of generation – Resources for power generation – Machine foundation.		CO1
UNIT II	**HYDRO ELECTRIC POWER PLANTS**	**9**
Elements of hydro-electric power plants – Advantages and disadvantages of water power - General and essential elements of Hydro electric Power Plant – Structural requirements – Selection of site for hydroelectric plant – Penstocks and surge Tanks in Power Station.		CO2
UNIT III	**THERMAL POWER PLANTS**	**9**
Planning, Analysis of thermal power plants – Layout – Ash handling – Dust collection – Induced draught and natural cooling towers – Air/water pollution by thermal power plants.		CO3
UNIT IV	**NUCLEAR POWER PLANTS**	**9**
General characteristics of Nuclear Power Plants – Classification of reactors – Pressurized Water Reactor, Boiling Water Reactor, Fusion Power Reactor, Heavy Water Reactor - Selection criteria of materials for different systems – Containment structures – Nuclear power plant safety measures –Safety systems and support systems.		CO4
UNIT V	**NON CONVENTIONAL POWER PLANTS**	**9**
Types – Wind power plants – Selection of wind mill – Tidal power plants – Solar thermal power plants – Geothermal power plants – Principles and essential features.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. S.C. Sharma and G.R. Nagpal, Power Plant Engineering, Khanna Publishers, 2013.
2. Raja A.K, Amit Prakash Srivastava and Manish Dwivedi, Power Plant Engineering, New Age International Publishers, 2013.

REFERENCE BOOKS

1. R.K Rajput, Power Plant Engineering, Fifth Edition, 2016.
2. P.C Sharma, power Plant Engineering, S.K. Kataria & Sons; 2013.
3. Wei Tong, Wind Power Generation and Wind Turbine Design, WIT Press / Computational Mechanics, First edition, 2010.
4. Dipak k Sarkar,Thermal Power plant: Design and Operation,Elsevier Publisher 2015.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Explain the principles, layout and functional aspects of a power plant structure.
CO2	Analyze and design the layout and components of hydroelectric power plant.
CO3	Explain, analyze and design the layout and components of Thermal power plant.
CO4	Explain the functioning of a nuclear power plant and design its components.

CO5	Develop an understanding of the various non-conventional sources of energy and design the layout and components.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	-	-	-	1	1	2	-	-	1	3	-	2
CO2	3	2	3	-	-	-	1	1	1	-	-	1	3	-	2
CO3	3	2	3	-	-	-	1	1	1	-	-	1	3	-	2
CO4	2	2	3	-	-	-	1	1	1	-	-	1	3	-	2
CO5	2	2	3	-	-	-	1	1	1	-	-	1	3	-	2

CE1022	PREFABRICATED STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the principles of prefabrication, behaviour and design of prefabricated components and structural connections.
- To appreciate modular construction and industrialised construction

UNIT I	INTRODUCTION	9
Need for prefabrication - Principles- Materials - Modular co-ordination – Standardization – Systems Production – Transportation – Erection - Disuniting of Structures.		CO1
UNIT II	**PREFABRICATED COMPONENTS**	**9**
Behavior of structural components–Large panel constructions–Construction of roof, floor slabs and Wall panels–Columns–Shear walls.		CO2
UNIT III	**DESIGN PRINCIPLES**	**9**
Design of Structural components–Beam, Column and Corbel-Stress limitations–Handling without cracking, handling with controlled cracking–Design for stripping forces.		CO3
UNIT IV	**JOINTS IN STRUCTURAL MEMBERS**	**9**
Joints for different structural connections–Beam to Column, Beam to Beam, Column to Column, Column to Foundation, Connections between wall panels, Connections between floor panels-Dimensions and detailing–Design of expansion joints-Jointing Materials.		CO4
UNIT V	**DESIGN FOR EARTHQUAKES AND CYCLONES**	**9**
Progressive collapse–Codal provisions–Equivalent design loads for considering abnormal effects such as earthquakes, cyclones etc.-Importance of avoidance of progressive collapse.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Hubert Bachmann and Alfred Steinle , Precast Concrete Structures, 2012.
2. Laszlo Mokk, Prefabricated Concrete for Industrial and Public Structures, Akademiai Kiado, Budapest, 1964.

REFERENCE BOOKS

1. PCI Design Hand Book, 6th Edition, 2004.
2. Handbook on Precast Concrete for Buildings, ICI Bulletin 02, First Edition, 2016.
3. A.S.G. Bruggeling and G.F.Huyghe, Prefabrication with concrete, Netherlands: A.A.Balkema Publishers, 1991.
4. Glover C.W, Structural Precast Concrete, Asia Publishing House, 1965.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the principles of modular coordination
CO2	Know the construction of roof and floors
CO3	Design for stripping forces
CO4	Identify the different types of connections between structural members
CO5	Understand the concept of progressivecollapse

MAPPING OF COs WITH POs AND PSOs															
COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	-	-	2	-	-	1	1	-	1	3	-	2
CO2	3	2	3	-	-	1	-	-	1	1	-	1	3	-	2
CO3	3	2	3	-	-	1	-	-	1	1	-	1	3	-	2
CO4	2	2	3	-	-	1	-	-	1	1	-	1	3	-	2
CO5	2	2	3	-	-	1	-	-	1	1	-	1	3	-	2

CE1023	TALL STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the design philosophy of tall buildings, the loading and behaviour of structural systems.

UNIT I	DESIGN CRITERIA AND MATERIALS	9
Design Philosophy - Modern concepts – Materials used - High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self-Compacting Concrete, High strength steel, Composites.		CO1
UNIT II	**LOADING**	**9**
Gravity Loading – Dead load, Live load – Live load reduction techniques, Impact load, Construction load, Sequential loading. Wind Loading – Static and Dynamic Approach, Analytical method, Wind Tunnel Experimental methods. Earthquake Loading – Equivalent lateral Load analysis, Dynamic Analysis, Combination of Loads.		CO2
UNIT III	**BEHAVIOUR OF STRUCTURAL SYSTEMS**	**9**
Factors affecting the growth, height and structural form, Behaviour of Braced frames, Rigid Frames, in filled frames, Shear walls, Coupled Shear walls, Wall – Frames, Tubular and Outrigger – Hybrid systems		CO3
UNIT IV	**ANALYSIS**	**9**
Modeling for approximate analysis, accurate analysis and reduction techniques, Analysis of structures as an integral unit, Analysis for drift and twist. Computerized 3D analysis.		CO4
UNIT V	**DESIGN PARAMETERS**	**9**
Design for differential movement, Creep and Shrinkage effects, Temperature Effects and Fire Resistance, Stability of Tall Structures - PΔ Effects, Buckling analysis of Tall Buildings.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Bryan Stafford Smith and Alex Coull, Tall Building Structures, Analysis and Design, John Wiley and Sons, Inc., 2011.
2. Taranath B.S, Structural Analysis and Design of Tall Buildings: Steel and Composite Construction, McGraw Hill, 2011.

REFERENCE BOOKS

1. Lin T.Y. and Burry D.Stotes, Structural Concepts and Systems for Architects and Engineers, John Wiley, 1994.
2. Lynn S.Beedle, Advances in Tall Buildings, CBS Publishers and Distributors, Delhi, 1996.
3. Wolfgang Schuler, High Rise Building Structures, John Wiley & Sons, New York, 1986.
4. Kolousek V, Pimer M, Fischer O and Naprstek J, Wind effects on Civil Engineering Structures. Elsevier Publications.1984.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Explain the design aspects and the various innovative materials which can be used for the construction of tall buildings
CO2	Apply the knowledge of engineering fundamentals to characterize various types of loading

	which could be considered for the analysis of tall building.
CO3	Identify various structural systems, their behavior and performance under different loading conditions.
CO4	Analyze the structures as an integral unit for drift and twist.
CO5	Design tall structures under different conditions like stability considerations, creep, shrinkage, and temperature and fire resistance.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1	1	1	1	3	1	1	1	1	1	1	2	2
CO2	3	3	3	3	3	3	1	3	1	1	1	1	2	2	2
CO3	1	2	2	1	2	1	1	1	1	1	1	1	3	1	3
CO4	1	3	2	1	3	2	1	1	2	1	1	1	3	3	2
CO5	1	3	3	2	2	2	1	1	2	2	1	1	3	2	2

CE1024	ASEISMIC DESIGN OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the behaviour of structures under dynamic, earthquake loading and design the structures as earthquake resistant as per codal provisions.

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 system – D'Alemberts Principles - Effect of damping – Free and forced vibration of damped and undamped structures – Response to harmonic forces and periodic loading.		CO1
UNIT II	**MULTI DEGREE OF FREEDOM SYSTEM**	**9**
Formulation of equation of motion for multidegree of freedom (MDOF) system – Evaluation of natural frequencies and modes – Eigen values and Eigen vectors – Orthogonality and normality principles – Response to free and forced vibration of undamped and damped MDOF systems – Modal superposition methods		CO2
UNIT III	**INTRODUCTION TO EARTHQUAKE ENGINEERING**	**9**
Elements of Engineering Seismology – Definitions, Introduction to Seismic hazard, Earthquake phenomenon – Seismotectonics – Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters – Soil Structure Interaction.		CO3
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 – Liquefaction of soil – Response Spectra – Causes of damage – Lessons learnt from past earthquakes.		CO4
UNIT V	**CONCEPTS OF EARTHQUAKE RESISTANT DESIGN**	**9**
Planning considerations and Architectural concepts – Evaluation of Earthquake forces – Static load method, Response spectrum method – Guidelines for Earthquake resistant design – Earthquake resistant design of masonry and RCC buildings - Design considerations – Guidelines– Design and detailing		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Mario Paz, Structural Dynamics – Theory and Computations, Fifth Edition 2nd printing, CBS publishers, 2006.
2. Agarwal.P and Shrikhande.M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2011.

REFERENCE BOOKS

1. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.138
2. Minoru Wakabayashi, Design of Earthquake Resistant Buildings, Mc Graw – Hill Book Company, 1986.

3. Anil K Chopra, Dynamics of structures – Theory and applications to Earthquake Engineering,Prentice Hall Inc., 2007.
4. Moorthy.C.V.R., Earthquake Tips, NICEE, IIT Kanpur,2002.
5. IS 4326: 2013 Earthquake Resistant Design And Construction Of Buildings – Code Of Practice
6. IS 1893: 2016 Criteria For Earthquake Resistant Design Of Structures – Part 1 General Provision And Buildings.
7. IS 13920:2016 Ductile Design And Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces – Code Of Practice.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Apply the knowledge of science and engineering fundamentals to idealize and formulate the equations of motion for SDOF system
CO2	Develop the equations of motion for MDOF system and to evaluate the natural frequencies and mode shapes.
CO3	Explain the elements of engineering seismology, characteristics of earthquake and seismic instrumentation.
CO4	To identify the various causes and effects of earthquakes on structures due to past earthquakes.
CO5	To analyse the structures subjected to dynamic loading and to design for seismic loading as per codal provisions.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	2	3	2	1	3	1	-	1	3	2	1
CO2	3	3	3	2	2	3	2	1	3	1	-	1	3	2	1
CO3	3	1	1	1	-	3	1	2	1	-	-	1	3	2	1
CO4	3	2	3	2	2	3	2	3	3	3	2	1	3	2	1
CO5	3	3	3	3	3	3	2	3	3	3	2	1	3	2	1

CE1025	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I	INTRODUCTION TO DISASTERS	9
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc – Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability – Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.		CO1
UNIT II	**APPROACHES TO DISASTER RISK REDUCTION**	**9**
Disaster cycle – Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.		CO2
UNIT III	**INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT**	**9**
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India – Relevance of indigenous knowledge, appropriate technology and local resources.		CO3
UNIT IV	**DISASTER RISK MANAGEMENT IN INDIA**	**9**
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy – Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.		CO4
UNIT V	**DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS**	**9**
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Singhal J.P. Disaster Management, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, Disaster Science and Management, McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCE BOOKS

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Differentiate the types of disasters, causes and their impact on environment and society
CO2	Assess vulnerability and various methods of risk reduction measures as well as mitigation
CO3	enhance awareness of institutional processes in the country
CO4	develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity
CO5	Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	0	0	0	2	2	1	3	0	1	2	0	0	2
CO2	3	2	0	0	0	2	2	1	2	0	2	1	0	0	2
CO3	3	2	0	0	0	1	2	1	2	0	1	2	0	0	2
CO4	3	2	0	0	0	1	1	1	1	0	1	3	0	0	1
CO5	3	2	0	0	0	1	2	1	3	0	1	3	0	0	2

CE1026	GEO-ENVIRONMENTAL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- The student acquires the knowledge on the Geotechnical engineering problems associated with soil contamination, safe disposal of waste and remediate the contaminated soils by different techniques thereby protecting environment.

UNIT I	GENERATION OF WASTES AND CONSQUENCES OF SOIL POLLUTION	9
Introduction to Geo environmental engineering – Environmental cycle – Sources, production and classification of waste – Causes of soil pollution – Factors governing soil pollution interaction clay minerals - Failures of foundation due to waste movement.		CO1
UNIT II	**SITE SELECTION AND SAFE DISPOSAL OF WASTE**	**9**
Safe disposal of waste – Site selection for landfills – Characterization of land fill sites and waste – Risk assessment – Stability of landfills – Current practice of waste disposal – Monitoring facilities – Passive containment system – Application of geosynthetics in solid waste management – Rigid or flexible liners.		CO2
UNIT III	**TRANSPORT OF CONTAMINANTS**	**9**
Contaminant transport in sub surface – Advection, Diffusion, Dispersion – Governing equations – Contaminant transformation – Sorption – Biodegradation – Ion exchange – Precipitation – Hydrological consideration in land fill design – Ground water pollution.		CO3
UNIT IV	**WASTE STABILIZATION**	**9**
Stabilization - Solidification of wastes – Micro and macro encapsulation – Absorption, Adsorption, Precipitation – Detoxification – Mechanism of stabilization – Organic and inorganic stabilization – Utilization of solid waste for soil improvement.		CO4
UNIT V	**REMEDIATION OF CONTAMINATED SOILS**	**9**
Exsitu and insitu remediation-Solidification, bio-remediation, incineration, soil washing, electro kinetics, soil heating, vetrification, bio-venting.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

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

REFERENCE BOOKS

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

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand basic knowledge of concepts and principles of Geo-environmental Engineering.
CO2	Select site for safe disposal of waste.

CO3	Aware of soil stabilization by utilizing solid waste.
CO4	Assess the contamination in the soil and to select suitable remediation methods based on contamination.
CO5	Prepare the suitable disposal system for particular waste.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	2	1	1	1	3	1	3	1	2	3	3	3	2
CO2	3	1	3	3	2	3	3	1	3	1	1	3	2	2	3
CO3	3	2	2	3	2	3	3	1	3	1	1	3	2	2	3
CO4	2	1	3	3	3	3	3	1	3	1	1	3	2	2	3
CO5	3	1	3	2	3	3	3	1	3	1	1	3	2	3	2

CE1027	GROUND IMPROVEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES

- Students will be exposed to various problems associated with soil deposits and methods to evaluate them. The different techniques will be taught to them to improve the characteristics of difficult soils as well as design techniques required to implement various ground improvement methods.

UNIT I	PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES	9
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.		CO1
UNIT II	**DEWATERING**	**9**
Dewatering Techniques - Well points – Vacuum and electroosmotic methods – Seepage analysis for two dimensional flow for fully and partially penetrated slots in homogeneous deposits – Design for simple cases.		CO2
UNIT III	**INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS**	**9**
In-situ 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.		CO3
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.		CO4
UNIT V	**GROUTING TECHNIQUES**	**9**
Types of grouts – Grouting equipment's and machinery – Injection methods – Grout monitoring –Stabilization with cement, lime and chemicals – Stabilization of expansive soil.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

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.

REFERENCE BOOKS

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 India Pvt.Ltd. New Delhi, 2011.
7. Koerner, R.M., “Designing with Geosynthetics” (Sixth Edition), Xlibris Corporation, U.S.A, 2012.
8. Relevant IS Codes.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Gain knowledge on methods and selection of ground improvement techniques.
CO2	Acquire dewatering techniques and design for simple cases.
CO3	Get knowledge on in-situ treatment of cohesionless and cohesive soils.
CO4	Get knowledge on in-situ treatment of cohesionless and cohesive soils.
CO5	Get to know types of grouts and grouting technique.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	-	3	1	2	-	-	-	3	3	-	2
CO2	3	3	2	2	-	3	1	2	-	-	-	3	3	-	2
CO3	2	3	3	2	-	3	1	2	-	-	-	3	3	-	2
CO4	3	2	3	3	-	3	1	2	-	-	-	3	3	-	2
CO5	3	3	2	2	-	3	1	2	-	-	-	3	3	-	2

CE1028	SOIL DYNAMICS AND MACHINE FOUNDATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basics of dynamics – dynamic behaviour of soils – effects of dynamic loads and the various design methods.

UNIT I	THEORY OF VIBRATION	9
Nature dynamic loads – Vibrations of single degree freedom system – Free vibrations of spring – mass systems – Forced vibrations – Viscous damping - Transmissibility – Principles of vibration measuring instruments – Effect of Transient and Pulsating loads		CO1
UNIT II	**WAVE PROPAGATION**	**9**
Elastic waves in rods of infinite length – Longitudinal and Torsional – Effect of end conditions – Longitudinal and torsional vibrations of rods of finite length – Wave Propagation in infinite, homogeneous isotropic and elastic medium - Wave propagation in elastic half space – Typical values of compression wave and shear wave velocity – Wave propagation due to Machine foundation – Surface wave – Typical values – Particle movements and velocity.		CO2
UNIT III	**DYNAMIC PROPERTIES OF SOILS**	**9**
Dynamic stress – Strain characteristics – Principles of measuring dynamic properties – Laboratory Techniques – Field tests – Factors affecting dynamic properties – Typical values – Dynamic bearing capacity – Dynamic earth pressure.		CO3
UNIT IV	**FOUNDATION FOR DIFFERENT TYPES OF MACHINES**	**9**
Types of machines and foundation – General requirements – Modes of vibration of a rigid foundation – Method of analysis – Linear elastic weightless spring method – Elastic half space method – Analog Method – Design of block foundation – Special consideration for rotary, Impact type of machines – Codal Provisions.		CO4
UNIT V	**INFLUENCE OF VIBRATION AND REMEDIATION**	**9**
Mechanism of Liquefaction – Influencing factors – Evaluation of Liquefaction potential based on SPT-Force Isolation – Motion Isolation – Use of spring and damping materials – Vibration control of existing machine foundation – Screening of vibration – Open trenches – Pile Barriers – Salient construction aspects of machine Foundations.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Swamisaran, “Soil Dynamics and Machine Foundations”, Galgotia Publications Pvt.Ltd. (Second Edition) 2006, (Reprint 2010), New Delhi-110002
2. Srinivasulu. P, and Vaidyanathan. C. V, “Handbook of Machine Foundations”, Tata McGraw-Hill, 2007

REFERENCE BOOKS

1. Kamaswara Rao., “Vibration Analysis and Foundation Dynamics”, Wheeler Publishing, New Delhi, 1998.
2. Kameswara Rao., “Dynamics Soil Tests and Applications”, Wheeler Publishing, New Delhi, 2003.
3. Moore, P.J., “Analysis and Design of Foundation for Vibration”, Oxford and IBH, 2005
4. Steven L. Kramer, “Geotechnical Earthquake Engineering”, Prentice Hall, 2014.

COURSE OUTCOMES

Upon completion of the course, students will be able to	
CO1	Have the basic knowledge about the theory of vibration.
CO2	Understand the different types of waves and its behaviour.
CO3	Have enough knowledge about various laboratory and field tests to determine
CO4	Assess the contamination in the soil and to select suitable remediation methods based on contamination.
CO5	Assess the influence of vibrations and selection of remediation methods based on the nature of vibration, properties and behaviour of soil.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	1	3	1	3	1	1	2	1	2	2
CO2	3	3	1	1	1	1	3	1	3	1	1	1	2	3	2
CO3	3	2	3	2	3	1	3	1	3	1	1	2	2	1	2
CO4	3	3	3	1	1	1	3	1	3	1	1	3	2	2	1
CO5	3	1	2	1	1	2	2	1	3	1	1	3	3	2	2

CE1029	ROCK MECHANICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart knowledge on fundamentals of rock mechanics and its application in solving simple problems associated with rock slopes and underground openings.
- Student gains the knowledge on the mechanics of rock and its applications in underground structures and rock slope stability analysis.

UNIT I	CLASSIFICATION AND INDEX PROPERTIES OF ROCKS	9
Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose – Rock Mass Rating and Q System.		CO1
UNIT II	**ROCK STRENGTH AND FAILURE CRITERIA**	**9**
Modes of rock failure – Strength of rock – Laboratory measurement of shear, tensile and compressive strength. Stress - strain behaviour of rock under compression – Mohr -Coulomb failure criteria and empirical criteria.		CO2
UNIT III	**INITIAL STRESSES AND THEIR MEASUREMENTS**	**9**
Estimation of initial stresses in rocks – influence of joints and their orientation in distribution of stresses – measurements of in-situ stresses – Hydraulic fracturing – Flat jack method – Over coring method.		CO3
UNIT IV	**APPLICATION OF ROCK MECHANICS IN ENGINEERING**	**9**
Simple engineering application – Underground openings – Rock slopes – Foundations and mining subsidence.		CO4
UNIT V	**ROCK STABILISATION**	**9**
Introduction – Rock support and Rock reinforcement – Principles – Support reaction curves – Shotcreting.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Goodman, P.E. “Introduction to Rock Mechanics”, John Wiley and Sons, 1999.
2. Ramamurthy. T., “Engineering in Rocks for Slopes, Foundation and Tunnels: (Third Edition), PHI Learning Private Limited, New Delhi, 2014.

REFERENCE BOOKS

1. Brown, E.T. “Rock Characterization Testing and Monitoring”. Pergaman Press 1991.
2. Arogyaswamy, R.N.P., Geotechnical Application in Civil Engineering”, Oxford and IBH, 1991.
3. Hook E.and Bray J., Rock slope Engineering, Institute of Mining and Metallurgy”, U.K.2004.
4. Brady, B.H.G. and Brown, E.T., Rock mechanics for underground mining (Third Edition), Kluwer Academic Publishers, Dordrecht, 2006.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Have the knowledge in characterizing and rating the rock mass.
CO2	Arrive at the behaviour of rock for the given project.
CO3	Calculate the insitu stresses of rock.
CO4	Design underground excavation, open excavation and sub-structures.

CO5	Design suitable support system under unstable condition.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	1	1	2	1	2	3	2	1	3
CO2	3	3	2	2	2	1	1	1	2	1	2	3	2	1	3
CO3	3	3	2	2	2	1	1	1	2	1	2	3	2	1	3
CO4	3	3	2	2	2	1	1	1	2	1	2	3	2	1	3
CO5	3	3	2	2	2	1	1	1	2	1	2	3	2	1	3

CE1030	COASTAL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- The main purpose of coastal engineering is to protect harbors and improve navigation.
- The students to the diverse topics as wave mechanics, wave climate, shoreline protection methods and laboratory investigations using model studies.

UNIT I	INTRODUCTION TO COASTAL ENGINEERING	9
Indian Scenario - Classification of Harbours. Introduction - wind and waves - Sea and Swell - Introduction to small amplitude wave theory - use of wave tables- Mechanics of water waves - Linear (Airy) wave theory, Introduction to Tsunami		CO1
UNIT II	**WAVE PROPERTIES AND ANALYSIS**	**9**
Behaviour of waves in shallow waters, Introduction to non-linear waves and their properties - Waves in shallow waters - Wave Refraction, Diffraction and Shoaling -Hindcast wave generation models, wave shoaling; wave refraction; wave breaking; wave diffraction random and 3D waves. Short term wave analysis - wave spectra and its utilities - Long term wave analysis- Statistics analysis of grouped wave data.		CO2
UNIT III	**TYPES AND WAVE TRANSFORMATION**	**9**
Tide analysis and prediction, storm surge, seiches and seasonal fluctuations - Long term water level fluctuations – Wave shoaling; wave refraction; wave breaking; wave diffraction		CO3
UNIT IV	**COASTAL DEFENSE**	**9**
Field measurement; models, groins, sea walls, offshore breakwaters, artificial nourishment - planning of coast protection works - Design of shore defense structures -Case studies.		CO4
UNIT V	**MODELING IN COASTAL ENGINEERING**	**9**
Physical modeling in Coastal Engineering - Limitations and advantages - Role of physical modeling in coastal engineering - Numerical modeling - Modeling aspects - limitations - Case studies using public domain models, Tsunami mitigation measures – Introduction to DPSIR Approach		CO5
	TOTAL : 45 PERIODS	

TEXT BOOKS

1. Mani J.S., Coastal Hydrodynamics. PHI Pvt.Ltd. New Delhi - 2012.
2. Dean, R.G. and Dalrymple, R.A., Water wave mechanics for Engineers and Scientists, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1994

REFERENCE BOOKS

1. Ippen, A.T., Estuary and Coastline Hydrodynamics, McGraw-Hill, Inc., New York, 1978.
2. Sorenson, R.M., Basic Coastal Engineering, A Wiley-Interscience Pub. New York, 1978.
3. Coastal Engineering Manual, Vol. I-VI, Coastal Engineering Research Centre, Dept. of the Army, US Army Corps of Engineers, Washington DC, 2006

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Describe the problems associated with Indian coast. Apply Linear wave theory and use wave tables for solving the dispersion equation.
CO2	Distinguish between linear and non-linear wave theories. Solve problems on wave transformations. Apply probability theory for wave analysis.
CO3	Types of waves, wave shoaling, diffraction, refraction

CO4	Model and design shore defense structures and describe the problems from reliability and risk perspective.
CO5	Compare and contrast physical and mathematical coastal models and critique the advantages and disadvantages between them.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	2	-	-	-	-	3	3	1	1
CO2	3	2	-	-	-	3	-	3	-	-	-	2	3	3	1
CO3	3	3	2	-	2	2	2	2	2	2	2	2	2	3	3
CO4	3	3	3	-	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3

CE1031	COASTAL ZONE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To be able to "see" the features and components of the natural, engineering and human aspects of the coast, the function of component and relationship between them.
- To be able to interpretation and analysis of coastal issues to determine appropriate approaches in coastal management.
- To be able to understand the need for coastal zone management and to develop an ICM plan.

UNIT I	COASTAL ZONE	9
Coastal Zone – Beach Profile – Surf Zone – Off Shore – Coastal Waters – Coastal sediments-Estuaries – Wet Lands And Lagoons – Coastal dunes-Coastal Geomorphology.		CO1
UNIT II	**COASTAL RESOURCES**	**9**
Types and functions of coastal and marine resources- Renewable and Non- Renewable resources – living marine resources and Nonliving marine resources-Marine minerals-placer deposits-hydrocarbon deposits-polymetallic nodules.		CO2
UNIT III	**COASTAL ECOSYSTEM**	**9**
Marine ecosystem: Mangroves- Sea grass -seaweeds - coral reef- Large marine ecosystem-Climate effects on living marine resources- Biological monitoring of marine ecosystem- Human impacts on marine ecosystem.		CO3
UNIT IV	**COASTAL PROCESSES**	**9**
Erosion And Depositional Shore Features – Methods Of Protection – Littoral Currents – Coastal Aquifers – Sea Water Intrusion – Impact Of Sewage Disposal In Seas.		CO4
UNIT V	**COASTAL REGULATIONS**	**9**
Introduction- What is ICM- Developing an ICM framework- Principles-Goals-defining boundaries- Coastal regulations for main land India – coastal regulations for Islands-introduction to Environmental Law and policy.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. NCSCM straigies and guideline for National implementation of Integrated Coastal zone management, 2013
2. Ramesh R and Purvaja R , E- learning moduleon ICZM for UNESCO-IHE, The Netherlands, 2006

REFERENCE BOOKS

1. Richard Sylvester, "Coastal Engineering, Volume I And II", Elseiner Scientific Publishing Co., 1999
2. Dwivedi, S.N., Natarajan, R And Ramachandran, S.,"Coastal Zone Management In Tamilnadu", Madras, 1991

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Describe The Coastal Zone Regulations, Coastal Processes And to identify natural, engineering and human components on the coast
CO2	Able to interpretation and analysis of coastal issues to determine appropriate

	approaches in coastal management and able to communicate effectively in speech and writings
CO3	Able to learn about different ecosystem available in coastal zones and their importance
CO4	Able to learn about coastal erosion and accretions, impacts of sewage disposal
CO5	Able to understand about coastal regulations, its laws and policies

MAPPING OF COs WITH POs AND PSOs

Cos	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	2	2	-	3	-	2	-	3	2	-	3	3	3
CO3	2	3	3	2	3	3	3	2	-	3	-	2	3	-	3
CO4	-	3	-	2	3	3	2	2	-	3	1	3	3	3	3
CO5	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-

CE1032	GLOBAL CLIMATE CHANGE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To give students the various perspectives on climatic change and the actions societies have taken to address its potential and actual impacts
- To highlight that natural processes and human activities alter the composition of the ocean and atmosphere, both globally and regionally, that trigger climate change at different temporal and spatial scales
- To provide a basic conceptual understanding of the complexity of the climate system; and the observed and potential effects of anthropogenic-induced climate change on human and natural systems based on IPCC recommendations
- To enable understanding of the international and national responses to climate change and consider individual responsibility and future challenges

UNIT I	INTRODUCTION	9
Historical Overview of Climate Change Science- Changes in Atmospheric Constituents and Radiative Forcing - The Ice Ages: An Introduction - Determining Past Climates - Reconstructing Past Climate Change -- Interannual to decadal variability- Observations: Atmospheric Surface and Climate Change		CO1
UNIT II	**OCEAN-ATMOSPHERE INTERACTIONS**	**9**
Role of the oceans in climate -Introduction to ocean-atmosphere interactions - Global radiation balance -Ocean currents - Thermohaline circulation and deep water masses - Ocean heat budgets a nd water mass mixing - the cryosphere		CO2
UNIT III	**IMPACTS OF CLIMATE CHANGE**	**9**
Global warming - greenhouse effect - green house gases - impacts on physical systems - impacts on ecological systems - vulnerability of coast - climate change and biodiversity - sectoral impacts - ocean acidification - carbon sequestration by ecological systems		CO3
UNIT IV	**ASSESSMENT OF CLIMATE CHANGE**	**9**
The IPCC Assessments -UNFCCC - global convention on climate change - protocols - international negotiations - Indian assessments - India's plan of action for climate change		CO4
UNIT V	**ADAPTATION AND MITIGATION**	**9**
Mitigating climate change - blue carbon- geoengineering - renewable energy and other alternate systems - adaptation indigenous knowledge - sectoral adaptations - coastal ecosystems - coastal communities - mainstreaming climate change into development practices		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Climate Change – The Science, Impacts and Solutions (2nd Edition) – A. Barrie Pittock, CSIRO Publishing, 2009.
2. Fundamentals of weather and climate (2nd Edition) – Robin McIlveen, Oxford University Press, 2009

REFERENCE BOOKS

1. Climate change – Mitigation of Climate, IPCC, 2013.

2. Atmosphere Weather and Climate – K Siddartha, Kisalaya Publications Pvt. Ltd, 2013

3. W. Neil Adger, Irene Lorenzoni and Karen L. O, Adapting to Climate Change: Thresholds, Values, Governance, Cambridge, 2009.

4. Vineet Kumar, Arjuna Srinidhi, Chandra Bhushan, Geetika Singh, Rising to the Call: Good Practices of Climate Change Adaptation in India, Centre For Science And Environment publisher, 2014.
5. Dan Gafta and John Akeroyd, Nature Conservation Concepts and Practice, Springer, 2006.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the science and basic of weather and climate
CO2	Student will attain the knowledge on natural and anthropogenic activities, which accelerate the climate change
CO3	Acquire knowledge on various protocols and agreement that help to control and reduce climate change impacts
CO4	Know the adaptive techniques to build the climate resilience society.
CO5	Gain awareness about the stress on natural based resources and to conserve it from natural calamities

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	-	3	-	-	2	-	-	-	-	-	2	2	2	-	-
CO4	-	-	3	2	2	3	3	-	-	-	2	-	2	2	3
CO5	-	-	-	-	-	-	-	2	3	3	-	3	-	3	3

CE1033	CLIMATE CHANGE AND VULNERABILITY ASSESSMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To familiarize the methodologies of climate impacts and vulnerability assessment on Natural resources

UNIT I	INTRODUCTION	9
Global, Regional and Local climates, Ocean Circulation, weather parameters. Tropical climate, Monsoons and their role in global climate change.		CO1
UNIT II	**NATIONAL ACTION PLAN ON CLIMATE CHANGE**	**9**
National and State Action Plan on Climate Change, Significance on Sustainable development of Natural resources – National Water Mission, Sustainable Agriculture Mission, Green India Mission, Coastal Conservation.		CO2
UNIT III	**CLIMATE SCENARIOS**	**9**
Global and Regional Climate Scenarios – Representative Concentration Pathways (RCP 2.6, 4.5,6.0 and 8.5), Global Circulation Model (GCM) - Statistical and Dynamical Downscaling of GCM – Regional Climate Model (RCM).		CO3
UNIT IV	**IMPACTS AND VULNERABILITY ASSESSMENT – METHODOGLOGY**	**9**
Definitions of Risk, Hazards, Exposure, Sensitivity and Vulnerability. Climate Risk Assessment, IPCC Methodology – Vulnerability indices.		CO4
UNIT V	**VALIDATION AND APPLICATION OF MODELS**	**9**
Climate Projections and Validation– Uncertainty analysis – Bias Correction – Sectoral wise Case Studies in India.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1.IPCC Fifth Assessment Report - Impacts, Adaptation and Vulnerability, Cambridge University Press, 2014.

2.Neelin David J, “Climate Change and Climate Modelling”, Cambridge University Press, 2011.

REFERENCE BOOKS

1. Thomas Stocker, “Introduction to Climate Modelling”, Advances in Geophysical and Environmental Mechanics and Mathematics. Springer Publication, 2011.

2. India's National Action Plan on Climate Change (NAPCC), Government of India, 2018

3. Michele Companion and Miriam S. Chaiken, Responses to Disasters and Climate Change: Understanding Vulnerability and Fostering Resilience, CRC Press, 2017.

4. Climate Change – The Science, Impacts and Solutions (2nd Edition) – A. Barrie Pittock, CSIRO Publishing, 2009.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the basic and concept behind the climate change
CO2	Know the global and national policies to combat the climate change impacts
CO3	Understand the basics of climate modelling and envisage the climate change impact based on different emission scenario

CO4	Able to assess the risk and vulnerability on different sectors due to climate change
CO5	Know the validation of climate models and correlate the climate related case studies

MAPPING OF COs WITH POs AND PSOs

Cos	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	2	-	-	-	-	-	2	3	-	2	2	3
CO3	2	-	-	2	3	-	-	-	-	-	-	3	-	-	-
CO4	2	3	3	3	3	3	3	3	2	3	-	2	-	-	2
CO5	2	2	2	-	3	-	2	2	-	2	2	-	-	2	-

OME103	ENERGY CONSERVATION IN THERMAL AND ELECTRICAL UTILITIES	L	T	P	C
		3	0	0	3

OBJECTIVES

- ❖ Understand and analyse the energy data of industries
- ❖ Carryout energy accounting and balancing
- ❖ Conduct energy audit and suggest methodologies for energy savings and
- ❖ Utilize the available resources in optimal ways

UNIT I	INTRODUCTION	9
Energy & Power scenario of the World; Present National Energy consumption Data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.		CO1
UNIT II	**THERMAL SYSTEMS**	**9**
Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution & Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories		CO2
UNIT III	**ELECTRICAL SYSTEMS**	**9**
Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.		CO3
UNIT IV	**ENERGY CONSERVATION IN MAJOR UTILITIES**	**9**
Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets		CO4
UNIT V	**ECONOMICS**	**9**
Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Energy Manager Training Manual (4 Volumes) available at www.energymanager training.com,a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.

REFERENCE BOOKS

1. Witte. L.C., P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation” Hemisphere Publ, Washington, 1988.
2. Callaghn, P.W. “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.
3. Dryden. I.G.C., “The Efficient Use of Energy” Butterworths, London, 1982
4. Turner. W.C., “Energy Management Hand book”, Wiley, New York, 1982.
5. Murphy. W.R. and G. Mc KAY, “Energy Management”, Butterworths, London 1987.

COURSE OUTCOMES

Upon completion of this course, the students can able to analyse the energy data of industries.

- Can carryout energy accounting and balancing
- Can suggest methodologies for energy savings

CO1	Ability to learn the concept of energy scenario, energy consumption and instruments for energy auditing.
CO2	Ability to carry out energy accounting and balancing in electrical system
CO3	Ability to carry out energy accounting and balancing in thermal system system
CO4	Ability to suggest methodologies for energy savings in major utilities
CO5	To understand the economics in energy saving

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	3	1	1	1	2	2	3	1	3
CO2	3	3	3	3	2	3	3	1	1	1	3	2	3	1	3
CO3	3	3	3	3	3	2	3	1	1	1	3	2	3	1	3
CO4	3	3	3	3	3	2	3	1	1	1	2	2	3	1	3
CO5	3	3	3	3	2	3	3	1	1	1	3	2	3	1	3

OCH 103	ENVIRONMENT AND AGRICULTURE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To emphasize on the importance of environment and agriculture on changing global scenario and the emerging issues connected to it

UNIT I	ENVIRONMENTAL CONCERNS	9
Environmental basis for agriculture and food – Land use and landscape changes – Water quality issues – Changing social structure and economic focus – Globalization and its impacts – Agro ecosystems.		CO1
UNIT II	**ENVIRONMENTAL IMPACTS**	**9**
Irrigation development and watersheds – mechanized agriculture and soil cover impacts – Erosion and problems of deposition in irrigation systems – Agricultural drainage and downstream impacts – Agriculture versus urban impacts		CO2
UNIT III	**CLIMATE CHANGE**	**9**
Global warming and changing environment – Ecosystem changes – Changing blue-green-grey water cycles – Water scarcity and water shortages – Desertification.		CO3
UNIT IV	**ECOLOGICAL DIVERSITY AND AGRICULTURE**	**9**
Ecological diversity, wild life and agriculture – GM crops and their impacts on the environment – Insects and agriculture – Pollination crisis – Ecological farming principles – Forest fragmentation and agriculture – Agricultural biotechnology concerns.		CO4
UNIT V	**EMERGING ISSUES**	**9**
Global environmental governance – alternate culture systems – Mega farms and vertical farms – Virtual water trade and its impacts on local environment – Agricultural environment policies and its impacts – Sustainable agriculture.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. M.Lakshmi Narasaiah, Environment and Agriculture, Discovery Pub. House, 2006.
2. Arvind Kumar, Environment and Agriculture, ABH Publications, New Delhi, 2005

REFERENCE BOOKS

1. T.C. Byerly, Environment and Agriculture, United States. Dept. of Agriculture. Economic Research Service, 2006.
2. Robert D. Havener, Steven A. Breth, Environment and agriculture: rethinking development issues for the 21st century: proceedings of a symposium, Winrock International Institute for Agricultural Development, 1994
3. Environment and agriculture: environmental problems affecting agriculture in the Asia and Pacific region; World Food Day Symposium, Bangkok, Thailand. 1989

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To gain knowledge on the issues of environmental concerns
CO2	To understand the environmental impacts on agriculture and watershed.
CO3	To gain knowledge on the basic concepts of Climate Change, Water scarcity and water

	knowledge
CO4	To understand the ecosystem, ecological diversity
CO5	To understand the global and local emerging issues on agriculture and biotechnology

MAPPING OF COs WITH POs AND PSOs

Cos	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	1	-	2	2	1	-	-	1	2	2	2	2
CO2	2	1	2	1	2	2	2	1	-	-	1	2	2	2	2
CO3	3	3	3	1	-	3	3	1	-	-	1	3	3	3	3
CO4	2	1	2	1	-	2	2	1	-	-	1	2	2	2	2
CO5	3	1	2	1	-	2	2	1	-	-	1	2	2	2	3

OEE102	RENEWABLE ENERGY SOURCES	L	T	P	C
	(Common to MECH, ECE &CIVIL)	3	0	0	3

OBJECTIVES

- To get exposure on solar radiation and its environmental impact to power.
- To know about the various collectors used for storing solar energy.
- To know about the various applications in solar energy.
- To learn about the wind energy and biomass and its economic aspects.
- To know about geothermal energy with other energy sources

UNIT I	BASICS OF SOLAR RADIATION	9
Environmental aspects of energy utilization- importance of renewable energy sources - physics of the sun-the solar constant, extra-terrestrial and terrestrial solar radiation, solar radiation on titled surface. Instruments for measuring solar radiation and sun shine - solar radiation data.		CO1
UNIT II	**SOLAR ENERGY COLLECTORS**	**9**
Non-Concentrating and concentrating collectors-classification of concentrating and non-concentrating collectors- orientation and thermal analysis- advanced collectors.		CO2
UNIT III	**SOLAR ENERGY STORAGE AND APPLICATIONS**	**9**
Storage methods- Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying. photovoltaic energy conversion.		CO3
UNIT IV	**WIND ENERGY AND BIOMASS**	**9**
Sources and potentials- horizontal and vertical axis windmills- performance characteristics- Types of wind Turbine generators- Betz criteria. BIO-MASS: Principles of Bio-Conversion- Anaerobic/aerobic digestion- types of Bio-gas digesters- gas yield- combustion characteristics of bio-gas- utilization for cooking.		CO4
UNIT V	**GEOTHERMAL AND OCEAN ENERGY**	**9**
Geothermal Resources- types of wells- methods of harnessing the energy- potential in India. OCEAN ENERGY: OTEC- Principles utilization- setting of OTEC plants- thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques- mini-hydel power plants and their economics.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Rai G.D, “Non-Conventional Energy Sources”, Khanna Publishers, 2011.
2. Twidell&Wier, “Renewable Energy Resources”, CRC Press (Taylor & Francis), 2011

REFERENCE BOOKS

1. Tiwari and Ghosal, “Renewable energy resources”, Narosa Publishing House, 2007.
2. Ramesh R & Kumar K.U , “Renewable Energy Technologies”,Narosa Publishing House, 2004.
3. Mittal K M , “Non-Conventional Energy Systems”, Wheeler Publishing Co. Ltd, New Delhi, 2003.
4. Kothari D.P, Singhal ., K.C., “Renewable energy sources and emerging technologies”, P.H.I, New Delhi, 2010.

COURSE OUTCOMES **Upon completion of the course, students will be able to**	
CO1	Ability to understand the physics of solar radiation and possible energy conversion.
CO2	Ability to understand the operation of various solar energy collectors.
CO3	Ability to learn the methodologies of storing solar energy.
CO4	Acquire Knowledge in wind and biomass energy conversion techniques.
CO5	Acquire Knowledge in geothermal and ocean energy conversion techniques.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	1	1	3	3	3	1	1	1	3	1	1	1
CO2	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3
CO4	3	3	3	3	3	3	2	3	3	1	2	3	3	3	3
CO5	3	3	3	3	3	3	2	3	3	1	2	3	3	3	3

OEI101	SENSORS AND TRANSDUCERS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the concepts of measurement technology.
- To learn the various sensors used to measure various physical parameters.
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development

UNIT I	INTRODUCTION TO SENSOR-BASED MEASUREMENT SYSTEMS	9
Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types		**CO1**
UNIT II	**MOTION, PROXIMITY AND RANGING SENSORS**	**9**
Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).		**CO2**
UNIT III	**FORCE, MAGNETIC AND HEADING SENSORS**	**9**
Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.		**CO3**
UNIT IV	**OPTICAL, PRESSURE AND TEMPERATURE SENSORS**	**9**
Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC Sensor, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors – Introduction to Smart Sensors – Film (Thin and thick film) sensor, MEMS & Nano mechanical Sensors, LASER sensors, Environmental (Air and water quality) monitoring sensors		**CO4**
UNIT V	**SIGNAL CONDITIONING and DAQ SYSTEMS**	**9**
Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances ,Manufacturing , Structural health monitoring		**CO5**
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Ernest O Doebelin, “Measurement Systems – Applications and Design”, Tata McGraw-Hill, 2009.
2. Sawhney A K and Puneet Sawhney, “A Course in Mechanical Measurements and Instrumentation and Control”, 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

REFERENCE BOOKS

1. Patranabis D, “Sensors and Transducers”, 2nd Edition, PHI, New Delhi, 2010.
2. John Turner and Martyn Hill, “Instrumentation for Engineers and Scientists”, Oxford Science Publications, 1999.
3. Richard Zurawski, “Industrial Communication Technology Handbook” 2nd edition, CRC Press, 2015.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Expertise in various calibration techniques and signal types for sensors.
CO2	Apply the proximity and ranging sensors in the automotive and mechatronics applications.
CO3	Understand the principles of various magnetic and heading sensors.
CO4	Understand the functioning of optical, pressure, temperature and smart sensors.
CO5	Implement the DAQ systems with different sensors for real time applications.

MAPPING OF COs WITH POs AND PSOs

Cos	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	0	0	0	0	0	0	2	3	2	1
CO2	3	2	1	2	2	0	0	0	0	0	0	2	3	2	1
CO3	3	2	1	2	2	0	0	0	0	0	0	2	3	2	1
CO4	3	2	1	2	2	0	0	0	0	0	0	2	3	2	1
CO5	3	2	1	2	2	0	0	0	0	0	0	2	3	2	1

OME107	VIBRATION AND NOISE CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES

- To study the basics, sources and its control techniques of vibration
- To study the basics, sources and its control techniques of noise
- To study the sources of vibration and noise in automobiles
- To reduce vibration and noise in automotive components

UNIT I	BASICS OF VIBRATION	9
Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non-linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.		CO1
UNIT II	**BASICS OF NOISE**	**9**
Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.		CO2
UNIT III	**AUTOMOTIVE NOISE SOURCES**	**9**
Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine necessary contributed noise, transmission noise, aerodynamic noise, tire noise, brake noise.		CO3
UNIT IV	**CONTROL TECHNIQUES**	**9**
Vibration isolation, tuned absorbers, un-tuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.		CO4
UNIT V	**SOURCE OF NOISE AND CONTROL**	**9**
Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1.Singiresu S.Rao, “Mechanical Vibrations”, 5th Edition, Pearson Education, 2010

2. David Bies and Colin Hansen, “Engineering Noise Control – Theory and Practice”,4th Edition, E and FN Spon, Taylore & Francise e-Library,2009

REFERENCE BOOKS

1. Benson H. Tongue, “Principles of Vibrations”, 2nd Edition, Oxford University,2007
2. William T. Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan, “Theory of Vibration with Application”, 5th Edition Pearson Education,2011
3. Grover. G.T., “Mechanical Vibrations”, Nem Chand and Bros., 1996
4. Bernard Challen and Rodica Baranescu - “Diesel Engine Reference Book”, Second Edition, SAE International,1999.
5. Julian Happian-Smith - “An Introduction to Modern Vehicle Design”- Butterworth-Heinemann, 2004
6. Rao, J.S and Gupta, K., “Introductory course on Theory and Practice of Mechanical Vibration”, 2nd Edition, New Age International Publications,2010
7. Shabana. A.A., “Theory of vibrations – An introduction”, 2nd Edition, Springer,2010
8. Balakumar Balachandran and Edward B. Magrab, “Fundamentals of Vibrations”, 1st Editon, Cengage Learning, 2009

9. John Fenton, “Handbook of Automotive body Construction and Design Analysis – Professional Engineering Publishing,1998

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To understand the basics, different types and source of vibration
CO2	To understand the basics, different types and source of noise
CO3	To understand and analyze the various sources of automotive noise
CO4	To understand the various control techniques of vibration
CO5	To understand the sources and control techniques of automotive noise

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	3	2	3	1	1	3	3	1	3	2	2
CO2	3	3	3	3	3	2	3	1	1	3	3	1	3	3	3
CO3	2	3	3	3	3	2	3	1	1	3	3	1	3	2	2
CO4	2	3	3	3	3	2	3	1	1	3	3	1	3	3	3
CO5	2	3	3	3	3	2	3	1	1	3	3	1	3	3	3

OCH104	TEXTILE EFFLUENT TREATMENTS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

UNIT I	CHARACTERISTICS OF EFFLUENTS	9
Constituents of water and their effect on textile wet processing, Effluent discharge standards for inland surface water public sewers, on land for irrigation, marine coastal areas and drinking water parameters, Quality requirements of water for cotton and synthetic Textile processing.		CO1
UNIT II	**PRIMARY TREATMENT**	**9**
Characteristics and treatment of cotton, synthetics and wool processing effluents, Reduction of pollution load, Primary treatment methods - screening, sedimentatation, equalisation, neutralisation, coagulation and flocculation		CO2
UNIT III	**SECONDARY TREATMENT**	**9**
Secondary treatment methods – Trickling filtration, Activated sludge process, aerated lagoons, secondary sedimentation, oxidation ponds, Anaerobic Digestion, sludge disposal.		CO3
UNIT IV	**TERTIARY TREATMENT**	**9**
Tertiary treatment – Evaporation (solar and steam), Advanced oxidation system, Membrane technologies (MF, UF, NF & RO) ,Reverse osmosis, ion exchange and activated carbon treatment. Quality parameters at entry and exit of RO.		CO4
UNIT V	**AIR QUALITY MANAGEMENT**	**9**
Air Pollution - Properties of air pollutants, control of air pollutants – Air pollution control equipment, Ambient air quality standards. Noise pollution – Types of noise – Noise measurement and – Control of noise pollution.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Rao,C.S., “Environment Pollution control Engineering”, New age International Ltd. and Publishers, N.Delhi, 2004.

2. Reife, A., and Freeman, H.S., (Ed)., “Environmental chemistry of dyes and pigment”, Wiley., London, 2000, ISBN: 047158276.

REFERENCE BOOKS

1. Horrockks, A.R (Ed)., “Ecotextiles’98: Sustainable development”, The Text.Inst., Manchester 1999, ISBN: 1855732426.

2. Modak.P., “The textile industry and the environment”, UNEP:HMSO, Blackwells, Leeds, 2003, ISBN: 9280713671

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the characteristics of water and effluent discharge standards
CO2	Understand the primary treatment process involved in textile industry

CO3	Understand the different treatment processes involved in waste water treatment
CO4	Perform the research and development to produce zero discharge effluents
CO5	Understand the textile processing related causes for pollution

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	0	3	3	0	2	0	3	2	1	2	2	2	2
CO2	3	1	0	3	3	0	2	0	3	2	1	2	2	2	2
CO3	3	1	0	3	3	0	2	0	3	2	1	2	3	3	3
CO4	3	1	0	3	3	0	2	0	3	2	1	2	2	2	2
CO5	3	1	0	3	3	0	2	0	3	2	1	2	2	2	3

OEI102	ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart awareness about the pollution created by different stages of wet processing
- To familiarize the students about the importance of water and its analysis
- To enable the students to understand about the waste water treatment plants and various treatments carried out

UNIT I	FUNDAMENTALS OF ROBOT	9
Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load-Robot Parts and their Functions-Need for Robots-Different Applications.		**CO1**

UNIT II	ROBOT DRIVE SYSTEMS AND END EFFECTORS	9
Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.		**CO2**

UNIT III	SENSORS AND MACHINE VISION	9
Requirements of a sensor, Principles and Applications of the following types of sensors-Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.		**CO3**

UNIT IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	9
Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.		**CO4**

UNIT V	IMPLEMENTATION AND ROBOT ECONOMICS	9
RGV (Rail Guided Vehicle), AGV (Automatic Guided Vehicle); Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations, Hazards of robot, Economic Analysis of Robots- Payback, EUAC, ROI Method.		**CO5**
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Klafter R.D., Chmielewski T.A and Negin M., “Robotic Engineering - An Integrated Approach”, Prentice Hall, 2003.

2. Groover M.P., “Industrial Robotics -Technology Programming and Applications”, McGraw Hill, 2001.

REFERENCE BOOKS

1. Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education, 2008.
2. Deb S.R., “Robotics Technology and Flexible Automation” Tata McGraw Hill Book Co., 1994.
3. Koren Y., “Robotics for Engineers", Mc Graw Hill Book Co., 1992.
4. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill Book Co., 1987.
5. Janakiraman P.A., “Robotics and Image Processing”, Tata McGraw Hill, 1995.
6. Rajput R.K., “Robotics and Industrial Automation”, S.Chand and Company, 2008.
7. Surender Kumar, “Industrial Robots and Computer Integrated Manufacturing”, Oxford and IBH Publishing Co. Pvt. Ltd., 1991.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	To learn concepts of Robotic system, its components and instrumentation and control related to robotics.
CO2	To improve skills on hardware drives and interfacing aspects.
CO3	To enhance basics of different sensors and machine vision interaction.
CO4	To develop student’s skills in performing kinematics analysis of robot systems.
CO5	To provide the student with some knowledge and skills associated with robot economics control.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	0	0	0	0	0	0	2	3	2	1
CO2	3	2	1	2	2	0	0	0	0	0	0	2	3	2	1
CO3	3	2	1	2	2	0	0	0	0	0	0	2	3	2	1
CO4	3	2	1	2	2	0	0	0	0	0	0	2	3	2	1
CO5	3	2	1	2	2	0	0	0	0	0	0	2	3	2	1

OME104	INDUSTRIAL SAFETY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

❖ · To impart knowledge on safety engineering fundamentals and safety management practices.

UNIT I	**INTRODUCTION**	**9**
Evolution of modern safety concepts – Fire prevention – Mechanical hazards – Boilers, Pressure vessels, Electrical Exposure.		**CO1**
UNIT II	**CHEMICAL HAZARDS**	**9**
Chemical exposure – Toxic materials – Ionizing Radiation and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology.		**CO2**
UNIT III	**ENVIRONMENTAL CONTROL**	**9**
Industrial Health Hazards – Environmental Control – Industrial Noise - Noise measuring instruments, Control of Noise, Vibration, - Personal Protection.		**CO3**
UNIT IV	**HAZARD ANALYSIS**	**9**
System Safety Analysis –Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment		**CO4**
UNIT V	**SAFETY REGULATIONS**	**9**
Explosions – Disaster management – catastrophe control, hazard control ,Safety education and training - Factories Act, Safety regulations Product safety – case studies.		**CO5**
		TOTAL : 45 PERIODS

TEXT BOOKS

1. John V.Grimaldi, “Safety Management”, AITB S Publishers, 2003.

REFERENCE BOOKS

1. Safety Manual, “EDEL Engineering Consultancy”, 2000.
2. David L.Goetsch, “Occupational Safety and Health for Technologists”, 5th Edition, Engineers and Managers, Pearson Education Ltd., 2005.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	understand the basic safety concepts in Industrial boilers, pressure vessels
CO2	understand the hazardous effects caused and prevention methods of chemicals used in industry
CO3	understand the environmental measures and controls towards safety
CO4	understand the analysis of safety preventions and hazards in industry
CO5	understand the safety regulations and safety management.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3

CO2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3

OCS101	INTRODUCTION TO C PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basic concepts in C Programming Language.
- To understand Input and Output Statements.
- To enhance analyzing and problem solving skills and use the same for writing programs in C.
- To familiarize the basic syntax in arrays and pointers
- To provide exposure to problem-solving through programming

UNIT I	INTRODUCTORY CONCEPTS & C FUNDAMENTALS	9
Introduction to Computers - Computer Characteristics - Modes of Operation - Types of Programming Languages - Introduction to C - Some Simple C Programs - Desirable Program Characteristics - The C Character Set - Identifiers and Keywords - Data Types - Constants - Variables and Arrays - Declarations - Expressions - Statements - Symbolic Constants.		CO1
UNIT II	**OPERATORS, EXPRESSIONS, DATA INPUT & OUTPUT AND CONTROL STATEMENTS**	**9**
Arithmetic Operators - Unary Operators - Relational and Logical Operators - Assignment Operators - The Conditional Operator - Library Functions - getchar, putchar, scanf, printf, gets and puts Functions - Preliminaries - Branching: The if else Statement - Looping: The while Statement - do while Statement - for Statement - Nested Control Structures - The switch Statement - The break Statement - The continue Statement - The Comma Operator - The goto Statement		CO2
UNIT III	**FUNCTIONS & PROGRAM STRUCTURE**	**9**
Defining a Function - Accessing a Function - Function Prototypes - Passing Arguments to a Function – Recursion - Storage Classes - Automatic Variables - External (Global) Variables - Static Variables - Multifile Programs - More About Library Functions		CO3
UNIT IV	**ARRAYS & POINTERS**	**9**
Defining an Array - Processing an Array - Passing Arrays to Functions - Multidimensional Arrays - Arrays and Strings - Fundamentals - Pointer Declarations - Passing Pointers to Functions - Pointers and One-Dimensional Arrays - Dynamic Memory Allocation - Operations on Pointers - Pointers and Multidimensional Arrays - Arrays of Pointers - Passing Functions to Other Functions		CO4
UNIT V	**STRUCTURES, UNIONS & DATA FILES**	**9**
Defining a Structure - Processing a Structure - User-Defined Data Types (typedef) - Structures and Pointers - Passing Structures to Functions - Self-Referential Structures – Unions - Opening and Closing a Data File - Creating a Data File - Processing a Data File - Unformatted Data Files		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Byron Gottfried - Schaum's Outline of Programming with C, 2nd Edition, McGraw-Hill, 1996.

REFERENCE BOOKS

1. The C Programming Language by Brian Kernighan and Dennis Ritchie 2nd Edition.
2. Let Us C Yashavant kanetkar, BPB

COURSE OUTCOMES

Upon completion of the course, students will be able to	
CO1	Identify situations where computational methods and computers would be useful.
CO2	Demonstrate the use of operators, input and output statements and control statements
CO3	Identify solution to a problem and apply control structures and user defined functions for solving the problem
CO4	Demonstrate the use of numeric arrays and pointers
CO5	Demonstrate the ability to design creative solutions to real life problems faced by the industry.

OME106	TESTING OF MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To study the various material testing methods and standards.
- To study the various mechanical testing and material characterization
- To study the various destructive and non-destructive testing methods of materials and its industrial applications.

UNIT I	INTRODUCTION TO MATERIALS TESTING	9
Overview of materials: Classification of material testing, Purpose of testing, Selection of material, Development of testing, Testing organizations and its committee, Testing standards, Result Analysis, Advantages of testing.		CO1
UNIT II	**MECHANICAL TESTING**	**9**
Introduction to mechanical testing: Hardness test (Vickers, Brinell, Rockwell), Tensile test, Impact test (Izod, Charpy) - Principles, Techniques, Methods, Advantages and Limitations, Applications. Bend test, Shear test, Creep and Fatigue test - Principles, Techniques, Methods, Advantages and Limitations, Applications.		CO2
UNIT III	**NON DESTRUCTIVE TESTING**	**9**
Visual inspection, Liquid penetrant test, Magnetic particle test, Thermography test – Principles, Techniques, Advantages and Limitations, Applications. Radiographic test, Eddy current test, Ultrasonic test, Acoustic emission- Principles, Techniques, Methods, Advantages and Limitations, Applications.		CO3
UNIT IV	**MATERIAL CHARACTERIZATION TESTING**	**9**
Macroscopic and Microscopic observations, Optical and Electron microscopy (SEM and TEM) - Principles, Types, Advantages and Limitations, Applications. Diffraction Techniques, Spectroscopic Techniques, Electrical and Magnetic Techniques- Principles, Types, Advantages and Limitations, Applications.		CO4
UNIT V	**OTHER TESTING**	**9**
Thermal Testing: Differential Scanning Calorimetry, Differential Thermal Analysis. Thermo-mechanical and Dynamic mechanical analysis: Principles, Advantages, Applications. Chemical Testing: X-Ray Fluorescence, Elemental Analysis by Inductively Coupled Plasma-Optical Emission Spectroscopy and Plasma-Mass Spectrometry.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Cullity, B. D., “Elements of X-ray diffraction”, 3rd Edition, Addison-Wesley Company Inc., New York, 2000.
3. P. Field Foster, “The Mechanical Testing of Metals and Alloys” 7th Edition, Cousens Press, 2007.
4. Suryanarayana A. V. K., “Testing of metallic materials”, 2nd Edition, BS publications, 2018

REFERENCE BOOKS

1. Metals Handbook: Mechanical testing, (Volume 8) ASM Handbook Committee, 9th Edition, American Society for Metals, 1978.

2. ASM Metals Handbook, “Non-Destructive Evaluation and Quality Control”, American Society of Metals, Metals Park, Ohio, USA.
3. Brandon D.G., “Modern Techniques in Metallography”, Von Nostrand Inc. NJ, USA, 1986. Publishing, 1998.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Identify various materials, different types of material testing, material testing standards and organizations, characterization and techniques
CO2	Identify various mechanical testing and its procedure with application for industrial use.
CO3	understand the various non-destructive testing techniques with application for industrial use.
CO4	analyze the surface and elemental behavior of various materials using different material characterization techniques.
CO5	understand the thermal and chemical behavior of various materials by special testing techniques.

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	2	2	1	2	1	1	1	1	3	2	1	1
CO2	3	2	2	1	2	1	2	1	1	1	2	3	2	2	2
CO3	3	2	1	2	2	1	2	1	1	1	2	3	2	1	1
CO4	3	1	2	2	2	1	2	1	1	1	1	3	2	2	2
CO5	3	2	2	2	2	1	2	1	1	1	1	3	2	1	1

OPEN ELECTIVES OFFERED TO OTHER DEPARTMENTS

OCE101	AIR POLLUTION AND CONTROL	L	T	P	C
	(COMMON TO BIOTECH, EEE, EIE, MECH)	3	0	0	3

OBJECTIVES

- To impart knowledge on the principle and design of particulate/ gaseous air pollutant and its emerging trends.
- To acquaint the students with the basics of selection of control equipment.
- To learn about indoor air quality control.

UNIT I	AIR QUALITY MONITORING	9
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 – Composition of Particulate and Gaseous Pollutants.		CO1
UNIT II	**EFFECT OF ATMOSPHERIC DISPERSION**	**9**
Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise		CO2
UNIT III	**PARTICULATE CONTAMINANTS**	**9**
Gas Particle Interaction – Working principle, Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations- Factors affecting Selection of Control Equipment.		CO3
UNIT IV	**GASEOUS CONTAMINANTS**	**9**
Working principle, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring – Operational Considerations- Factors affecting Selection of Control Equipment –CO2 capturing.		CO4
UNIT V	**INDOOR AIR QUALITY MONITORING**	**9**
Sources, types and control of indoor air pollutants, sick building syndrome types –Sources and Effects of Noise Pollution– Standards–Control and Preventive measures.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, Air Pollution Control Engineering, Tokyo, 2004.
2. Noel de Nevers, Air Pollution Control Engineering, Mc Graw Hill, New York, 1995.
3. Anjaneyulu. Y, “Air Pollution and Control Technologies" , Allied Publishers (P) Ltd., India 2002

REFERENCE BOOKS

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

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Understand the chemistry of atmosphere, characterize the air pollutants , know the effects of air pollution, identify the criteria air pollutants and know about NAAQS
CO2	Apply the knowledge of mathematics and science fundamentals to understand the concept of meteorology, air pollution dispersion and Gaussian plume dispersion model
CO3	Select suitable method and design the particulate pollutant control equipment
CO4	Select appropriate method for control of gaseous pollutant by due consideration of sources of emission
CO5	Understand the source of indoor air pollution, effects and control methods as well as to identify the source of noise, and select suitable method for control of noise pollution

MAPPING OF COs WITH POs AND PSOs

COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	0	0	0	0	0	0	0	0	0	0	1	2	3
CO2	2	1	0	0	0	0	0	0	0	0	0	0	1	2	3
CO3	3	2	0	0	0	1	0	0	0	0	0	0	2	3	3
CO4	3	2	0	0	0	1	0	0	0	0	0	0	2	3	3
CO5	3	2	0	0	0	1	0	0	0	0	0	0	2	3	3

OCE102	INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEM	L	T	P	C
	(COMMON TO AIDS, AIML, CSE, ECE, IT)	3	0	0	3

OBJECTIVES

- To introduce the fundamentals and components of Geographic Information System
- To provide details of spatial data structures and input, management and output
- processes.

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.		CO1
UNIT II	**SPATIAL DATA MODELS**	**9**
Database Structures – Relational, Object Oriented – ER diagram - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID data models - OGC standards - Data Quality.		CO2
UNIT III	**DATA INPUT AND TOPOLOGY**	**9**
Scanner - Raster Data Input – Raster Data File Formats – Vector Data Input –Digitiser – Topology - Adjacency, connectivity and containment – Topological Consistency rules – Attribute Data linking – ODBC – GPS - Concept GPS based mapping.		CO3
UNIT IV	**DATA ANALYSIS**	**9**
Vector Data Analysis tools - Data Analysis tools - Network Analysis - Digital Education models - 3D data collection and utilisation		CO4
UNIT V	**APPLICATIONS**	**9**
GIS Applicant - Natural Resource Management - Engineering - Navigation - Vehicle tracking and fleet management - Marketing and Business applications - Case studies.		CO5
		TOTAL : 45 PERIODS

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 BOOKS

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

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	Have basic idea about the fundamentals of GIS.
CO2	Understand the types of data models.
CO3	Get knowledge about data input and topology.
CO4	Gain knowledge on data quality and standards.
CO5	Understand data management functions and data output

MAPPING OF COs WITH POs AND PSOs															
COs	**PROGRAM OUTCOMES (POs)**												**PROGRAM SPECIFIC OUTCOMES (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	-	1	-	2	1	-	-	-	-	-	-	1	2	2
CO2	2	1	2	2	3	1	-	-	-	-	-	-	2	3	2
CO3	2	1	2	2	3	1	-	-	-	-	-	-	2	1	2
CO4	2	1	2	-	3	1	-	-	-	-	-	-	2	2	1
CO5	2	-	2	-	3	1	-	-	-	-	-	-	3	2	2

OCE103	ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	C
	(COMMON CHEMICAL, MECHANICAL)	3	0	0	3

OBJECTIVES

- To impart knowledge on Environmental management and Environmental Impact Assessment.

UNIT I	INTRODUCTION	9
Impact of development projects–EIA Notifications-Urbanization–Meaning– Activities involved–Effects on environment-Environmental Impact Assessment(EIA)-Environmental Impact Statement(EIS).		CO1
UNIT II	**METHODOLOGIES**	**9**
Methods of EIA–Checklists–Matrices–Networks–Cost-benefit analysis–Analysis of alternatives – Uncertainty in EIA.		CO2
UNIT III	**PREDICTION AND ASSESSMENT**	**9**
Assessment of Impact on land, water, air, social & cultural activities and on flora& Fauna-Mathematical models-Public participation–SIA Judgment authorities-Rapid EIA.		CO3
UNIT IV	**ENVIRONMENTAL MANAGEMENT PLAN**	**9**
Plan for mitigation of adverse impact on environment–Options for mitigation of impact on water, air, land and on flora& fauna- Addressing the issues related to the Project Affected People		CO4
UNIT V	**CASE STUDIES**	**9**
EIA for infrastructure projects–Dams–Highways–Multi-storey Buildings–Water Supply and Drainage Projects–Waste water treatment plants, STP.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. Canter,R.L., “Environmental Impact Assessment”, McGraw-Hill Inc., New Delhi,1996.
2. Richard K. Morgan., “Environmental Impact Assessment” Kluwer Academic Publications, London, 2002

REFERENCE BOOKS

1. John G. Rauand David C Hooten (Ed).,“Environmental Impact Analysis Handbook”, McGraw-Hill BookCompany,1990.
2. “Environmental Assessment Sourcebook”, Vol.I, II &III. The World Bank, Washington, D.C., 1991.
3. Judith Petts, “Handbook of Environmental Impact Assessment Vol.I & II”, Blackwell Science, 1999.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	carry out scoping and screening of developmental projects for environmental and social assessments
CO2	explain different methodologies for environmental impact prediction and assessment
CO3	plan environmental impact assessments and environmental management plans
CO4	evaluate environmental impact assessment reports
CO5	understand the Membrane Applications.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	2	1	2	2	4	2	1	1	1	2	1	-
CO2	3	2	1	2	2	1	2	1	3	4	1	2	1	1	-
CO3	1	2	4	3	1	2	4	3	1	2	4	5	1	2	-
CO4	1	2	2	4	2	1	1	1	2	1	3	2	1	2	-
CO5	2	1	3	1	2	4	3	2	1	2	3	1	1	2	-

OCE104	GREEN BUILDING DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES

- The course aims to develop skills of the students in the area of Civil Engineering with emphasis in environmental implications of buildings and comforts in building
- This will enable the students to perform calculations pertaining to processes and operations.

UNIT I	ENVIRONMENTAL IMPLICATIONS OF BUILDINGS	9
Energy use, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transportation Energy for Building Materials; Maintenance Energy for Buildings.		CO1
UNIT II	**IMPLICATIONS OF BUILDING TECHNOLOGIES EMBODIED ENERGY OF BUILDINGS**	**9**
Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.		CO2
UNIT III	**COMFORTS IN BUILDING**	**9**
Thermal Comfort in Buildings- Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations		CO3
UNIT IV	**UTILITY OF SOLAR ENERGY IN BUILDINGS**	**9**
Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.		CO4
UNIT V	**GREEN COMPOSITES FOR BUILDINGS**	**9**
Concepts of Green Composites. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.		CO5
		TOTAL : 45 PERIODS

TEXT BOOKS

1. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.
2. Low Energy Cooling for Sustainable Buildings. John Wiley and Sons Ltd, 2009.
3. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

REFERENCE BOOKS

1. Osman Attmann Green Architecture Advanced Technologies and Materials. McGraw Hill, 2010.
2. Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.
3. Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1	understand core building science fundamentals
CO2	perform some building sustainability concepts
CO3	understand energy efficiency in relation to cost performance, ROI, etc
CO4	understand and perform some building performance testing and be exposed to different

	agencies involved in the testing.
CO5	understand and perform some weatherization fundamentals.

MAPPING OF COs WITH POs AND PSOs

COs	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	3	3	3	3	-	-	-	3	2	1	-	3
CO2	3	3	-	3	3	3	3	-	-	-	3	2	1	-	3
CO3	3	3	-	3	3	3	3	-	-	-	3	2	1	-	3
CO4	3	3	-	3	3	3	3	-	-	-	3	2	1	-	3
CO5	3	3	-	3	3	3	3	-	-	-	3	2	1	-	3