PRIST UNIVERSITY

VALLAM, THANJAVUR.

DEPARTMENT OF CIVIL ENGINEERING

PROGRAM HANDBOOK

B.TECH

(CIVIL ENGINEERING)

FULL TIME

[REGULATION 2021]

[for candidates admitted to B.Tech (Civil Engineering) program from June 2021 onwards]

COURSE STRUCTURE

Program Educational Objectives

PEO1 To produce graduates who have developed the skills required to design Civil Engineering systems and facilities, including the graduate's abilities to formulate problems, to think creatively, to synthesize information, and to work collaboratively in teams.

PEO2 To produce graduates who are trained thoroughly in methods of analysis, including the mathematical and computational skills appropriate for Civil Engineers to use when problem solving.

PEO3 To produce graduates who are prepared for life-long learning and successful careers asCivil Engineers & also taught to use current, experimental and data analysis techniques for Civil Engineering applications.

PEO4 Contribute towards technological development through academic research and industrial practices.

PEO5 Practice their profession with good communication, leadership, ethicsand social responsibility.

PROGRAMME OUTCOMES:

Engineering Graduates will be able to:

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

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **The engineer and society**: An ability to develop the professional status using the broad education to understand the potential impact of Engineering solutions in various geographical settings including societal and environmental contexts.

6. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

8. **Individual and team work**: Function effectively as an individual, and as a member or leaderin diverse teams, and in multidisciplinary settings.

9. **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 andreceive clear instructions.

10. **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.

11. **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.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMMEOUTCOMES

Programme Educational Objectives	Programme Outcomes										
	A	B	C	D	E	F	G	H	I	J	K
PEO 1	3	3	2	3	2	1	1	2	1	1	3
PEO 2	3	3	3	3	3	1	1	1	1	1	1
PEO 3	3	3	3	3	3	2	2	3	1	2	2
PEO 4	3	3	2	3	3	2	3	2	1	2	2
PEO 5	3	3	3	3	3	3	3	2	2	2	2

1-Reasonable: 2- Significant: 3- Strong

B.TECH (CIVIL ENGINEERING) – FULL TIME-R-2021
I - VIII SEMESTERS CURRICULUM AND
SEMESTER I

SL.NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			
			L	T	P	C
1.	21147IP	Induction Programme				
THEORY						
2	21147S11	Professional English-I	3	0	0	3
3	21148S12	Matrices and Calculus	3	1	0	4
4	21149S13	Engineering Physics	3	0	0	3
5	21149S14	Engineering Chemistry	3	0	0	3
6	21150S15	Problem Solving and Python Programming	3	0	0	3
PRACTICALS						
7	21150L16	Problem Solving and Python ProgrammingLaboratory	0	0	4	2
8	21149L17	Physics and Chemistry Laboratory	0	0	4	2
		TOTAL	**15**	**1**	**10**	**21**

SEMESTER II

SI. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	21147S21	Professional English-II	3	0	0	3
2.	21148S22	Statistics and Numerical Methods	3	1	0	4
3.	21149S23E	Physics for Civil Engineering	3	0	0	3
4.	21154S24	Engineering Graphics	2	0	4	4
5.	21153S25C	Basic Electrical, Electronics and Instrumentation Engineering	3	0	0	3
PRACTICALS						
6.	21154L21	Engineering Practices Laboratory	0	0	4	2
7.	21153L22D	Basic Electrical, Electronics And Instrumentation Engineering Laboratory	0	0	4	2
		TOTAL	**14**	**1**	**16**	**23**

SEMESTER III

S. NO	SUB. CODE	NAME OF THE SUBJECT	L	T	P	C
THEORY						
1	21148S31D	Transforms and Partial Differential Equations	3	1	0	4
2	21154S32	Engineering Mechanics	3	0	0	3
3	21155C33	Fluid Mechanics	3	0	0	3
4	21155C34	Construction Materials and Technology	3	0	0	3
5	21155C35	Water Supply and Wastewater Engineering	4	0	0	4
6	21155C36	Surveying and Levelling	3	0	0	3
PRACTICALS						
7	21155L37	Surveying and LevellingLaboratory	0	0	4	2
8	21155L38	Water and Wastewater Analysis Laboratory	0	0	4	2
9	21155L39	Professional Development	0	0	2	1
		TOTAL	**19**	**1**	**10**	**25**

SEMESTER IV

S. No	Sub. Code	Name of the Subject	L	T	P	C
THEORY						
1	21155C41	Applied Hydraulics Engineering	3	1	0	4
2	21155C42	Strength of Materials	3	0	0	3
3	21155C43	Concrete Technology	3	0	0	3
4	21155C44	Soil Mechanics	3	0	0	3
5	21155C45	Highway and Railway Engineering	3	0	0	3
6	21149S46	Environmental Sciences and Sustainability	3	0	0	3
PRACTICALS						
7	21155L47	Hydraulic Engineering Laboratory	0	0	4	2
8	21155L48	Materials Testing Laboratory	0	0	4	2
9	21155L49	Soil Mechanics Laboratory	0	0	4	2
		TOTAL	**18**	**1**	**12**	**25**

SEMESTER – V

S. No	Sub. Code	Name of the Subject	L	T	P	C
THEORY						
1	21155C51	Design of Reinforced ConcreteStructural Elements	3	0	0	3
2	21155C52	Structural Analysis I	3	0	0	3
3	21155C53	Foundation Engineering	3	0	0	3
4	21155E54_	Elective I	3	0	0	3
5	21155E55_	ElectiveII	3	0	0	3
6	21155E56_	Elective III	3	0	0	3
7	21147MC51_	Mandatory Course-I	3	0	0	0
PRACTICALS						
8	21155L58	Highway Engineering Laboratory	0	0	4	2
9	21155L59	Survey Camp (2weeks)	0	0	0	1
		TOTAL	**21**	**0**	**4**	**21**

SEMESTER – VI

S. No	Sub. Code	Name of the Subject	L	T	P	C
THEORY						
1	21150OE61_	Open Elective–I	3	0	0	3
2	21155C62	Design of Steel Structural Elements	3	0	0	3
3	21155C63	Structural Analysis II	3	0	0	3
4	21155C64	Hydrology and Water Resource Engineering	3	0	0	3
5	21155E65_	Elective IV	3	0	0	3
6	21155E66_	Elective V	3	0	0	3
7	21155E67_	Elective VI	3	0	0	3
8	21147MC61_	Mandatory Course-II	3	0	0	0
PRACTICALS						
7	21155L69	Building Drawing and Detailing Laboratory	0	0	4	2
		TOTAL	**24**	**0**	**4**	**23**

SEMESTER – VII

S. No	Sub. Code	Name of the Subject	L	T	P	C
THEORY						
1	21147S71	Human Values and Ethics	2	0	0	2
2	21150OE72_	Open Elective–II	3	0	0	3
3	211_ _OE73_	Open Elective–III	3	0	0	3
4	211_ _OE74_	Open Elective–IV	3	0	0	3
5	21155C75	Estimation, Costing and Valuation Engineering	3	0	0	3
6	21155C76	Irrigation Engineering and Drawing	3	0	0	3
7	21160S77	Total Quality Management	3	0	0	3
		TOTAL	**20**	**0**	**0**	**20**

SEMESTER – VIII

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	21155PW81	Project Work	0	0	20	10
		TOTAL	0	0	20	10

TOTAL CREDITS: 168

MANDATORYCOURSES I

SEM V

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	21147MC51A	Introduction to Womenand Gender Studies	3	0	0	0
2	21147MC51B	Elements of Literature	3	0	0	0
3	21147MC51C	Film Appreciation	3	0	0	0
4	21147MC51D	Disaster Management	3	0	0	0

MANDATORYCOURSES II
SEM VI

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	21147MC61A	Well Being with Traditional Practices(Yoga, Ayurveda and Siddha)	3	0	0	0
2	21147MC61B	History of Science and Technology in India	3	0	0	0
3	21147MC61C	Political and Economic Thought for a Humane Society	3	0	0	0
4	21147MC61D	State, Nation Building And Politics in India	3	0	0	0
5	21147MC61E	Safety In Engineering Industries	3	0	0	0

LIST OF ELECTIVES

SEMESTER – V

ELECTIVE I

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	21155E54A	Airports and Harbours	3	0	0	3
2	21155E54B	Concrete Structures	3	0	0	3
3	21155E54C	Groundwater Engineering	3	0	0	3
4	21155E54D	Dynamics and Earthquake Resistant Structures	3	0	0	3
5	21155E54E	Introduction to Finite Element Method	3	0	0	3
6	21155E54F	Steel Concrete Composite Structures	3	0	0	3
7	21155E54G	Environmental Quality Monitoring	3	0	0	3
8	21155E54H	Transport and Environment	3	0	0	3
9	21155E54I	Rainwater Harvesting	3	0	0	3
10	21155E54J	Marine Geotechnical Engineering	3	0	0	3

ELECTIVE II

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	21155E55A	Steel Structures	3	0	0	3
2	21155E55B	Air and Noise Pollution Control Engineering	3	0	0	3
3	21155E55C	Rehabilitation/ Heritage Restoration	3	0	0	3
4	21155E55D	Formwork Engineering	3	0	0	3
5	21155E55E	Digitalized Construction Lab	3	0	0	3
6	21155E55F	Sustainable Construction And Lean Construction	3	0	0	3
7	21155E55G	Environmental Quality Monitoring	3	0	0	3
8	21155E55H	Coastal Engineering	3	0	0	3
9	21155E55I	Ocean Wave Dynamics	3	0	0	3

ELECTIVE III

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	21155E56A	Water Quality and Management	3	0	0	3
2	21155E56B	Prefabricated Structures	3	0	0	3
3	21155E56C	Total Station and GPS Surveying	3	0	0	3
4	21155E56D	Rock Mechanics	3	0	0	3
5	21155E56E	Earth and Earth Retaining Structures	3	0	0	3
6	21155E56F	Tunneling Engineering	3	0	0	3
7	21155E56G	Soil Dynamics and Machine Foundations	3	0	0	3
8	21155E56H	Port and Harbour Engineering	3	0	0	3
9	21155E56I	Watershed Conservation and Management	3	0	0	3

SEMESTER – VI
ELECTIVE IV

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	21155E65A	Prestressed Concrete Structures	3	0	0	3
2	21155E65B	Water Resources Systems Engineering	3	0	0	3
3	21155E65C	Remote Sensing Concepts	3	0	0	3
4	21155E65D	Satellite Image Processing	3	0	0	3
5	21155E65E	Cartography and GIS	3	0	0	3
6	21155E65F	Photogrammetry	3	0	0	3
7	21155E65G	Airborne and Terrestrial Laser Mapping	3	0	0	3
8	21155E65H	Hydrographic Surveying	3	0	0	3
9	21155E65I	Participatory Water Resources Management	3	0	0	3
10	21155E65J	Design of Plate and Shell Structures	3	0	0	3

ELECTIVE V

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	21155E66A	Pile Foundation	3	0	0	3
2	21155E66B	Urban Planning and Development	3	0	0	3
3	21155E66C	Construction Equipment and Machinery	3	0	0	3
4	21155E66D	Smart Cities	3	0	0	3
5	21155E66E	Intelligent Transport Systems	3	0	0	3
6	21155E66F	Transportation Planning Process	3	0	0	3
7	21155E66G	Coastal Hazards and Mitigation	3	0	0	3
8	21155E66H	Solid and Hazardous Waste Management	3	0	0	3
9	21155E66I	Green Building Design	3	0	0	3
10	21155E66J	Powerplant Structures	3	0	0	3

ELECTIVE VI

S. No	Sub. Code	Name of the Subject	L	T	P	C
1	21155E67A	Advanced Construction Techniques	3	0	0	3
2	21155E67B	Traffic Engineering and Management	3	0	0	3
3	21155E67C	Dynamics and Earthquake Resistant Structures	3	0	0	3
4	21155E67D	Climate Change Adaptation and Mitigation	3	0	0	3
5	21155E67E	Environmental Health and Safety	3	0	0	3
6	21155E67F	Industrial Wastewater Management	3	0	0	3
7	21155E67G	Coastal Zone Management and Remote Sensing	3	0	0	3
8	21155E67H	Computational Fluid Dynamics	3	0	0	3
9	21155E67I	Earth and Rockfill Dams	3	0	0	3
10	21155E67J	Finance for Engineers	3	0	0	3

SEMESTER VI
OPEN ELECTIVE-I

1	21150OE61A	IoT Concepts and Applications (CSE)	2	0	2	3
2	21150OE61B	Augmented and VirtualReality (CSE)	2	0	2	3

SEMESTER VII
OPEN ELECTIVE-II

1	21150OE72A	Data Science Fundamentals (CSE)	2	0	2	3
2	21150OE72B	Artificial Intelligence and MachineLearning Fundamentals	2	0	2	3

OPEN ELECTIVE-III

1	21147OE73A	English for Competitive Examinations	3	0	0	3
2	21153OE73A	Renewable Energy Technologies	3	0	0	3
3	21153OE73B	Electric and Hybrid Vehicle	3	0	0	3
4	21154OE73A	Introduction to non-Destructive testing	3	0	0	3
5	21154OE73B	Industrial Management	3	0	0	3
5	21152OE73A	Biomedical Instrumentation	3	0	0	3
6	21152OE73B	Fundamentals of ElectronicDevices and Circuits	3	0	0	3

OPEN ELECTIVE-IV

1	21154OE74A	Additive Manufacturing	3	0	0	3
2	21154OE74B	Industrial safety	3	0	0	3
3	21153OE74A	Sensors	3	0	0	3
4	21153OE74B	Electrical, Electronic andMagnetic materials	3	0	0	3
5	21152OE75A	Wearable devices	3	0	0	3
6	21152OE77B	Medical Informatics	3	0	0	3

CGPA CREDITS

Semester	Core	Elective Courses	Open Electives	Practical	Project	Total
I	16	-	-	05	-	21
II	17	-	-	06	-	23
III	20	-	-	05	-	25
IV	19	-	-	06	-	25
V	09	09	-	03	-	21
VI	09	09	03	02	-	23
VII	11	-	09	-	-	20
VIII	-	-	-	-	10	10
Total Credits						**168**

21147IP **INDUCTION PROGRAMME**

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution.Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective: "Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying valuesare needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. "
Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, peoplearound them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for thestudent for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. Thiswould familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in buildingthings (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be notests / assessments during this programme.

21147S11 PROFESSIONAL ENGLISH I L T P C
3 0 0 3

COURSE OBJECTIVES:

- To improve the communicative competence of learners
- To learn to use basic grammatic structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understand theirmeaning in a text
- To help learners use language effectively in professional contexts
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION 1

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C's of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills toget the best out of this course?

INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 8

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technicalcontexts).

UNIT II NARRATION AND SUMMATION 9

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms, Phrasal verbs.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT 9

Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions;instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT IV CLASSIFICATION AND RECOMMENDATIONS 9

Reading – Newspaper articles; Journal reports –and Non Verbal Communication (tables, pie charts etc,.). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non verbal (chart , graph etc, to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed /Semi fixed expressions.

UNIT V EXPRESSION 9

Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple,Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.

TOTAL: 45 PERIODS

LEARNING OUTCOMES:

At the end of the course, learners will be able

CO1: To use appropriate words in a professional context

CO2: To gain understanding of basic grammatical structures and use them in right context.

CO3: To read and infer the denotative and connotative meanings of technical texts

CO4: To read and interpret information presented in tables, charts and other graphic forms

CO5: To write definitions, descriptions, narrations and essays on various topics

TEXT BOOKS :

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English,Anna University, (2020 edition)
2. English for Science & Technology Cambridge University Press, 2021.

Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba,and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES:

1. Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma,Oxford Univ. Press, 2016, New Delhi.
2. A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt.Ltd.
3. English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education, ISBN : 0070264244.
4. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
5. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.

CO's-PO's & PSO's MAPPING

CO	PO									PSO					
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	1	1	1	1	1	3	3	3	1	3	-	3	-	-	-
2	1	1	1	1	1	3	3	3	1	3	-	3	-	-	-
3	2	3	2	3	2	3	3	3	2	3	3	3	-	-	-
4	2	3	2	3	2	3	3	3	2	3	3	3	-	-	-
5	2	3	3	3	-	3	3	3	2	3	-	3	-	-	-
AVg.	**1.6**	**2.2**	**1.8**	**2.2**	**1.5**	**3**	**3**	3	**1.6**	**3**	**3**	**3**	**-**	**-**	**-**

- 1-low, 2-medium, 3-high, '-"- no correlation
- **Note:** The average value of this course to be used for program articulation matrix.

21148S12 MATRICES AND CALCULUS L T P C
3 1 0 4

COURSE OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals andtheir applications.

UNIT I MATRICES 9+3

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

UNIT II DIFFERENTIAL CALCULUS 9+3

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules(sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications : Maxima and Minima of functions of one variable.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 9+3

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

UNIT IV INTEGRAL CALCULUS 9+3

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 - Applications : Hydrostatic force and pressure, moments and centres of mass.

UNIT V MULTIPLE INTEGRALS 9+3

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double andtriple integrals – Applications: Moments and centres of mass, moment of inertia.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Use the matrix algebra methods for solving practical problems.
CO2 Apply differential calculus tools in solving various application problems.
CO3 Able to use differential calculus ideas on several variable functions.
CO4 Apply different methods of integration in solving practical problems.
CO5 Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXT BOOKS :

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition,2018.
3. James Stewart, "Calculus : Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 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, 7.1 - 7.4and 7.8].

REFERENCES:

1. Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016

2. Bali. N., Goyal. M. and Watkins. C., “Advanced Engineering Mathematics”, Firewall Media (Animprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain. R.K. and Iyengar. S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, NewDelhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K.,“Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi,2016.
6. Srimantha Pal and Bhunia. S.C, "Engineering Mathematics " Oxford University Press, 2015.
7. Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2018.

CO’s-PO’s & PSO’s MAPPING

	PO 01	**PO 02**	**PO 03**	**PO 04**	**PO 05**	**PO 06**	**PO 07**	**PO 08**	**PO 09**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO3	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
Avg	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-

21149S13 **ENGINEERING PHYSICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to be successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I MECHANICS **9**

Multi particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M .I –moment of inertia of continuous bodies –M.I of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum –double pendulum –Introduction to nonlinear oscillations.

UNIT II ELECTROMAGNETIC WAVES **9**

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuuminterface for normal incidence.

UNIT III OSCILLATIONS, OPTICS AND LASERS **9**

Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave - soundwaves - Doppler effect. Reflection and refraction of light waves - total internal reflection - interference –Michelson interferometer –Theory of air wedge and experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO2 laser, semiconductor laser –Basic applications of lasers in industry.

UNIT IV BASIC QUANTUM MECHANICS **9**

Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes-Normalization, probabilities andthe correspondence principle.

UNIT V APPLIED QUANTUM MECHANICS **9**

The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)-Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch's theorem forparticles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of this course, the students should be able to

CO1 Understand the importance of mechanics.

CO2 Express their knowledge in electromagnetic waves.

CO3 Demonstrate a strong foundational knowledge in oscillations, optics and lasers.

CO4 Understand the importance of quantum physics.

CO5 Comprehend and apply quantum mechanical principles towards the formation of energy bands.

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (IndianEdition), 2017.

2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.

3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw-Hill(Indian Edition), 2017.

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition),2009.
2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications,(Indian Edition), 2019.
4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
5. N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer-Verlag,2012.

CO's-PO's & PSO's MAPPING

CO's	**PO's**												**PSO's**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2	1	1	1	-	-	-	-	-	-	-	-	-
2	3	3	2	1	2	1	-	-	-	-	-	-	-	-	-
3	3	3	2	2	2	1	-	-	-	-	-	1	-	-	-
4	3	3	1	1	2	1	-	-	-	-	-	-	-	-	
5	3	3	1	1	2	1	-	-	-	-	-	-	-	-	-
AVG	3	3	1.6	1.2	1.8	1	-	-	-	-	-	1	-	-	-

1-Low,2-Medium,3-High,"-"-no correlation

Note: the average value of this course to be used for program articulation matrix.

21149S14 **ENGINEERING CHEMISTRY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To inculcate sound understanding of water quality parameters and water treatmenttechniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties andcombustion characteristics.
- To familiarize the students with the operating principles, working processes and applicationsof energy conversion and storage devices.

UNIT I WATER AND ITS TREATMENT **9**

Water: Sources and impurities, **Water quality parameters:** Definition and significance of-colour, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, flouride and arsenic. **Municipal water treatment:** primary treatment and disinfection (UV, Ozonation, break-point chlorination)**. Desalination of brackish water**: Reverse Osmosis. **Boiler troubles:** Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. **Treatment of boiler feed water**: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment –Ion exchange demineralisation and zeolite process.

UNIT II NANOCHEMISTRY **9**

Basics: Distinction between molecules, nanomaterials and bulk materials; **Size-dependent properties** (optical, electrical, mechanical and magnetic); **Types of nanomaterials**: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. **Preparation of nanomaterials:** sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. **Applications** of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III PHASE RULE AND COMPOSITES **9**

Phase rule: Introduction, definition of terms with examples. One component system - water system;Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process. **Composites: Introduction**: Definition & Need for composites; **Constitution**: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). **Properties and applications of**: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. **Hybrid composites** - definition and examples.

UNIT IV FUELS AND COMBUSTION **9**

Fuels: Introduction: Classification of fuels; **Coal and coke**: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). **Petroleum and Diesel:** Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil cetane number; **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** - ORSAT Method. **CO2 emission and carbon foot print.**

UNIT V ENERGY SOURCES AND STORAGE DEVICES **9**

Stability of nucleus: mass defect (problems), binding energy;Nuclear energy: light water nuclear power plant, breeder reactor. **Solar energy conversion:** Principle, working and applications of solar cells**; Recent developments in solar cell materials. Wind energy; Geothermal energy;Batteries:**Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion- battery; **Electric vehicles-working principles; Fuel cells:** H2-O2 fuel cell, microbial fuel cell; **Supercapacitors:** Storage principle, types and examples.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.

CO2 To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
CO3 To apply the knowledge of phase rule and composites for material selection requirements.
CO4 To recommend suitable fuels for engineering processes and applications.
CO5 To recognize different forms of energy resources and apply them for suitable applications inenergy sectors.

TEXT BOOKS:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3. S.S. Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.

REFERENCES:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscienceand nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4. ShikhaAgarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge UniversityPress, Delhi, Second Edition, 2019.
5. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

CO's-PO's & PSO's MAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	1	-	1	1	-	-	-	-	1	-	-	-
2	2	-	-	1	-	2	2	-	-	-	-	-	-	-	-
3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
4	3	1	1	-	-	1	2	-	-	-	-	-	-	-	-
5	3	1	2	1	-	2	2	-	-	-	-	2	-	-	-
Avg.	**2.8**	**1.3**	**1.6**	**1**	**-**	**1.5**	**1.8**		**-**	**-**	**-**	**1.5**	-	-	-

- 1-low, 2-medium, 3-high, '-"- no correlation

21150S15 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms(iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, andlist; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V FILES, MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments,errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs using conditionals and looping for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

1. Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition,O'Reilly Publishers, 2016.

2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving andprogramming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.

2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data‘‘, Third Edition, MIT Press 2021
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”,2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill,2018.

CO’s-PO’s & PSO’s MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	2	-	-	-	-	-	2	2	3	3	-
2	3	3	3	3	2	-	-	-	-	-	2	2	3	-	-
3	3	3	3	3	2	-	-	-	-	-	2	-	3	-	-
4	2	2	-	2	2	-	-	-	-	-	1	-	3	-	-
5	1	2	-	-	1	-	-	-	-	-	1	-	2	-	-
6.	2	2	-	-	2	-	-	-	-	-	1	-	2	-	-

- 1-low, 2-medium, 3-high, ‘-“- no correlation

PRACTICALS

21150L16 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY **L T P C 0 0 4 2**

COURSE OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted tothe sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components ofan automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another,word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational problems

CO2: Develop and execute simple Python programs.

CO3: Implement programs in Python using conditionals and loops for solving problems.

CO4: Deploy functions to decompose a Python program.

CO5: Process compound data using Python data structures.

CO6: Utilize Python packages in developing software applications.

TEXT BOOKS:

1. Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.

2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.

2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers andData Scientists”, 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applicationsto Computational Modeling and Understanding Data‘‘, Third Edition, MIT Press, 2021
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”,2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018.

COs- PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	2	-	-	-	-	-	2	2	3	3	-
2	3	3	3	3	2	-	-	-	-	-	2	2	3	-	-
3	3	3	3	3	2	-	-	-	-	-	2	-	3	-	-
4	2	2	-	2	2	-	-	-	-	-	1	-	3	-	-
5	1	2	-	-	1	-	-	-	-	-	1	-	2	-	-
AVg.	2	2	-	-	2	-	-	-	-	-	1	-	2	-	-
	2	**3**	**3**	**3**	**2**	-	-	-	-	-	**2**	**2**	**3**	**3**	-

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

21149L17 PHYSICS AND CHEMISTRY LABORATORY L T P C
0 0 4 2

PHYSICS LABORATORY:
(Any Seven Experiments)
COURSE OBJECTIVES:

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation ofexperimental data.
- To determine error in experimental measurements and techniques used to minimize sucherror.
- To make the student as an active participant in each part of all lab exercises.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regularand irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young's modulus
4. Uniform bending – Determination of Young's modulus
5. Laser- Determination of the wave length of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
10. Post office box -Determination of Band gap of a semiconductor.
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students should be able to
CO1 Understand the functioning of various physics laboratory equipment.
CO2 Use graphical models to analyze laboratory data.
CO3 Use mathematical models as a medium for quantitative reasoning and describing physical reality.
CO4 Access, process and analyze scientific information.
CO5 Solve problems individually and collaboratively.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	3	1	1	-	-	-	-	-	-	-	-	-	-
2	3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
3	3	2	3	1	1	-	-	-	-	-	-	-	-	-	-
4	3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
5	3	2	3	1	1	-	-	-	-	-	-	-	-	-	-
AVG	3	2.4	2.6	1	1										

- **1-Low,2-Medium,3-High,"-"-no correlation**
- **Note: the average value of this course to be used for program articulation matrix.**

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)
COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters, suchas, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry,potentiometry and conductometry in the determination of impurities in aqueous

solutions.

- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles

1. Preparation of Na2CO3 as a primary standard and estimation of acidity of a water sample usingthe primary standard
2. Determination of types and amount of alkalinity in water sample.
- Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
12. Estimation of sodium /potassium present in water using flame photometer.
13. Preparation of nanoparticles (TiO2/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

TOTAL: 30 PERIODS

COURSE OUTCOMES :

CO1 To analyse the quality of water samples with respect to their acidity, alkalinity, hardness andDO.

CO2 To determine the amount of metal ions through volumetric and spectroscopic techniques

CO3 To analyse and determine the composition of alloys.

CO4 To learn simple method of synthesis of nanoparticles

CO5 To quantitatively analyse the impurities in solution by electroanalytical techniques'' 40

TEXT BOOKS :

1. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook ofQuantitative Chemical Analysis (2009).

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	1	-	-	2	2	-	-	-	-	2	-	-	-
2	3	1	2	-	-	1	2	-	-	-	-	1	-	-	-
3	3	2	1	1	-	-	1	-	-	-	-	-	-	-	-
4	2	1	2	-	-	2	2	-	-	-	-	-	-	-	-
5	2	1	2	-	1	2	2	-	-	-	-	1	-	-	-
Avg.	2.6	1.3	1.6	1	1	1.4	1.8	-	-	-	-	1.3	-	-	-

- **1-low, 2-medium, 3-high, '-"- no correlation**

21147L18 **ENGLISH LABORATORY** **L T P C**
0 0 2 1

COURSE OBJECTIVES :

- To improve the communicative competence of learners
- To help learners use language effectively in academic /work contexts
- To develop various listening strategies to comprehend various types of audio materials likelectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking andgrammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION **6**

Listening for general information-specific details- conversation: Introduction to classmates - Audio /video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests andoffers- understanding basic instructions(filling out a bank application for example).

UNIT II NARRATION AND SUMMATION **6**

Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk- describing requirements and abilities.

UNIT III DESCRIPTION OF A PROCESS PRODUCT **6**

Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes andweights- talking about quantities(large & small)-talking about precautions.

UNIT IV CLASSIFICATION AND RECOMMENDATIONS **6**

Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-

UNIT V EXPRESSION **6**

Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions- understanding a website-describing processes

TOTAL : 30 PERIODS

LEARNING OUTCOMES:

At the end of the course, learners will be able

CO1 To listen to and comprehend general as well as complex academic information

CO2 To listen to and understand different points of view in a discussion

CO3 To speak fluently and accurately in formal and informal communicative contexts

CO4 To describe products and processes and explain their uses and purposes clearly and accurately

CO5 To express their opinions effectively in both formal and informal discussions

COs- PO's & PSO's MAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
2	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
3	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
4	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
5	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
AVg.	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**

- 1-low, 2-medium, 3-high, ‘-“- no correlation

Note: The average value of this course to be used for program articulation matrix

SEMESTER II

21147S21	PROFESSIONAL ENGLISH II	L T P C
		2 0 0 2

COURSE OBJECTIVES:

- To engage learners in meaningful language activities to improve their reading and writingskills
- To learn various reading strategies and apply in comprehending documents in professionalcontext.
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship andplacements

UNIT I MAKING COMPARISONS **6**

Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Emailetiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases

UNIT II EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING **6**

Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds

UNIT III PROBLEM SOLVING **6**

Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor,Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences

UNIT IV REPORTING OF EVENTS AND RESEARCH **6**

Reading –Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions

UNIT V THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY **6**

Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numericaladjectives, Relative Clauses.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

CO1 To compare and contrast products and ideas in technical texts.

CO2 To identify and report cause and effects in events, industrial processes through technical texts

CO3 To analyse problems in order to arrive at feasible solutions and communicate them in the written format.

CO4 To present their ideas and opinions in a planned and logical manner

CO5 To draft effective resumes in the context of job search.

TEXT BOOKS :

1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Departmentof English, Anna University.
2. English for Science & Technology Cambridge University Press 2021.
3. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN.Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES:

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. NewDelhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi.
3. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
2	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
3	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
4	3	3	3	3	2	3	3	3	2	3	3	3	-	-	-
5	-	-	-	-	-	-	-	-	3	3	3	3	-	-	-
AVg.	**3**	**3**	**3**	**3**	**2.75**	**3**	**3**	**3**	**2.2**	**3**	**3**	**3**	-	-	-

- 1-low, 2-medium, 3-high, '-"- no correlation

Note: The average value of this course to be used for program articulation matrix

21148S22 STATISTICS AND NUMERICAL METHODS L T P C
3 1 0 4

COURSE OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinarydifferential equations.

UNIT I TESTING OF HYPOTHESIS 9+3

Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENT 9+3

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - 22 factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

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 and Jacobi's method for symmetric matrices.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9+3

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO2 Apply the basic concepts of classifications of design of experiments in the field of agriculture.

CO3 Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.

CO4 Understand the knowledge of various techniques and methods for solving first and secondorder ordinary differential equations.

CO5 Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXT BOOKS:

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

REFERENCES:

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
5. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
6. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010.

COs- PO's & PSO's MAPPING

	PO 01	**PO 02**	**PO 03**	**PO 04**	**PO 05**	**PO 06**	**PO 07**	**PO 08**	**PO 09**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO3	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
Avg	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-

21149S23E **PHYSICS FOR CIVIL ENGINEERING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To introduce the basics of heat transfer through different materials, thermal performance of building and various thermal applications
- To impart knowledge on the ventilation and air conditioning of buildings
- To introduce the concepts of sound insulation and lighting designs
- To give an introduction to the processing and applications of new engineering materials
- To create an awareness on natural disasters and safety measures

UNIT I THERMAL APPLICATIONS **9**

Principles of heat transfer, steady state of heat flow, conduction through compound media-series and parallel-conductivity of rubber tube and powder materials - 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.

UNIT II VENTILATION AND REFRIGERATION **9**

Requirements, principles of natural ventilation - ventilation measurements, design for natural ventilation - Window types and packaged air conditioners - chilled water plant - fan coil systems - water piping - cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C.Systems.

UNIT III ACOUSTICS AND LIGHTING DESIGNS **9**

Methods of sound absorptions - absorbing materials - noise and its measurements, sound insulation and its measurements, impact of noise in multistored buildings. Visual field glare, colour - day light calculations - day light design of windows, measurement of day-light and use of models and artificial skies, principles of artificial lighting, supplementary artificial lighting.

UNIT IV NEW ENGINEERING MATERIALS **9**

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

UNIT V NATURAL DISASTERS **9**

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 acquire knowledge about heat transfer through different materials, thermal performance of building and thermal insulation.

CO2 gain knowledge on the ventilation and air conditioning of buildings

CO3 understand the concepts of sound absorption, noise insulation and lighting designs

CO4 now about the processing and applications of composites, metallic glasses, shape memory alloys and ceramics

CO5 get an awareness on natural disasters such as earth quake, cyclone, fire and safety measures

TEXT BOOKS:

1. Marko Pinteric, Building Physics, Springer 2017.
2. D.S.Mathur. Elements of Properties of Matter. S Chand & Company, 2010.
3. Hugo Hens, Building Physics: Heat, Air and Moisture, Wiley, 2017

REFERENCES:

1. W.R.Stevens. Building Physics: Lighting. Pergamon Press, 2013..
2. Hugo Hens, Applied Building Physics, Wiley, 2016
3. K.G.Budinski and M.K.Budinski. Engineering Materials: Properties and Selection. Pearson Education, 2016.
4. Peter A. Claisse, Civil Engineering Materials, Elsevier, 2016.
5. Patrick L. Abbott, Natural Disasters, McGraw-Hill, 2017.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	-	1	1	-	-	-	-	-	-	-	-	-
2	3	2	2	-	1	1	-	-	-	-	-	-	-	-	-
3	3	2	2	-	1	1	-	-	-	-	-	-	-	-	-
4	3	-	2	2	2	1	-	-	-	-	-	-	-	-	-
5	3	1	-	-	1	3	-	-	-	-	-	-	-	-	-
AVG	3	1.75	2	2	1.2	1.4									

1-Low,2-Medium,3-High,"-"-no correlation

Note: the average value of this course to be used for program articulation matrix.

21154S24 **ENGINEERING GRAPHICS** **L T P C**
2 0 4 4

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Drawing engineering curves.
- Drawing freehand sketch of simple objects.
- Drawing orthographic projection of solids and section of solids.
- Drawing development of solids
- Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

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 **6+12**

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

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

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

UNIT III PROJECTION OF SOLIDS AND FREEHAND SKETCHING **6+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axisis inclined to one of the principal planes and parallel to the other by rotating object method. 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. Practicing three dimensional modeling of simple objects by CAD Software(Not for examination)

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES **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.Practicing three dimensional modeling of simple objects by CAD Software(Not for examination)

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS **6+12**

Principles of isometric projection — isometric scale —lsometric 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. Practicing three dimensional modeling of isometric projection of simple objects by CADSoftware(Not for examination)

TOTAL: (L=30+P=60) 90 PERIODS

COURSE OUTCOMES:

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

CO1 Use BIS conventions and specifications for engineering drawing.

CO2 Construct the conic curves, involutes and cycloid.

CO3 Solve practical problems involving projection of lines.

CO4 Draw the orthographic, isometric and perspective projections of simple solids.

CO5 Draw the development of simple solids.

TEXT BOOKS:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2. Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
3. Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press, 2015

REFERENCES:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2nd Edition, 2019.
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.
6. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

COs- PO's & PSO's MAPPING

CO	**PO**												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	2		2					3		2	2	2	
2	3	1	2		2					3		2	2	2	
3	3	1	2		2					3		2	2	2	
4	3	1	2		2					3		2	2	2	
5	3	1	2		2					3		2	2	2	
Avg	**3**	**1**	**2**		**2**					**3**		**2**	**2**	**2**	
Low (1) ; Medium (2) ; High (3)															

21153S25C	BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING	L T P C 3 0 0 3

COURSE OBJECTIVES:

- To introduce the basics of electric circuits and analysis
- To impart knowledge in domestic wiring
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To introduce the functional elements and working of sensors and transducers.

UNIT I ELECTRICAL CIRCUITS **9**

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state) Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only), Three phase supply – star and delta connection – power in three- phase systems

UNIT II MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS **9**

Magnetic circuits-definitions-MMF, flux, reluctance, magnetic field intensity, flux density, fringing, self and mutual inductances-simple problems. Domestic wiring , types of wires and cables, earthing ,protective devices- switch fuse unit- Miniature circuit breaker-moulded case circuit breaker- earth leakage circuit breaker, safety precautions and First Aid

UNIT III ELECTRICAL MACHINES **9**

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.

UNIT IV ANALOG ELECTRONICS **9**

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET,IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters, harmonics

UNIT V SENSORS AND TRANSDUCERS **9**

Sensors, solenoids, pneumatic controls with electrical actuator, mechatronics, types of valves and its applications, electro-pneumatic systems, proximity sensors, limit switches, piezoelectric, hall effect, photo sensors,Strain gauge, LVDT, differential pressure transducer,optical and digital transducers, Smart sensors, Thermal Imagers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1: Compute the electric circuit parameters for simple problems
CO2: Explain the concepts of domestics wiring and protective devices
CO3: Explain the working principle and applications of electrical machines
CO4: Analyze the characteristics of analog electronic devices
CO5: Explain the types and operating principles of sensors and transducers

TEXT BOOKS:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, Second Edition, 2020
2. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

3. S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
4. James A Svoboda, Richard C. Dorf, Dorf's Introduction to Electric Circuits, Wiley,2018

REFERENCES:

1. John Bird, "Electrical Circuit theory and technology", Routledge; 2017.
2. Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.
3. Albert Malvino, David Bates, '**Electronic Principles**, McGraw Hill Education; 7th edition, 2017
4. Muhammad H.Rashid, "Spice for Circuits and electronics", 4th Edition., Cengage India,2019.
5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

CO's, PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	1					1					-	-	-
2	2	1	1					1					-	-	-
3	2	1	1					1					-	-	-
4	2	1	1					1					-	-	-
5	2	1	1					1					-	-	-
Avg.	2	1	1					1					-	-	-

PRACTICALS

21154L21 ENGINEERING PRACTICES LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES 15

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.

b) Preparing plumbing line sketches.

c) Laying pipe connection to the suction side of a pump

d) Laying pipe connection to the delivery side of a pump.

e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

a) Sawing,

b) Planing and

c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture

b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES 15

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket

b) Staircase wiring

c) Fluorescent Lamp wiring with introduction to CFL and LED types.

d) Energy meter wiring and related calculations/ calibration

e) Study of Iron Box wiring and assembly

f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)

g) Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.

b) Practicing gas welding.

BASIC MACHINING WORK:

a) (simple)Turning.

b) (simple)Drilling.

c) (simple)Tapping.

ASSEMBLY WORK:

a) Assembling a centrifugal pump.

b) Assembling a household mixer.
c) Assembling an airconditioner.

SHEET METAL WORK:
a) Making of a square tray
FOUNDRY WORK:
a) Demonstrating basic foundry operations**.**
PART IV ELECTRONIC ENGINEERING PRACTICES **15**
SOLDERING WORK:
a) Soldering simple electronic circuits and checking continuity**.**
ELECTRONIC ASSEMBLY AND TESTING WORK:
a) Assembling and testing electronic components on a small PCB.
ELECTRONIC EQUIPMENT STUDY:
a) Study an elements of smart phone..
b) Assembly and dismantle of LED TV.
c) Assembly and dismantle of computer/ laptop

TOTAL : 60 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1 Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
CO2 Wire various electrical joints in common household electrical wire work.
CO3 Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
CO4 Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.
COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2			1	1	1					2	2	1	1
2	3	2			1	1	1					2	2	1	1
3	3	2			1	1	1					2	2	1	1
Avg	**3**	**2**			**1**	**1**	**1**					**2**	**2**	**1**	**1**
Low (1) ; Medium (2) ; High (3															

21153L22D **BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING LABORATORY** **L T P C 0 0 4 2**

COURSE OBJECTIVES:

- To train the students in conducting load tests electrical machines
- To gain practical experience in experimentally obtaining the characteristics of electronic devices and rectifiers
- To train the students to measure three phase power and displacement

List of Experiments

1. Verification of ohms and Kirchhoff's Laws.
2. Three Phase Power Measurement
3. Load test on DC Shunt Motor.
4. Load test on Self Excited DC Generator
5. Load test on Single phase Transformer
6. Load Test on Induction Motor
7. Characteristics of PN and Zener Diodes
8. Characteristics of BJT, SCR and MOSFET
9. Design and analysis of Half wave and Full Wave rectifiers
10. Measurement of displacement of LVDT

TOTAL: 60 PERIODS

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1: Use experimental methods to verify the Ohm's law and Kirchhoff's Law and to measure three phase power

CO2: Analyze experimentally the load characteristics of electrical machines

CO3: Analyze the characteristics of basic electronic devices

CO4: Use LVDT to measure displacement

CO's, PO's & PSO's MAPPING

CO's	PO's										PSO's				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	3	1	2				1.5	2				-	-	-
2	2	3	1	2				1.5	2				-	-	-
3	2	3	1	2				1.5	2				-	-	-
4	2	3	1	2				1.5	2				-	-	-
Avg.	1.6	1.4	0.8	1.6				1.2	1.6						

21147L23 COMMUNICATION LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To analyse concepts and problems and make effective presentations explaining them clearly and precisely.
- To be able to communicate effectively through formal and informal writing.
- To be able to use appropriate language structures to write emails, reports and essays
- To give instructions and recommendations that are clear and relevant to the context

UNIT I **12**

Speaking-Role Play Exercises Based on Workplace Contexts, - talking about competition-discussing progress toward goals-talking about experiences- talking about events in life- discussing past events-Writing: writing emails (formal & semi-formal).

UNIT II **12**

Speaking: discussing news stories-talking about frequency-talking about travel problems- discussing travel procedures- talking about travel problems- making arrangements-describing arrangements-discussing plans and decisions- discussing purposes and reasons- understanding common technologyterms-Writing: - writing different types of emails.

UNIT III **12**

Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios- talking about purchasing-discussing advantages and disadvantages- making comparisons- discussing likes and dislikes- discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.

UNIT IV **12**

Speaking: discussing the natural environment-describing systems-describing position and movement- explaining rules-(example- discussing rental arrangements)- understanding technical instructions-Writing: writing instructions-writing a short article.

UNIT V **12**

Speaking: describing things relatively-describing clothing-discussing safety issues(making recommendations) talking about electrical devices-describing controlling actions- Writing: job application(Cover letter + Curriculum vitae)-writing recommendations.

TOTAL: 60 PERIODS

LEARNING OUTCOMES

At the end of the course, learners will be able

CO1 Speak effectively in group discussions held in a formal/semi formal contexts.

CO2 Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions

CO3 Write emails, letters and effective job applications.

CO4 Write critical reports to convey data and information with clarity and precision

CO5 Give appropriate instructions and recommendations for safe execution of tasks

Assessment Pattern

COs- PO's & PSO's MAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	3	3	3	1	3	3	3	3	3	3	3	-	-	-
2	2	3	3	3	1	3	3	3	3	3	3	3	-	-	-
3	2	2	3	3	1	3	3	3	3	3	3	3	-	-	-
4	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
5	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
AVg.	**2.4**	**2.8**	**3**	**3**	**1.8**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**

- low, 2-medium, 3-high, '-"- no correlation

Note: The average value of this course to be used for program articulation matrix.

SEMESTER III

21148S31D TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C

3 1 0 4

COURSE OBJECTIVES

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineeringapart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Formation of partial differential equations –Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types- Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 9 + 3

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

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+ 3

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 oftwo dimensional equation of heat conduction (Cartesian coordinates only).

UNIT IV FOURIER TRANSFORMS 9 + 3

Statement of Fourier integral theorem– Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 9+ 3

Z-transforms - Elementary properties – Convergence of Z-transforms - – Initial and final value theorems - Inverse Z-transform using partial fraction and convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms.

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

CO1 Understand how to solve the given standard partial differential equations.

CO2 Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.

CO3 Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.

CO4 Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

CO5 Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS:

1. Grewal B.S.,"Higher Engineering Mathematics" 44thEdition, Khanna Publishers,New Delhi, 2018.

2. Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2016.

REFERENCES:

1. Andrews. L.C and Shivamoggi. B, "Integral Transforms for Engineers" SPIE Press, 1999.
2. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt. Ltd, 2015.
3. James. G., "Advanced Modern Engineering Mathematics", 4thEdition, Pearson Education, New Delhi, 2016.
4. Narayanan. S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2018.
6. Wylie. R.C. and Barrett . L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

COs- PO's & PSO's MAPPING

	PO 01	**PO 02**	**PO 03**	**PO '04**	**PO 05**	**PO 06**	**PO 07**	**PO 08**	**PO 09**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO2	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO3	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO4	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
CO5	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
Avg	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-

21154S32 ENGINEERING MECHANICS L T P C
3 0 0 3

COURSE OBJECTIVES

- To Learn the use scalar and vector analytical techniques for analyzing forces in Statically determinate structures
- To introduce the equilibrium of rigid bodies
- To study and understand the distributed forces, surface, loading on beam and intensity.
- To learn the principles of friction, forces and to determine the apply the concepts of frictional forces at the contact surfaces of various engineering systems.
- To develop basic dynamics concepts – force, momentum, work and energy;

UNIT I STATICS OF PARTICLES 9

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles -Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton's First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNIT II EQUILIBRIUM OF RIGID BODIES 9

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

UNIT III DISTRIBUTED FORCES 9

Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies , Determination of Centroids of Volumes by Integration. Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia , Radius of Gyration of an Area , Parallel-Axis Theorem , Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates , Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

UNIT IV FRICTION 9

The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, Wheel Friction, Rolling Resistance, Ladder friction.

UNIT V DYNAMICS OF PARTICLES 9

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact of bodies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would 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 distributed forces

CO4 Determine the friction and the effects by the laws of friction

CO5 Calculate dynamic forces exerted in rigid body

TEXTBOOKS:

1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, SanjeevSanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 11thEdition, 2017.

2. Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018.

REFERENCES:

1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
3. Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics, 4thEdition, Pearson Education Asia Pvt. Ltd., 2005.
4. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
5. Timoshenko S, Young D H, Rao J V and SukumarPati, Engineering Mechanics, 5thEdition, McGraw Hill Higher Education, 2013.

COs- PO's & PSO's MAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	1	2						2		3	1	1
2	3	2	2	1	2						2		3	1	1
3	3	2	3	1	2						2		3	1	2
4	3	2	3	1	2						2		3	1	2
5	3	2	3	1	2						2		3	1	2
Avg	**3**	**2**	**3**	**1**	**2**						**2**		**3**	**1**	**2**
Low (1); Medium (2); High (3)															

21155C33 **FLUID MECHANICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

To introduce the students about properties and behaviour of the fluids under static conditionsand to impart basic knowledge of the dynamics of fluids through the control volume approach and to expose to the applications of the conservation laws to a) flow measurements
b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends with anexposure to the significance of boundary layer theory and its applications.

UNIT I FLUIDS PROPERTIES AND FLUID STATICS **10**

Scope of fluid mechanics – Definitions of a fluid – Methods of analysis – Continuum hypothesis – System and Control volume approach – Reynold's transportation theorem – Fluid properties – Fluid statics – Manometry – Forces on plane and curved surfaces – Buoyancy and floatation – Stability offloating bodies.

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 equationof motion along a stream line – Bernoulli's equation – Applications to velocity and discharge measurements – Linear momentum equation – Application to Pipe bends – Moment of momentumequation.

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.

UNIT IV INCOMPRESSIBLE VISCOUS FLOW **10**

Reynolds experiment – Laminar flow in pipes and between parallel plates – Development of laminarand turbulent flows in pipes – Darcy-Weisbach equation – Moody diagram – Major and minor lossesof flow in pipes – Total energy line – Hydraulic grade line – Siphon – Pipes in series and parallel – Equivalent pipes.

UNIT V BOUNDARY LAYERS **8**

Definition of boundary layers – Laminar and turbulent boundary layers – Displacement, momentumand energy thickness – Momentum integral equation – Applications – Separation of boundary layer-Drag and Lift forces.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected 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 kinematicsand dynamics.

CO3 Formulate the relationship among the parameters involved in the given fluid phenomenon andto predict the performance of prototypes by model studies.

CO4 Estimate the losses in pipelines for both laminar and turbulent conditions and analysis of pipesconnected in series and parallel.

CO5 Explain the concept of boundary layer and its application to find the drag force excreted by thefluid on the flat solid surface.

TEXTBOOKS:

1. Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines StandardBook House New Delhi. 2015.
2. Streeter, V.L. Wylie, E. B. and Bedford K.W, Fluid Mechanics. (9th Ed.) Tata McGraw Hill, NewDelhi, 1998.

REFERENCES:

1. S K Som; Gautam Biswas and S Chakraborty, Introduction to Fluid Mechanics and FluidMachines, Tata McGraw Hill Education Pvt. Ltd., 2012.
2. Pani B S, Fluid Mechanics: A Concise Introduction, Prentice Hall of India Private Ltd, 2016.
3. Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2014.
4. Narayana Pillai N. Principles of Fluid Mechanics and Fluid Machines, (3rd Ed.) University Press(India) Pvt. Ltd. 2009.

COs- PO's & PSO's MAPPING

PO/PSO		**Course Outcome**					**Overall Correlation of COs to POs**
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	2	2	2	3	3	2
PO3	Design / development of solutions	1	1	3	3	2	3
PO4	Investigation	1	1	2	2	2	2
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	2	2	2	3	3	2
PO7	Environment and Sustainability	2	2	2	2	2	2
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	1	1	1	1	1	1
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	2	2	3	3	2
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis ofCivil Engineering problems and innovation	2	2	3	3	3	3
PSO3	Conceptualization andevaluation of engineering solutions to Civil Engineering Issues	1	1	2	3	3	3

21155C34 CONSTRUCTION MATERIALS AND TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:

To introduce students to various construction materials and the techniques that are commonly used in civil engineering construction.

UNIT I STONES - BRICKS - CONCRETE BLOCKS - LIME 9

Stone as building material – Criteria for selection – Tests on stones – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive strength – Water Absorption – Efflorescence – Lime – Preparation of lime mortar – Concrete hollow blocks – Lightweight concreteblocks.

UNIT II OTHER MATERIALS 9

Timber – Market forms – Plywood – Veneer – False ceiling materials – Steel – Mechanical treatment – Aluminum – Uses – Market forms – Glass – Ceramics – Refractories – Composite Materials – Types and applications – FRP – Fibre textiles – Geomembranes and Geotextiles for earthreinforcement.

UNIT III CONSTRUCTION PRACTICES & SERVICE REQUIREMENTS 9

Types of Foundations – Shallow and Deep Foundations – Stone Masonry – Brick Masonry – Plastering and Pointing – Cavity Walls – Diaphragm Walls – Formwork – Centering and Shuttering

– Shoring – Scaffolding – Underpinning – Roofing – Flooring – Joints in concrete – Contraction/Construction/Expansion joints – Fire Protection – Thermal Insulation – Ventilation andAir conditioning – Acoustics and Sound Insulation – Damp Proofing.

UNIT IV CONSTRUCTION EQUIPMENTS 9

Selection of equipment for earthwork excavation, concreting, material handling and erection of structures – Dewatering and pumping equipment.

UNIT V CONSTRUCTION PLANNING 9

Introduction to construction planning – Scheduling for activities – Critical path method (CPM) andPERT network modelling and time analysis – Case illustrations.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Students will be able to

CO1 Identify the good quality brick, stone and blocks for construction.

CO2 Recognize the market forms of timber, steel, aluminum and applications of various compositematerials.

CO3 Identify the best construction and service practices such as thermal insulations and air conditioning of the building

CO4 Select various equipments for construction works conditioning of building

CO5 Understand the construction planning and scheduling techniques

TEXTBOOKS

1. Varghese.P.C, Building Materials, Second Edition PHI Learning Ltd., 2015.

2. Arora S.P and Bindra S.P Building construction, Dhanpat Rai and sons, 2013.

REFERENCES:

1. Varghese.P.C, Building Construction, Second Edition PHI Learning ltd., 2016.

2. Punmia ,B.C Building construction , Laxmi publication (p)ltd..,2008.

3. Peurifoy R.L., Schexnayder,C.J., Shapira A., Schmitt.R., Construction Planning Equipment andMethods, Tata McGraw-hill, 2011.

4. Srinath L.S.,PERT and CPM -Principles and applications, Affliated East West Press 2001

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	2	3	3	2	2	2
PO2	Problem analysis	2				3	2
PO3	Design / development of solutions					2	1
PO4	Investigation	3	2	2		3	2
PO5	Modern Tool Usage					2	1
PO6	Engineer and Society	2		2			1
PO7	Environment and Sustainability	2	2	3			2
PO8	Ethics						
PO9	Individual and Team work					2	1
PO10	Communication						
PO11	Project Management and Finance			2	2	3	2
PO12	Life Long Learning	2	2			2	2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineeringproblems and innovation				3	3	2
PSO3	Conceptualization and evaluation ofengineering solutions to Civil Engineering Issues		2		2	3	2

21155C35 WATER SUPPLY AND WASTEWATER ENGINEERING **L T P C**
4 0 0 4

COURSE OBJECTIVES:

To introduce students to various components and design of water supply scheme, water treatment methods, water storage distribution system, sewage treatment and disposal anddeign of intake structures and sewerage system.

UNIT I WATER SUPPLY **12**

Estimation of surface and subsurface water resources - Predicting demand for water- Impurities of water and their significance - Physical, chemical and bacteriological analysis - Waterborne diseases -Standards for potable water. Intake of water: Pumping and gravity schemes.

UNIT II WATER TREATMENT **12**

Objectives - Unit operations and processes - Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation – Clarifloccuator - Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - softening, removal of iron and manganese - Defluoridation - Softening - Desalination process - Residue Management - Construction, Operationand Maintenance aspects

UNIT III WATER STORAGE AND DISTRIBUTION **12**

Storage and balancing reservoirs - types, location and capacity. Distribution system: layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters, analysis of distribution systems, leak detection, maintenance of distribution systems, pumping stations and their operations - House service connections.

UNIT IV PLANNING AND DESIGN OF SEWERAGE SYSTEM **12**

Characteristics and composition of sewage - Population equivalent - Sanitary sewage flow estimation - Sewer materials - Hydraulics of flow in sanitary sewers - Sewer design - Storm drainage-Storm runoff estimation - Sewer appurtenances - Corrosion in sewers - Prevention and control – Sewage pumping-drainage in buildings - Plumbing systems for drainage

UNIT V SEWAGE TREATMENT AND DISPOSAL **12**

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Understand the various components of water supply scheme and design of intake structure and conveyance system for water transmission

CO2 Understand on the characteristics and composition of sewage, ability to estimate sewage generation and design sewer system including sewage pumping stations

CO3 Understand the process of conventional treatment and design of water and wastewater treatment system and gain knowledge of selection of treatment process and biological treatment process

CO4 Ability to design and evaluate water distribution system and water supply in buildings and understand the self-purification of streams and sludge and septage disposal methods.

CO5 Able to understand and design the various advanced treatment system and knowledge about therecent advances in water and wastewater treatment process and reuse of sewage

TEXTBOOKS:

1. Garg, S.K. Environmental Engineering, Vol.I Khanna Publishers, New Delhi, 2010.
2. Modi, P.N., Water Supply Engineering, Vol.I Standard Book House, New Delhi, 2016.
3. Garg, S.K., Environmental Engineering Vol.II, Khanna Publishers, New Delhi, 2015.
4. Duggal K.N., “Elements of Environmental Engineering” S. Chand and Co. Ltd., New Delhi, 2014.
5. Punmia, B.C., Jain, A.K., and Jain.A.K.., Environmental Engineering, Vol.II, Laxmi Publications,2010.

REFERENCES:

1. Punmia B.C, Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd.,New Delhi 2010.
2. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Governmentof India, New Delhi, 1999.
3. Syed R. Qasimand Edward M. Motley Guang Zhu, Water Works Engineering Planning, Designand Operation, Prentice Hall of India Learning Private Limited, New Delhi, 2009.
4. Of Urban Development, Government of India, New Delhi, 2013.
5. Metcalf and Eddy – Waste water Engineering – Treatment and Reuse, Tata Mc. Graw – HillCompany, New Delhi, 2010.
6. Syed R.Qasim "Waste water Treatment Plants", CRCPress,WashingtonD.C.,2010
7. Gray N.F, "Water Technology", Elsevier India Pvt.Ltd. New Delhi, 2006.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	2	2	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design / development of solutions			3	3	3	3
PO4	Investigation	2	2			2	2
PO5	Modern Tool Usage				2	2	2
PO6	Engineer and Society			3	3	3	3
PO7	Environment and Sustainability			2	3	3	3
PO8	Ethics	1	1	2	2	2	2
PO9	Individual and Team work	1	1	2	3	3	2
PO10	Communication					2	2
PO11	Project Management and Finance			2	2	2	2
PO12	Life Long Learning					3	3
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and			2	2	2	2
	innovation						
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues			2	2	3	2

21155C36 SURVEYING AND LEVELLING L T P C
3 0 0 3

COURSE OBJECTIVES:

To introduce the rudiments of plane surveying and geodetic principles to Civil Engineers and to learn the various methods of plane and geodetic surveying to solve the real world problems. To introduce the concepts of Control Surveying. To introduce the basics of Astronomical Surveying

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING 9

Definition – Classifications – Basic principles – Equipment and accessories for ranging and chaining– Methods of ranging – Well conditioned triangles – Chain traversing – Compass – Basic principles– Types – Bearing – System and conversions – Sources of errors and Local attraction – Magnetic declination – Dip – compass traversing – Plane table and its accessories – Merits and demerits – Radiation – Intersection – Resection – Plane table traversing.

UNIT II LEVELLING 9

Level line – Horizontal line – Datum – Benchmarks – Levels and staves – Temporary and permanent adjustments – Methods of leveling – Fly leveling – Check leveling – Procedure in leveling – Booking – Reduction – Curvature and refraction – Reciprocal leveling – Precise leveling - Contouring.

UNIT III THEODOLITE SURVEYING 9

Horizontal and vertical angle measurements – Temporary and permanent adjustments – Heights and distances – Tacheometric surveying – Stadia Tacheometry – Tangential Tacheometry – Trigonometric leveling – Single Plane method – Double Plane method.

UNIT IV 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.

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 antispoofing receiver components and antenna – Planning and data acquisition – Data processing – Errors in GPS-Field procedure and applications.

TOTAL 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Introduce the rudiments of various surveying and its principles.

CO2 Imparts knowledge in computation of levels of terrain and ground features

CO3 Imparts concepts of Theodolite Surveying for complex surveying operations

CO4 Understand the procedure for establishing horizontal and vertical control

CO5 Imparts the knowledge on modern surveying instruments

TEXTBOOKS:

1. Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, Sixteenth Edition, 2016.
2. T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008.

REFERENCES:

1. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, Mc Graw Hill 2001.
3. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.
4. S. K. Roy, Fundamentals of Surveying, Second Edition, Prentice‸ Hall of India 2010.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	2	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design / development of solutions	3	2	3	3	3	3
PO4	Investigation	2	2	2	3	3	2
PO5	Modern Tool Usage	2	2	3	3	3	3
PO6	Engineer and Society	3	3	3	3	3	3
PO7	Environment and Sustainability				2	2	2
PO8	Ethics	2	2	2	2	3	2
PO9	Individual and Team work	2	2	2	3	2	2
PO10	Communication						
PO11	Project Management and Finance	2	2	2	2	2	2
PO12	Life Long Learning				2	2	2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems andinnovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

PRACTICALS

21155L37 SURVEYING AND LEVELLING LABORATORY L T P C

0 0 3 1.5

COURSE OBJECTIVE:

At the end of the course the student will possess knowledge about survey field techniques

LIST OF EXPERIMENTS:

Chain Survey

1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicularoffset
2. Setting out works – Foundation marking using tapes single Room and Double Room

Compass Survey

3. Compass Traversing – Measuring Bearings & arriving included angles

Levelling - Study of levels and levelling staff

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

Theodolite - Study of Theodolite

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

Tacheometry – Tangential system – Stadia system

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

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

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

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course, the student is expected to

CO1 Impart knowledge on the usage of basic surveying instruments like chain/tape, compass andlevelling instruments

CO2 Able to use levelling instrument for surveying operations

CO3 Able to use theodolite for various surveying operations

CO4 Able to carry out necessary surveys for social infrastructures

CO5 Able to prepare planimetric maps

REFERENCES:

1. T. P. Kanetkarand S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi GrihaPrakashan, Pune, 24th Reprint, 2015.
2. Dr. B. C. Punmia, Ashok K. Jainand Arun K Jain, Surveying Vol. I & II, Lakshmi PublicationsPvt Ltd, New Delhi, 17th Edition, 2016.
3. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition,McGraw Hill 2001
4. Bannisterand S. Raymond, Surveying, Seventh Edition, Longman 2004 a. David Clark, Plane andGeodetic Surveying for Engineers, Volume I, Constable and Company Ltd, London, CBS, 6th Edition, 2004.
5. David Clark and James Clendinning, Plane and Geodetic Surveying for Engineers, VolumeII,Constable and Company Ltd, London, CBS, 6th Edition, 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.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	2	2	1	3	3	2
PO3	Design / development of solutions	3	3	2	2	3	3
PO4	Investigation	3			3	2	3
PO5	Modern Tool Usage	2	3	3	2	2	3
PO6	Engineer and Society	3	3	2	3	3	3
PO7	Environment and Sustainability	2	3		3	3	3
PO8	Ethics	3	3		2	2	3
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication	3	3		3	3	3
PO11	Project Management and Finance	3	3		3	3	3
PO12	Life Long Learning	1	1	2	1	1	1
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

21155L38 WATER AND WASTEWATER ANALYSIS LABORATORY L T P C
0 0 3 1.5

COURSE OBJECTIVE:

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.

LIST OF EXPERIMENTS: ANALYSIS OF WATER SAMPLE

1. Sampling and preservation methods for water and wastewater (Demonstration only)
2. Measurement of Electrical conductivity and turbidity
3. Determination of fluoride in water by spectrophotometric method /ISE
4. Determination of iron in water (Demo)
5. Determination of Sulphate in water
6. Determination of Optimum Coagulant Dosage by Jar test apparatus
7. Determination of available Chlorine in Bleaching powder and residual chlorine in water

ANALYSIS OF WASTEWATER SAMPLE

8. Estimation of suspended, volatile and fixed solids
9. Determination of Sludge Volume Index in waste water
10. Determination of Dissolved Oxygen
11. Estimation of B.O.D.
12. Estimation of C.O.D.
13. Determination of TKN and Ammonia Nitrogen in wastewater
14. Determination of total and faecal coliform (Demonstration only)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Calibrate and standardize the equipment

CO2 Collect proper sample for analysis

CO3 To know the sample preservation methods

CO4 To perform field oriented testing of water, wastewater

CO5 To perform coliform analysis

REFERENCES:

1. APHA, "Standard Methods for the Examination of Water and Waste water", 22nd Ed.Washington, 2012.
2. "Laboratory Manual for the Examination of water, wastewater soil Rump", H.H. and Krist,H. –Second Edition, VCH, Germany, 3rd Edition, 1999.
3. "Methods of air sampling & analysis",James P.Lodge Jr(Editor) 3rd Edition, Lewispublishers,Inc,USA,1989.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	2	2	1	3	2	2
PO2	Problem analysis	1	1	1	3	2	2
PO3	Design / development of solutions	1	1	1	3	3	2
PO4	Investigation	1	1	1	3	3	2
PO5	Modern Tool Usage	2	1	1	3	3	2
PO6	Engineer and Society	1	2	2	2	2	2
PO7	Environment and Sustainability	2	2	2	2	2	2
PO8	Ethics	2	2	2	3	3	3
PO9	Individual and Team work	1	1	2	3	2	2
PO10	Communication	1	1	2	2	2	2
PO11	Project Management and Finance	1	2	2	3	2	2
PO12	Life Long Learning	3	3	2	2	3	3
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	1	2	2	3	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	3	2	2
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	2	2	2	3	2	2

21155L39 **PROFESSIONAL DEVELOPMENT** **L T P C**
0 0 2 1

COURSE OBJECTIVES:

- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize,interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD: 10 Hours

Create and format a documentWorking with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office toolsCreating and Using document templates
Inserting equations, symbols and special characters Working with Table of contents and References, citationsInsert and review comments
Create bookmarks, hyperlinks, endnotes footnoteViewing document in different modes
Working with document protection and securityInspect document for accessibility

MS EXCEL: 10 Hours

Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate, Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,)
Work with Lookup and reference formulae
Create and Work with different types of charts
Use pivot tables to summarize and analyse data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros
Protecting data and Securing the workbook

MS POWERPOINT: 10 Hours

Select slide templates, layout and themes
Formatting slide content and using bullets and numberingInsert and format images,
smart art, tables, charts
Using Slide master, notes and handout master
Working with animation and transitions
Organize and Group slides
Import or create and use media objects: audio, video, animation
Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS

COURSE OUTCOMES:

On successful completion the students will be able to

CO1 Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements

CO2 Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding

CO3 Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

SEMESTER IV

21155C41 APPLIED HYDRAULICS ENGINEERING L T P C

3 1 0 4

COURSE OBJECTIVES:

To impart basic knowledge to the students about the open channel flows with analysis of uniform flow, gradually varied flow and rapidly varied flow and to expose them to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, Centrifugal and Reciprocating pumps.

UNIT I UNIFORM FLOW 9+3

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's equation, Manning equation - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.

UNIT II VARIED FLOWS 9+3

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.

UNIT III RAPIDLY VARIED FLOWS 8+3

Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation – Positive and Negative surges.

UNIT IV TURBINES 9+3

Turbines - Classification - Impulse turbine – Pelton wheel - Reaction turbines - Francis turbine - Kaplan turbine - Draft tube - Cavitation - Performance of turbine - Specific speed - Runaway speed Minimum Speed to start the pump.

UNIT V PUMPS 9+3

Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitation's in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Indicator diagrams and itsvariations - Air vessels - Savings in work done.

TOTAL: (L: 45+ T: 15) 60 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Describe the basics of open channel flow, its classification 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.

TEXT BOOKS:

1. Jain. A.K., Fluid Mechanics, Khanna Publishers, Delhi, 2010.
2. Chandramouli P N, Applied Hydraulic Engineering, Yes Dee Publisher, 2017

REFERENCES:

1. Ven Te Chow, Open Channel Hydraulics, McGraw Hill, New York, 2009.
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 19th edition, 2013.
3. Mays L. W., Water Resources Engineering, John Wiley and Sons (WSE), New York, 2019
4. Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2019.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s toPOs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design / development of solutions	2	2	2	3	3	2
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	2	1	1	1	1
PO6	Engineer and Society	2	2	2	2	2	2
PO7	Environment and Sustainability	2	2	2	2	2	2
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	2	2	2	2	2	2
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	2	2
PSO3	Conceptualization and evaluation of engineering solutions to CivilEngineering Issues	2	2	3	3	3	3

21155C42 **STRENGTH OF MATERIALS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

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

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.

UNIT III DEFLECTION OF BEAMS **9**

Double Integration method – Macaulay's method – Area moment method – Conjugate beam method Strain energy method for determinate beams.

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 threemoments – Shear Force and Bending Moment Diagrams.

UNIT V ADVANCED TOPICS **9**

Unsymmetrical bending of beams - shear centerapplied - Thick cylinders - Theories of failure – Principal stress, principal strain, shear stress, strain energy and distortion energy theories – application problems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

TEXTBOOKS

1. Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 2018.
2. Rattan.S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2017.
3. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain,"Theory of Structures" (SMTS) Vol - II, Laxmi Publishing Pvt Ltd, New Delhi 2017.
4. Basavarajiah and Mahadevapa, Strength of Materials, University press, Hyderabad, 2016
5. 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.

REFERENCES:

1. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2017
2. William A .Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, Tata McGraw Hill Publishing company, 2017.
3. Singh. D.K., " Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2021

4. Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	2	2	2	2	2	2
PO6	Engineer and Society	3	3	3	3	3	3
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	3	3	3	3	3	3
PO9	Individual and Team work	2	2	2	2	2	2
PO10	Communication	3	3	3	3	3	3
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

21155C43 CONCRETE TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To study the properties of concrete making materials.
- To have better knowledge about the chemical and mineral admixtures in concrete.
- To familiarize with the IS method of mix design as per the latest code .
- To understand the fresh and hardened properties of concrete. To know the importance and applications of special concretes

UNIT I CONSTITUENT ATERIALS 9

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

UNIT II CHEMICAL AND MINERAL ADMIXTURES 9

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

UNIT III PROPORTIONING OF CONCRETE MIX 9

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

UNIT IV FRESH AND HARDENED PROPERTIES OF CONCRETE 9

Workability-Tests for workability of concrete-Slump Test and Compacting factor Test-Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS - Properties of Hardened concrete- Stress-strain curve for concrete-Determination of Modulus of elasticity.

UNIT V SPECIAL CONCRETES 9

Light weight concretes - High strength concrete - Fibre reinforced concrete – Ferrocement - Ready mix concrete - SIFCON - Shotcrete – Polymer concrete - High performance concrete- self compacting concrete - Geopolymer Concrete.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1 Understand the requirements of cement, aggregates and water for concrete
CO2 Select suitable admixtures for enhancing the properties of concrete
CO3 Design concrete mixes as per IS method of mix design
CO4 Determine the properties of concrete at fresh and hardened state.
CO5 Know the importance of special concretes for specific requirements.

TEXTBOOKS:

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

REFERENCES:

1. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London,1995
2. Gambhir.M.L.Concrete Technology,Fifth Edition, McGraw Hill Education,2017.
3. Job Thomas., Concrete Technology, Cencage learning India Private Ltd, New Delhi, 2015.
4. IS10262-2019 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhii.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	1	1	2	1	1	1
PO3	Design / development of solutions	1	1	3	1	1	2
PO4	Investigation	2	1	3	1	1	2
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	3	3	3	3	3	3
PO7	Environment and Sustainability	3	3	3	3	3	3
PO8	Ethics	2	1	1	2	2	2
PO9	Individual and Team work	1	1	1	1	1	1
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	1	1	1	1	2	1
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineeringdiscipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems andinnovation	2	2	2	2	2	2
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

21155C44 **SOIL MECHANICS** **L T P C**
3 0 0 3

COURSE 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 bothfinite and infinite slopes.

UNIT I SOIL CLASSIFICATION AND COMPACTION **9**

Formation of soil - Soil description – Particle – Size shape and colour – Composition of gravel, sand, silt, clay particles – Particle behaviour – Soil structure – Phase relationship – Index properties – Significance – BIS classification system – Unified classification system – Compaction of soils – Theory, Laboratory and field tests – Field Compaction methods – Factors influencing compaction of soils.

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 weir).

UNIT III STRESS DISTRIBUTION AND SETTLEMENT **9**

Stress distribution in homogeneous and isotropic medium – Boussinesq theory – (Point land, Line land and udl) Use of New marks influence chart –Components of settlement — Immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – Computation of rate ofsettlement. - √t and log t methods– e-log p relationship.

UNIT IV SHEAR STRENGTH **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.

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 – Fellenious and Bishop's method - Slope protection measures.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Demonstrate an ability to identify various types of soils and its properties, formulate and solve engineering Problems

CO2 Show the basic understanding of flow through soil medium and its impact of engineering solution

CO3 Understand 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.

CO5 Demonstrate an ability to design both finite and infinite slopes, component and process as per needs and specifications.

TEXTBOOKS:

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.

REFERENCES:

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. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 2005.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	2	3	3	2	3	3
PO2	Problem analysis	3	2	3	3	3	3
PO3	Design / development of solutions	2	3	2	3	2	2
PO4	Investigation	2	2	2	2	2	2
PO5	Modern Tool Usage	3	3	2	2	2	2
PO6	Engineer and Society	1	1	2	1	1	1
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	2	2	2	1	1	2
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	2	2	2	2	1	2
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	3	2	2	2	3	2
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	2	3	3	3	2	3

21155C45 HIGHWAY AND RAILWAY ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVE:

To give an overview about the highway and railway engineering with respect to, planning, design, construction and maintenance as per IRC standards, specifications and methods.

UNIT I HIGHWAY ENGINEERING 9

Classification of highways – Institutions for Highway planning, design and construction at different levels – factors influencing highway alignment –Typical cross sections of Urban and Rural roads – Engineering surveys for alignment- Conventional and Modern method

UNITII DESIGN OF HIGHWAY ELEMENTS 9

Cross sectional elements – Horizontal curves, super elevation, transition curves, widening of curves Sight distances – Vertical curves, gradients– pavement components and their role - Design practice for flexible and rigid pavements (IRC methods only).

UNIT III HIGHWAY CONSTRUCTION AND MAINTENANCE 9

Highway construction materials, properties, testing methods – Construction practice of flexible and concrete pavement- Highway drainage – Evaluation and Maintenance of pavements.

UNIT IV RAILWAY PLANNING AND CONSTRUCTION 9

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 (Problems)-Railway drainage- Level Crossings-Signalling.

UNIT V RAILWAY TRACK CONSTRUCTION MAINTENANCE AND OPERATION 9

Points and Crossings - Design of Turnouts, Working Principle-Track Circuiting - Construction & Maintenance – Conventional, Modern methods and Materials, Lay outs of Railway Stations and Yards, Rolling Stock, Tractive Power, Track Resistance - Role of Indian Railways in National Development – Railways for Urban Transportation – LRT & MRTS Feasibility study, Planning and construction.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course, the student is expected to

CO1 Plan a highway according to the principles and standards adopted in various institutions in India.

CO2 Design the geometric features of road network and components of pavement.

CO3 Test the highway materials and construction practice methods and know its properties and able to perform pavement evaluation and management.

CO4 Understand the methods of route alignment and design elements in railway planning and constructions.

CO5 Understand the construction techniques and maintenance of track laying and railway stations

TEXTBOOKS:

1. Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", Nemchand Publishers, 2014.

2. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai,2010

3. Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications, 6th edition Delhi, 2015.

4. C. Venkatramaiah., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels., Universities Press (India) Private Limited, Hyderabad, 2015.

REFERENCES:

1. Indian Road Congress (IRC), Guidelines for the Design of Flexible Pavements, (Third Revision), IRC:37-2012

2. Indian Road Congress (IRC), Guidelines for the Design of Plain Jointed Rigid Pavements for

Highways, (Third Revision), IRC:58-2012

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	2	2	3		2
PO2	Problem analysis		3	3			3
PO3	Design / development of solutions		3	2		3	3
PO4	Investigation	2	2	2			2
PO5	Modern Tool Usage		2	2		2	2
PO6	Engineer and Society	3		3	3		3
PO7	Environment and Sustainability	1	2	3			2
PO8	Ethics	3	3	3	3		3
PO9	Individual and Team work		2			2	2
PO10	Communication	`			1		1
PO11	Project Management and Finance		2	3			3
PO12	Life Long Learning		3	3		2	3
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineeringdiscipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems andinnovation	2	3	3	2	3	3
PSO3	Conceptualization and evaluation of engineering solutions to CivilEngineering Issues				2	3	2

21149S46 ENVIRONMENTAL SCIENCES AND SUSTAINABILITY L T P C
2 0 0 2

COURSE OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.

UNIT I ENVIRONMENT AND BIODIVERSITY 6

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION 6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts .

UNIT III RENEWABLE SOURCES OF ENERGY 6

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT 6

Development , GDP ,Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT V SUSTAINABILITY PRACTICES 6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles-carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

CO1 To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.

CO2 To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.

CO3 To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.

CO4 To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.

CO5 To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

TEXTBOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES :

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 . Edition 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

COs- PO's & PSO's MAPPING

CO	**PO**									**PSO**					
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	-	-	-	2	3	-	-	-	-	2	-	-	-
2	3	2	-	-	-	3	3	-	-	-	-	2	-	-	-
3	3	-	1	-	-	2	2	-	-	-	-	2	-	-	-
4	3	2	1	1	-	2	2	-	-	-	-	2	-	-	-
5	3	2	1	-	-	2	2	-	-	-	-	1	-	-	-
AVg.	**2.8**	**1.8**	**1**	**1**	**-**	**2.2**	**2.4**	**-**	**-**	**-**	**-**	**1.8**	**-**	**-**	**-**

- 1-low, 2-medium, 3-high, '-"- no correlation

PRACTICALS

21155L47 HYDRAULIC ENGINEERING LABORATORY L T P C

0 0 3 1.5

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS (Any 10 of the following)

A. FLOW MEASUREMENT

1. Calibration of Rotameter
2. Flow through Orifice meter/mouthpiece,Venturimeter and Notches
3. Bernoulli's Experiment

B. LOSSES IN PIPES

4. Determination of friction factor in pipes.
5. Determination of minor losses

C. PUMPS

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

D. TURBINES

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

E. DETERMINATION OF METACENTRIC HEIGHT

12. Determination of metacentric height of floating bodies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

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.

REFERENCES:

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

COs- PO's & PSO's MAPPING

PO/PSO		**Course Outcome**					**Overall Correlation ofCOs to POs**
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PO1	Knowledge of Engineering Sciences	2	3	3	3	3	3
PO2	Problem analysis	2	2	3	3	3	3
PO3	Design / development of solutions	1	1	2	2	2	2
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	2	2	2	2	2	2
PO7	Environment and Sustainability	2	2	2	2	2	2
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	2	2	3	3	3	2
PO10	Communication	1	1	1	1	1	1
PO11	Project Managementand Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	3	3	3	3	3
PSO2	Critical analysis ofCivil Engineering problems and innovation	1	1	2	2	2	2
PSO3	Conceptualization andevaluation of engineering solutions to Civil Engineering Issues	1	1	1	1	1	1

21155L48 MATERIALS TESTING LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:
To develop skills to test various construction materials.

I. TESTS ON METALS
a. Tension test on steel rod
b. Torsion test on mild steel rod
c. Deflection test on metal beam
d. Double shear test on metal
e. Impact test on metal specimen (Izod and Charpy)
f. Hardness test on metals (Rockwell and Brinell Hardness Tests)
g. Compression test on helical spring
h. Deflection test on carriage spring

II. TESTS ON CEMENT
a. Determination of fineness of cement
b. Determination of consistency of cement
c. Determination of specific gravity of cement
d. Determination of initial and final setting time of cement

III. TESTS ON FINE AGGREGATE
a. Determination of specific gravity and water absorption of fine aggregate
b. Determination of grading of fine aggregate
c. Determination of water absorption for fine aggregate

IV. TESTS ON COARSE AGGREGATE
a. Determination of compacted and loose bulk density of coarse aggregate
b. Determination of impact value of coarse aggregate
c. Determination of elongation index of coarse aggregate
d. Determination of flakiness index of coarse aggregate
e. Determination of aggregate crushing value of coarse aggregate
f. Determination of specific gravity and water absorption of coarse aggregate

V. TESTS ON BRICKS
a. Determination of compressive strength of bricks
b. Determination of water absorption of bricks
c. Determination of efflorescence of bricks

VI. TESTS ON CONCRETE
a. Determination of slump of concrete
b. Determination of compressive strength of concrete
c. Determination of flowability of self-compacting concrete (Demo only)

VII. TEST ON WOOD
a. Determination of Compression test on wood

TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO1 Determine the mechanical properties of steel.
CO2 Determine the physical properties of cement
CO3 Determine the physical properties of fine and coarse aggregate.
CO4 Determine the workability and compressive strength of concrete.
CO5 Determine the strength of brick and wood.

COs- PO's & PSO's MAPPING

PO/PSO		**Course Outcome**					**Overall Correlation of COs toPOs**
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PO1	Knowledge of Engineering Sciences	2	3	3	3	3	3
PO2	Problem analysis	2	2	3	3	3	3
PO3	Design / development of solutions	1	1	2	2	2	2
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	1	2	1
PO6	Engineer andSociety	2	2	2	2	2	2
PO7	Environment and Sustainability	2	2	2	2	2	2
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	3	3	3	3	3
PSO2	Critical analysis ofCivil Engineering problems and innovation	2	2	2	2	2	2
PSO3	Conceptualizati onand evaluation of engineering solutions to Civil Engineering Issues	2	2	2	2	2	2

21155L49 SOIL MECHANICS LABORATORY L T P C
0 0 3 1.5

COURSE OBJECTIVES:

To develop skills to test the soils for their index and engineering properties and to characterize the soil based on their properties.

EXERCISES:

1. DETERMINATION OF INDEX PROPERTIES

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

2. DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS

a. Field density Test (Sand replacement method)
b. Determination of moisture – density relationship using standard proctor compaction test.

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 cohesion less soil
d. Unconfined compression test in cohesive soil
e. Laboratory vane shear test in cohesive soil
f. Tri-axial compression test in cohesion less soil (Demonstration only)
g. California Bearing Ratio Test

4. TEST ON GEOSYNTHETICS (Demonstration only) Determination of tensile strength and interfacial friction angle.

a. Determination of apparent opening sizes and permeability.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Conduct tests to determine the index properties of soils
CO2 Determine the insitu density and compaction characteristics.
CO3 Conduct tests to determine the compressibility, permeability and shear strength of soils.
CO4 Understand the various tests on Geosynthetics.

REFERENCES:

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. G.Venkatappa Rao and Goutham .K. Potable, "Geosynthetics Testing – A laboratory Manual", Sai Master Geoenvironmental Services Pvt. Ltd., 1st Edition 2008.
6. Braja M.Das., "Soil Mechanics: Laboratory Manual", Oxford University Press, eighth edition, 2012.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome				Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	
PO1	Knowledge of Engineering Sciences	2	1	3	1	1
PO2	Problem analysis	2	2	3	2	2
PO3	Design / development ofsolutions	3	3	3	2	3
PO4	Investigation	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	2	1
PO6	Engineer and Society	1	1	1	1	1
PO7	Environment and Sustainability	1	1	1	1	1
PO8	Ethics	1	1	1	1	1
PO9	Individual and Team work	3	3	3	3	3
PO10	Communication	1	2	1	1	1
PO11	Project Management and Finance	1	1	1	1	1
PO12	Life Long Learning	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES(PSO)						
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2
PSO2	Critical analysis ofCivil Engineering problems and innovation	3	3	3	2	3
PSO3	Conceptualizati onand evaluation of engineering solutions to Civil Engineering Issues	3	2	3	3	3

SEMESTER – V

21155C51	**DESIGN OF REINFORCED CONCRETE STRUCTURAL ELEMENTS**	**L T P C 3 0 0 3**

COURSE OBJECTIVE:

To introduce the different design philosophy for reinforced concrete and discuss the limit state method of design of RC rectangular beams and to learn the concept in the design of RC flanged beams and design for shear and torsion and design of RC slabs and staircase, short RC columns, RC footing for walls, pad, sloped and combined rectangular footings.

UNIT I METHODS OF DESIGN OF CONCRETE STRUCTURES 9

Concept of Elastic method, ultimate load method and limit state method – Working stress method as detailed in IS code - Design of Singly Reinforced beam by working stress method - Limit State philosophy as detailed in IS code - Advantages of Limit State Method over other methods - Analysis and design of singly and doubly reinforced rectangular beams by limit State Method.

UNIT II LIMIT STATE METHOD - FLANGED BEAM, SHEAR & TORSION 9

Analysis and design of flanged beams – Use of design aids for Flexure - Behaviour of RC members in bond and Anchorage - Design requirements as per current code - Behaviour of RC beams in shear and torsion - Design of RC members for combined bending, shear and torsion - serviceability.

UNIT III LIMIT STATE DESIGN OF SLABS AND STAIRCASE 9

Analysis and design of cantilever, one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions- Types of Staircases – Design of dog-legged Staircase –Introduction to Flat Slab.

UNIT IV LIMIT STATE DESIGN OF COLUMNS 9

Types of columns – Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending.

UNIT V LIMIT STATE DESIGN OF FOOTING 9

Design of wall footing – Design of axially and eccentrically loaded rectangular pad and sloped footings – Design of combined rectangular footing for two columns only.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Know the various design concepts and design RC rectangular beams by working stress and limit state methods

CO2 Understand the design of flanged beams, design for shear and torsion, and anchorage and development length.

CO3 Design a RC slabs and staircase and draw the reinforcement detailing.

CO4 Design short columns for axial, uni-axial and bi-axial eccentric loadings

CO5 Design wall footings, isolated footings and combined rectangular footing.

TEXT BOOKS:

1. Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.

2. Krishnaraju.N " Design of Reinforced Concrete Structurres ", CBS Publishers & Distributors Pvt. Ltd., New Delhi.

REFERENCES:

1. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017

2. Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., 2021

3. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete",Laxmi Publication Pvt. Ltd., New Delhi, 2016

4. Shah V L Karve S R., "Limit State Theory and Design of Reinforced Concrete", Structures Publilcations, Pune, 2013

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	3	3	3	3	3	3
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication	2	2	2		2	2
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems andinnovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

21155C52 **STRUCTURAL ANALYSIS I** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

To introduce the students to the basic theory and concepts of classical methods of structural analysis

UNIT I ANALYSIS OF TRUSSES **9**

Determinate and indeterminate trusses - analysis of determinate trusses - method of joints – method of sections - Deflections of pin-jointed plane frames - lack of fit - change in temperature method oftension coefficient - Application to space trusses.

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.

UNIT III MOMENT DISTRIBUTION METHOD **9**

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

UNIT IV FLEXIBLITY METHOD **9**

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

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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Analyze the pin-jointed plane and space frames.

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 usingmatrix flexibility method.

CO5 Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

TEXTBOOKS:

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 & Arun Kumar Jain, Theory of structures, Laxmi Publications,New Delhi, 2004.

REFERENCES:

1. William Weaver, Jr and James M.Gere, Matrix analysis of framed structures, CBS Publishers &Distributors, Second Edition, Delhi, 2004

2. Reddy .C.S, “Basic Structural Analysis”, Tata McGraw Hill Publishing Company, 2005.

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

4. Bhavikatti, S.S, Matrix Method of Structural Analysis, I. K. International Publishing HousePvt.Ltd.,New Delhi-4, 2014.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	3	3	3	3	3	3
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication	2	2	2	2	2	2
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	1	1	1	1	1
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineeringproblems and innovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluation of engineering solutions to CivilEngineering Issues	3	3	3	3	3	3

21155C53 FOUNDATION ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVE:

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 forthe 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 – Penetrationtests (SPT and SCPT) – Data interpretation - Strength parameters and Evaluation of Liquefaction potential - Selection of foundation based on soil condition- Bore log report.

UNIT II BEARING CAPACITY OF 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.

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

UNIT IV PILE FOUNDATION 9

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

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 toline load – Stability analysis of retaining walls – Codal provision.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Graduate will demonstrate an ability to plan and execute a detailed site investigation to select geotechnical design parameters and type of foundation

CO2 Graduate will demonstrate an ability to design shallow foundations, its component or processas per the needs and specifications.

CO3 Graduate will demonstrate an ability to design combined footings and raft foundations, its component or process as per the needs and specifications.

CO4 Graduate will demonstrate an ability to design deep foundations, its component or process asper the needs and specifications.

CO5 Graduate will demonstrate an ability to design retaining walls, its component or process as perthe needs and specifications.

TEXTBOOKS:

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and DistributersLtd., New Delhi, 2015.

2. Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", New Age International (P)Ltd, New Delhi,2006.

REFERENCES:

1. Das, B.M. "Principles of Foundation Engineering" (Eigth edition), Thompson Asia Pvt. Ltd., Singapore, 2017.

2. Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill publishing company Ltd., New Delhi, 2017.

3. Varghese, P.C.,"Foundation Engineering", Prentice Hall of India Private Limited, New Delhi, 2012.

4. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt.Ltd., New Delhi, 2017.

COs- PO's & PSO's MAPPING

PO/PSO		**Course Outcome**					**Overall Correlation of CO s to POs**
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	2	2	2	3	2	2
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	2	2	2	1	2	2
PO7	Environment and Sustainability	1	2	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	1	1	1	1	1	1
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	1	1	2	2	2	2
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	3	3
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	3	2	2	3	3	3

PRACTICALS

21155L58	**HIGHWAY ENGINEERING LABORATORY**	**L T P C** **0 0 4 2**

COURSE OBJECTIVE:

To learn the principles and procedures of testing of materials used in the construction of highways.

EXCERCISES:

I TEST ON AGGREGATES

1. Specific gravity determination of the coarse aggregate sample
2. Determination of abrasion value of the coarse aggregate sample.
3. Determination of water absorption capacity of the coarse aggregate sample.

II TEST ON BITUMEN

4. Specific gravity determination of the bitumen/asphalt sample.
5. Determination of consistency of the bituminous material.
6. Viscosity determination of bituminous binder.
7. Determination of softening point of the asphalt/bitumen sample
8. Determination of ductility value of the bitumen sample.
9. Estimation of loss of bitumen on heating.
10. Determination of optimum binder content by Marshall method.

III BITUMINOUS MIXES

11. Determination of stripping value of the bituminous mix Demonstration.
12. Determination of bitumen content in the bituminous mix by cold solvent extraction method.

TOTAL: 60 PERIODS

COURSE OUTCOMES

CO1 Characterize Pavement Aggregate through relevant test.
CO2 Ascertain the Quality of Bitumen.
CO3 Determine the Optimum Binder Content Using Marshall Method.
CO4 Evaluate the Consistency and Properties of Bitumen.
CO5 Determine the Bitumen Content in the Bituminous Mixes

REFERENCES

1. Highway Materials and Pavement Testing, Nem Chandand Bros.,Roorkee, Revised Fifth Edition,2009
2. N.L.Arora,A Textbook of Transportation Engineering, New India Publication,1997
3. http://vlabs.iitb.ac.in/vlabsdev/labs/nitk_labs/Transportation_Engineering_Lab/index.html
4. Laboratory Manual in Highway engineering published, Duggal,Ajay K 2017

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s toPOs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	1	1	1	1	1	1
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	2	2	2	2	2	2
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	1	1	1	1	1	1
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication	3	3	3	3	3	3
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems andinnovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluation of engineering solutions to CivilEngineering Issues	2	2	2	2	2	2

21155L59 **SURVEY CAMP (2 weeks)** **L T P C**
0 0 0 1

COURSE OBJECTIVES:

The objective of the survey camp is to enable the students to get practical training in the field work. Groups of not more than six members in a group will carry out each exercise in survey camp. At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

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

1. Traverse – using Theodolite / Total station
2. Contouring

(i). Radial tachometric contouring - Radial Line at Every 45 Degree and Length not less than 60Meter on each Radial Line

(ii). Block Level/ By squares of size at least 100 Meter x 100 Meter atleast 20 Meter interval

(iii). L.S & C.S - Road and canal alignment for a Length of not less than 1 Kilo Meter atleast L.S atEvery 30M and C.S at every 90 M

3. Offset of Buildings and Plotting the Location
4. Sun observation to determine azimuth (guidelines to be given to the students)
5. Use of GPS to determine latitude and longitude and locate the survey camp location
6. Traversing using GPS
7. Curve setting by deflection angle

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

COURSE OUTCOMES

On completion of the course, the student is expected to be able to

CO1 Handle the modern surveying instruments like Total station and GPS

CO2 Apply modern surveying techniques in field to establish horizontal control.

CO3 Understand the surveying techniques in field to establish vertical control

CO4 Apply different survey adjustment techniques.

CO5 Carry out different setting out works in the field

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design / development of solutions			2	2	2	2
PO4	Investigation	3	3	3			3
PO5	Modern Tool Usage	3	3	3	3	3	3
PO6	Engineer and Society	3	3	2	2	2	2
PO7	Environment and Sustainability	2	2	2	2	2	2
PO8	Ethics	2	2	2	2		2
PO9	Individual and Team work	2	2	3	2	2	2
PO10	Communication	3	3	3	3	3	3
PO11	Project Management and Finance	2	2	2	2	2	2
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems andinnovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

SEMESTER – VI

21155C62 DESIGN OF STEEL STRUCTURAL ELEMENTS L T P C

3 0 0 3

COURSE OBJECTIVE

To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections and 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 TO STRUCTURAL STEEL AND DESIGN OF CONNECTIONS 9

General -Types of Steel -Properties of structural steel - I.S. rolled sections - Concept of Limit StateDesign - Design of Simple and eccentric Bolted and welded connections - Types of failure and efficiency of joint – prying action - Introduction to HSFG bolts

UNIT II DESIGN OF TENSION AND COMPRESSION MEMBERS 9

Behaviour and Design of simple and built-up members subjected to tension - Shear lag effect-Design of lug angles - tension splice - Behaviour of short and long columns - Euler's column theory-Design of simple and built-up compression members with lacings and battens - Design of column bases - slab base and gusseted base

UNIT III DESIGN OF BEAMS 9

Design of laterally supported and unsupported beams - Design of built-up beams - Design of plategirders

UNIT IV INDUSTRIAL STRUCTURES 9

Design of roof trusses – loads on trusses – purlin design using angle and channel sections – truss design, Design of joints and end bearings–Design of gantry girder - Introduction to pre-engineeredbuildings

UNIT V PLASTIC ANALYSIS AND DESIGN 9

Introduction to plastic analysis - Theory of plastic Analysis - Design of continuous beams and portalframes using plastic design approach

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Recognize the design philosophy of steel structures and identify the different failure modes ofbolted and welded connections, and determine their design strengths

CO2 Select the most suitable section shape and size for tension and compression members and beams according to specific design criteria

CO3 Apply the principles, procedures and current code requirements to the analysis and design ofsteel tension members, columns, column bases and beams

CO4 Identify and compute the design loads on Industrial structures, and gantry girder

CO5 Find out ultimate load of steel beams and portal frames using plastic analysis

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.

REFERENCES

1. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India PvtLimited, 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

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	2	2	3	2	2	2
PO2	Problem analysis	2	2	2	2	3	2
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	3	3	3		2	2
PO5	Modern Tool Usage		2	2	2		2
PO6	Engineer and Society				2		2
PO7	Environment and Sustainability	2			2		2
PO8	Ethics				2		2
PO9	Individual and Team work				2		2
PO10	Communication					1	1
PO11	Project Management and Finance		2	2	2		2
PO12	Life Long Learning	2	2	2	3	3	2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	2	2
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues				3	3	3

21155C63 STRUCTURAL ANALYSIS II L T P C
3 0 0 3

COURSE OBJECTIVE:

To learn the method of drawing influence lines and its uses in various applications likebeams, bridges and plane trusses and to analyse arches and suspension bridges

UNIT I INFLUENCE LINES FOR DETERMINATE STRUCTURES 9

Introduction to moving loads, Concept of Influence Lines, Influence lines for reactions in statically determinate structures –Influence lines for shear force and bending moment in beam section – Calculation of critical stress resultants due to concentrated and distributed moving loads - Influencelines for member forces in pin jointed plane frames.

UNIT II INFLUENCE LINES FOR INDETERMINATE BEAMS 9

Muller Breslau's principle - Influence line for support reactions, shearing force and bending moments for indeterminate beams - propped cantilevers, fixed beams and continuous beams.

UNIT III ARCHES 9

Arches - Eddy's theorem - Types of arches – Analysis of three-hinged, two-hinged and fixed arches-Parabolic and circular arches - influence lines, rib shortening– Settlement and temperature effects.

UNIT IV SUSPENSION BRIDGES AND SPACE TRUSSES 9

Analysis of suspension bridges – Unstiffened cables and cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders - Introduction to analysis of space trusses using method of tension coefficients.

UNIT V APPROXIMATE ANALYSIS OF FRAMES 9

Approximate analysis for gravity loadings - substitute frame method for maximum moments in beams and columns - Approximate analysis for horizontal loads - portal method and cantilever method - assumptions - axial force, shearing force and bending moment diagrams.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to ;

CO1 Draw influence lines for statically determinate structures and calculate critical stress resultants

.**CO2** Understand Muller Breslau principle and draw the influence lines for statically indeterminate beams.

CO3 Analyse three hinged, two hinged and fixed arches.

CO4 Analyse the suspension bridges with stiffening girders

CO5 AnalysHYDe rigid frames by approximate methods for gravity and horizontal loads.

TEXTBOOKS:

1. Bhavikatti,S.S, Structural Analysis,Vol.1 & 2, Vikas Publishing House Pvt.Ltd., NewDelhi-4,2014.

2. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, Theory of structures, Laxmi,Publications,2004.

REFERENCES:

1. Negi.L.S and Jangid R.S ., Structural Analysis , Tata McGraw-Hill Publishers, 2004.
2. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co. Ltd., Third Edition,2010.
3. Gambhir.M.L., Fundamentals of Structural Mechanics and Analysis, PHI Learning Pvt. Ltd.,2011.
4. Vazrani.V.N And Ratwani,M.M, Analysis of Structures, Vol.II, Khanna Publishers,2015.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of EngineeringSciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Engineer and Society	3	3	3	3	3	3
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication	2	2	2	2	2	2
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	1	1	1	1	1
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineeringdiscipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems andinnovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

21155C64 HYDROLOGY AND WATER RESOURCE ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

To introduce to the students, the concepts of hydrological processes, hydrological extremes and groundwater. To prepare the students to quantify, regulate and manage water resources.

UNIT I PRECIPITATION AND ABSTRACTIONS 9

Hydrological cycle - Meteorological measurements – Types and forms of precipitation - Rain gauges-Spatial analysis of rainfall data using Thiessen polygon and Iso-hyetal methods - Interception – Evaporation: Measurement, Evaporation suppression methods – Infiltration: Horton‟s equation -Double ring infiltrometer - Infiltration indices.

UNIT II RUNOFF 9

Catchment: Definition, Morphological characteristics - Factors affecting runoff - Run off estimation using Strange's table and empirical methods - SCS-CN method – Stage discharge relationship - Flowmeasurements - Hydrograph – Unit Hydrograph – IUH.

UNIT III HYDROLOGICAL EXTREMES 9

Natural Disasters - Frequency analysis - Flood estimation - Flood management - Definitions of drought: Meteorological, Hydrological, Agricultural and Integrated - IMD method - NDVI analysis -Drought Prone Area Programme (DPAP).

UNIT IV RESERVOIRS 9

Classification of reservoirs - Site selection - General principles of design - Spillways -Elevation-Area Capacity curve - Storage estimation - Sedimentation - Life of reservoirs – Rule curve. 100

UNIT V GROUNDWATER AND MANAGEMENT 9

Origin - Classification and types - Properties of aquifers - Governing equations – Steady and unsteady flow - Artificial recharge - RWH in rural and urban areas.

TOTAL: 45 PERIODS

TEXT BOOKS:

1.Subramanya K, "Engineering Hydrology"- Tata McGraw Hill, 2010

2.Jayarami Reddy P, "Hydrology", Tata McGraw Hill, 2008.

REFERENCES:

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 InternationalBook Company, 1998.

3. Raghunath. H.M., "Hydrology", Wiley Eastern Ltd., 1998.

4. Bhagu R. Chahar, Groundwater Hydrology, McGraw Hill Education (India) Pvt Ltd, New Delhi,2017.

COURSE OUTCOMES:

On completion of the course, the student is expected to

1. Define the hydrological processes and their integrated behaviour in catchments
2. Apply the knowledge of hydrological processes to address basin characteristics, runoff andhydrograph
3. Explain the concept of hydrological extremes and its management strategies
4. Describe the principles of storage reservoirs
5. Understand and apply the concepts of groundwater management

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of EngineeringSciences	2	2	2	2	2	2
PO2	Problem analysis	2	3	2	2	2	2
PO3	Design / development of solutions		2	2	1	2	1
PO4	Investigation	2	2	1	1	2	2
PO5	Modern Tool Usage	1	1	-	1	1	1
PO6	Engineer and Society	2	2	2	3	3	2
PO7	Environment and Sustainability	2	2	2	2	2	2
PO8	Ethics	-	-	-	2	2	1
PO9	Individual and Team work	2	3	2	2	3	2
PO10	Communication	2	2	2	2	2	2
PO11	Project Management and Finance	-		2		2	1
PO12	Life Long Learning	2	2	2	3	3	2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineeringdiscipline	2	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems andinnovation	2	2	2	2	2	2
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	2	3	2	3	3	3

PRACTICALS

21155L69 BUILDING DRAWING AND DETAILING LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVE:

To impart knowledge and skill relevant to Building drawing and Detailing lab using computer software

LIST OF EXPERIMENTS

1. Principles of planning and orientation
2. Buildings with load bearing walls and RCC roof (Plan , section , elevation)
3. Buildings with sloping roof
4. Buildings with Framed structures.
5. Building information modeling.
6. Reinforcement details of RCC structural elements (slab, beam and column)
7. Reinforcement details of footings (Isolated, stepped, combined footing)
8. Steel structures (Steel Connections detailing, beam to column connection, beam to beamconnection – bolt & Weld, Roof truss & purlin)

TOTAL : 60 PERIODS

REFERENCES:

1. V.B.Sikka, "A course in Civil Engineering Drawing" S.K.Kataria & Sons Publishers, SeventhEdition, 2015.
2. D.N.Ghose, "Civil Engineering Drawing and Design" CBS Publishers & Distributors Pvt.Ltd.,2nd Edition, 2010.
3. National Building Code of India 2016 (NBC 2016)
4. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design (Third Edition), Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2017.
5. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016

COURSE OUTCOME

On completion of the course, the student is expected to be able to

CO1 Draft the plan, elevation and sectional view of the load bearing and framed buildings
CO2 Draw the structural detailing of RCC elements
CO3 Draw the structural detailing of RCC water tanks, footings and retaining walls
CO4 Draw the structural detailing of steel structures
CO5 Draft the structural detailing of Industrial structures

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of EngineeringSciences	3	3	3	3	3	3
PO2	Problem analysis	-	2	2	2	2	2
PO3	Design / development of solutions	-	-	-	-	-	-
PO4	Investigation	-	-		2	2	2
PO5	Modern Tool Usage	2	2	2	2	2	2
PO6	Engineer and Society	-	3	3	3	3	3
PO7	Environment and Sustainability	-	-	-	-	-	-
PO8	Ethics	1	2	2	1	2	2
PO9	Individual and Team work	-	3	3	3	3	3
PO10	Communication	-	2	2	2	2	2
PO11	Project Management and Finance	-	-	-	-	-	-
PO12	Life Long Learning	1	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	2	2
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	-	2	2	2	2	2

SEMESTER – VII

21147S71 HUMAN VALUES AND ETHICS

8

UNIT I HUMAN VALUES

Morals- Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality

UNIT II ENGINEERING ETHICS **9**

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics –industrial standards- a balanced outlook on law - the challenger case study

UNIT IV SAFETY- RESPONSIBILITIES AND RIGHTS **10**

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies- Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination

UNIT V GLOBAL ISSUES **9**

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics like ASME- ASCE- I-EE-E- Institution of Engineers (IEI) India- Institution of Electronics and Telecommunication engineers(IETE) India- etc

TUTORIAL : 15

TOTAL: 60 PERIODS

REFERENCES :

1. Mike Martin and Roland Schinzinger- “Ethics in Engineering”- Tata McGraw-Hill- -1996-3 e.
2. Govindarajan M- Natarajan S- Senthil Kumar V- S- “Engineering Ethics”- PrenticeHall of India- New Delhi- 2004.
3. R-S Nagarazan -”A textbook on Professional Ethics and Human Values” New AgeInternational Publishers- New Delhi 2006.
4. Charles D- Fleddermann- “Engineering Ethics”- Pearson Education / Prentice Hall-New Jersey- 2004 (Indian Reprint).
5. Charles E Harris- Michael S- Protchard and Michael J Rabins- “Engineering Ethics –Concepts and Cases”- Wadsworth Thompson Learning- United States- 2000 (Indian Reprint now available).
6. John R Boatright- “Ethics and the Conduct of Business”- Pearson Education- NewDelhi- 2003.

21155C75 ESTIMATION, COSTING AND VALUATION ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVE:

The students will acquire knowledge in estimation, tender practices, contract procedures,and valuation and will be able to prepare estimates, call for tenders and execute works.

UNIT I QUANTITY ESTIMATION 9

Philosophy – Purpose – Methods of estimation – Centre line method – Long and short wall method – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, bituminous and cement concrete roads, septic tank, soak pit, retaining walls – Culverts (additional practice in class room using computer softwares- qE Pro)

UNIT II RATE ANALYSIS AND COSTING 9

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

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- e NOI – e NOT -Digital signature certificates – Encrypting -Decrypting – Reverse auctions.

UNIT IV CONTRACTS 9

Contract – Types of contracts – BOT – Types - 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 ,litigation and legal requirements.

UNIT V VALUATION 9

Definitions – Various types of valuations – Valuation methods - Necessity –Year's purchase-sinking fund- Capitalised value – Depreciation – Escalation – Valuation of land – Buildings – Calculation of Standard rent – Mortgage – Lease - Types of lease

TOTAL : 45 PERIODS

COURSE OUTCOMES:

The student will be able to

CO1 Gain knowledge on types of contracts.

CO2 Understand types of specifications, principles for report preparation, tender notices types.

CO3 Rate Analysis for all Building works, canals, and Roads and Cost Estimate.

CO4 Estimate the quantities for buildings.

CO5 Evaluate valuation for building and and.

TEXTBOOKS:

1. B.N Dutta 'Estimating and Costing in Civil Engineering', CBS Publishers & Distributors (P) Ltd, Twenty eighth revised edition, 2020.
2. B.S.Patil, 'Civil Engineering Contracts and Estimates', 7th edition, University Press, 2015
3. D.N. Banerjee, 'Principles and Practices of Valuation', V Edition, Eastern Law House, 2015

REFERENCES:

1. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD
2. Tamil Nadu Transparencies in Tenders Act, 1998 and rules 2000
3. Arbitration and Conciliation Act, 1996
4. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996
5. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2019

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of EngineeringSciences	3	3	3	3	3	3
PO2	Problem analysis	3	2	1	1	2	2
PO3	Design / development of solutions	3	3	2	1	2	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	3	3	1	1	3	3
PO6	Engineer and Society	3	3	3	3	3	3
PO7	Environment and Sustainability	3	3	2	2	2	2
PO8	Ethics	2	2	2	2	2	2
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication	2	2	2	2	2	2
PO11	Project Management and Finance	3	3	2	2	2	2
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineeringdiscipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems andinnovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

21155C76 IRRIGATION ENGINEERING AND DRAWING L T P C
2 0 2 3

COURSE OBJECTIVE:

To expose the students to irrigation principles, concept of available water, storage and diversion structures, and canal irrigation with the design components, so that they could understand the necessity of irrigation which aims at providing water at the right quantity, at the right time and atthe right place.

UNIT I IRRIGATION PRINCIPLES 7

Need for irrigation – Advantages and ill effects – National Water Policy – Tamil Nadu scenario – Physicalproperties of soil that influence soil moisture characteristics – Concept of soil water potential and its components – Concept of available water – Measurement of soil moisture content.

UNIT II CROP WATER REQUIREMENT 7

Necessity and importance – Crop and crop seasons in India – Duty, Delta, Base Period – Factors affecting Duty – Irrigation efficiencies – Consumptive use of water – Irrigation scheduling: CROPWAT – Standardsfor irrigation water.

UNIT III DIVERSION AND IMPOUNDING STRUCTURES 7

Diversion Head works: Components, Location, Functions – Weirs and Barrages – Types of dams – Factorsaffecting, location of dams – Forces acting on a dam – Spillways – Energy dissipaters.

UNIT IV CANAL IRRIGATION AND IRRIGATION WATER MANAGEMENT 9

Classification – Design of irrigation canals: Regime theories – Canal regulators – Canal drops – Cross drainage works – Canal Outlets – Canal Escapes – Lining of canals – Methods of Irrigation: Surface, Subsurface and Micro Irrigation – Systems of Rice Intensification – Water delivery systems – Rehabilitation-Modernization – Participatory Irrigation Management.

UNIT V DRAWING

i. Tank Surplus Weir – Design principles - Drawings showing Plan, Elevation and Sections **6**
ii. Gravity Dam – Design principles - Profile of gravity dam **6**
iii. Canal Drop - Design principles - Drawings showing Plan, Elevation and Sections **6**
iv. Canal Regulator - Design principles - Drawings showing Plan, Elevation and Sections **6**
v. Canal Aqueduct - Syphon Aqueduct (Type III) - Design principles - Drawings showing Plan, Elevation andSections **6**

TOTAL: (L:30 + P:30) 60 PERIODS

COURSE OUTCOMES

On completion of the course, the student is expected to be able to:

CO1 Acquire an in-deapth understanding about the National Water Policy, soil-water- plant characteristicsand the measurement of soil water.

CO2 Capture the basics of crop water requirement and hence to perform irrigation scheduling.

CO3 Understand the diversion and storage structures along with its components.

CO4 Design the irrigation canal and get a knowledge about the various irrigation methods and apply theconcepts for irrigation water management.

CO5 Design and draw the irrigation structure showing the detailed plan, elevation and sections.

TEXTBOOKS:

1. Sharma, R.K., and Sharma, T.K., "Irrigation Engineering", S. Chand and Company, New Delhi, 2008.
2. Michael, A.M., "Irrigation Engineering", Vikas Publishers, New Delhi,2008.
3. Garg, S.K., "Irrigation Engineering and Hydraulic Structures," KH Publications, New Delhi,2006.
4. Satya Narayana Murthy Challa, "Water Resources Engineering: Principles and Practice", New Age International Publishers, New Delhi, 2020.

REFERENCES:

1. Punmia, B.C., "Irrigation and Water Power Engineering", Laxmi Publishers, New Delhi, 2021.
2. Arora, K.R., "Irrigation, Water Power and Water Resources Engineering", Standard Publishers Distributors, New Delhi,2018.

3. Basak, N.N., “Irrigation Engineering”, Tata McGraw-Hill Publishing Co, New Delhi,2017.
4. Dilip Kumar Majumdar, “Irrigation Water Management”, Prentice-Hall of India, New Delhi, 2013.

COs- PO’s & PSO’s MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of EngineeringSciences	2	2	3	3	2	2
PO2	Problem analysis	1	1	3	3	1	2
PO3	Design / development of solutions	2	2	3	3	1	2
PO4	Investigation	2	1	3	2	2	2
PO5	Modern Tool Usage	-	2	2	2	2	2
PO6	Engineer and Society	-	-	3	3	3	3
PO7	Environment and Sustainability	1	3	1	1	2	2
PO8	Ethics	-	-	-	-	1	1
PO9	Individual and Team work	-	-	-	-	3	3
PO10	Communication	-	-	-	-	2	2
PO11	Project Management and Finance	-	2	3	3	3	3
PO12	Life Long Learning	2	2	1	1	3	2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineeringdiscipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems andinnovation	2	3	3	3	2	3
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	1	2	2	2	2	2

21160S77 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- Describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM - Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES 9

Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal-- Continuous process improvement –Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership-Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six-sigma Process Capability- Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages: Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation-Internal Audits-Registration-ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Ability to apply TQM concepts in a selected enterprise.
CO2: Ability to apply TQM principles in a selected enterprise.
CO3: Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
CO4: Ability to understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.
CO5: Ability to apply QMS and EMS in any organization.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and RashmiUrdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. Joel.E. Ross, "Total Quality Management – Text and Cases", Routledge.,2017.
2. Kiran.D.R, "Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 2016.

CO's- PO's & PSO's MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1		3										3	2		3
2						3						3		2	
3					3				3					2	3
4		2			3	2	3	2				3	3	2	
5			3			3	3	2							
AVg.		2.5	3		3	2.6	3	2	3			3	2.5	2	3

SEMESTER – VIII

21155PW81 **PROJECT WORK** **L T P C**
0 0 20 10

COURSE OBJECTIVE:

To develop the ability to solve a specific problem right from its identification and literaturereview 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.

TOTAL: 300 PERIODS

COURSE OUTCOMES:

On Completion of the project works students will be in a position to take up any challengingpractical problems and find solution by formulating proper methodology.

CO1 Identify civil engineering problems reviewing available literature.

CO2 Identify appropriate techniques to analyze complex civil engineering problems.

CO3 Apply engineering and management principles through efficient handling of Project have a clear idea of his/her area of work and they are in a position to carry out the work in a systematic way.

COs- PO's & PSO's MAPPING

PO/PSO		**Course Outcome**			**Overall Correlation of COs to POs**
		CO1	**CO2**	**CO3**	
PO1	Knowledge of Engineering Sciences	3	3	2	3
PO2	Problem analysis	1	3	2	2
PO3	Design / development of	1	1	2	1
	solutions				
PO4	Investigation	3	3		3
PO5	Modern Tool Usage				
PO6	Individual and Team work	3	3	2	3
PO7	Communication	2		2	2
PO8	Engineer and Society	2		2	2
PO9	Ethics	2		2	2
PO10	Environment and Sustainability	1	1	1	1
PO11	Project Management and Finance	1	1	1	1
PO12	Life Long Learning	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	3	1	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	1	3

PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	3	3	1	3

MANDATORYCOURSES I

21147MC51A INTRODUCTION TO WOMEN AND GENDER STUDIES L T P C

3 0 0 0

COURSE OUTLINE

UNIT I CONCEPTS

Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.

UNIT II FEMINIST THEORY

Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

UNIT III WOMEN'S MOVEMENTS: GLOBAL, NATIONAL AND LOCAL

Rise of Feminism in Europe and America. Women's Movement in India.

UNIT IV GENDER AND LANGUAGE

Linguistic Forms and Gender. Gender and narratives.

UNIT V GENDER AND REPRESENTATION

Advertising and popular visual media.

Gender and Representation in Alternative Media. Gender and social media.

TOTAL : 45 PERIODS

21147MC51B **ELEMENTS OF LITERATURE** **L T P C**
3 0 0 0

OBJECTIVE:

- To make the students aware about the finer sensibilities of human existence through an art form. The students will learn to appreciate different forms of literature as suitable modes of expressing human experience.

1. COURSE CONTENTS

Introduction to Elements of Literature

1. Relevance of literature

a) Enhances Reading, thinking, discussing and writing skills.
b) Develops finer sensibility for better human relationship.
c) Increases understanding of the problem of humanity without bias.
d) Providing space to reconcile and get a cathartic effect.

2. Elements of fiction

a) Fiction, fact and literary truth.
b) Fictional modes and patterns.
c) Plot character and perspective.

3. Elements of poetry

a) Emotions and imaginations.
b) Figurative language.
c) (Simile, metaphor, conceit, symbol, pun and irony).
d) Personification and animation.
e) Rhetoric and trend.

4. Elements of drama

a) Drama as representational art.
b) Content mode and elements.
c) Theatrical performance.
d) Drama as narration, mediation and persuasion.
e) Features of tragedy, comedy and satire.

3. READINGS:

1. An Introduction to the Study of English Literature, W.H. Hudson, Atlantic, 2007.
2. An Introduction to Literary Studies, Mario Klarer, Routledge, 2013.
3. The Experience of Poetry, Graham Mode, Open college of Arts with Open Unv Press, 1991.
4. The Elements of Fiction: A Survey, Ulf Wolf (ed), Wolfstuff, 2114.
5. The Elements of Drama, J.L.Styan, Literary Licensing, 2011.

Textbook:

*Reference Books:: To be decided by the teacher and student, on the basis of individual studentso as to enable him or her to write the term paper.

4. OTHER SESSION:

*Tutorials:

*Laboratory:

*Project: The students will write a term paper to show their understanding of a particular piece of literature

5. *ASSESSMENT:

HA:

Quizzes-HA:

Periodical Examination: one

Project/Lab: one (under the guidance of the teachers the students will take a volume of poetry, fiction or drama and write a term paper to show their understanding of it in a given context; sociological, psychological, historical, autobiographical etc.

Final Exam:

TOTAL : 45 PERIODS

OUTCOME OF THE COURSE:

- Students will be able to understand the relevance of literature in human life and appreciate its aspects in developing finer sensibilities.

21147MC51C **FILM APPRECIATION** **L T P C**
3 0 0 0

In this course on film appreciation, the students will be introduced broadly to the development of film as an art and entertainment form. It will also discuss the language of cinema as it evolved over a century. The students will be taught as to how to read a film and appreciate the various nuances of a film as a text. The students will be guided to study film joyfully.

Theme - A: The Component of Films

A-1: The material and equipment
A-2: The story, screenplay and script
A-3: The actors, crew members, and the director
A-4: The process of film making… structure of a film

Theme - B: Evolution of Film Language

B-1: Film language, form, movement etc.
B-2: Early cinema… **silent film** (Particularly French)
B-3: The emergence of feature films: **Birth of a Nation**
B-4: Talkies

Theme - C: Film Theories and Criticism/Appreciation

C-1: Realist theory; Auteurists
C-2: Psychoanalytic, Ideological, Feminists
C-3: How to read films?
C-4: Film Criticism / Appreciation

Theme – D: Development of Films

D-1: Representative Soviet films
D-2: Representative Japanese films
D-3: Representative Italian films
D-4: Representative Hollywood film and the studio system

Theme - E: Indian Films

E-1: The early era
E-2: The important films made by the directors
E-3: The regional films
E-4: The documentaries in India

READING:

A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these.

21147MC51D **DISASTER MANAGEMENT** **L T P C**
3 0 0 0

COURSE OBJECTIVE

- To impart knowledge on concepts related to disaster, disaster risk reduction, disaster management
- To acquaint with the skills for planning and organizing disaster response

UNIT I HAZRADS, VULNERABILITY AND DISASTER RISKS **9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced –Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India and Tamil Nadu - Global trends in disasters: urban disasters, pandemics, Complex emergencies, - -, Inter relations between Disasters and Sustainable development Goals

UNIT II DISASTER RISK REDUCTION (DRR) **9**

Sendai Framework for Disaster Risk Reduction**,** 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 stakeholders- Early Warning System – Advisories from Appropriate Agencies.- Relevance of indigenous Knowledge, appropriate technology and Local resources.

UNIT III DISASTER MANAGEMENT **9**

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA – SDMA-DDMA-NRDF- Civic Volunteers)

UNIT IV TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT **9**

Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disaster Management

UNIT V DISASTER MANAGEMENT: CASE STUDIES **9**

Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters-Landslide Hazard Zonation: 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.- Field work-Mock drill -

TOTAL : 45 PERIODS

TEXT BOOKS:

1 Taimpo (2016), Disaster Management and Preparedness, CRC Publications

2 Singh R (2017), Disaster Management Guidelines for earthquakes, Landslides, Avalanches and tsunami, Horizon Press Publications

3 Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423

4 Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]

REFERENCES

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

CO's – PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	3	-	-	2	2	-	-	2	-	2	-	1
2	3	3	3	3	-	-	2	1	-	-	2	-	2	-	1
3	3	3	3	3	-	-	2	2	-	-	-	-	2	-	1
4	3	3	2	3	-	-	2	1	-	-	2	-	2	-	1
5	3	3	2	3	-	-	2	2	-	-	2	-	3	-	1
AVG	3	3	3	3	-	-	2	2	-	-	2	-	2	-	1

MANDATORYCOURSES II

SEMESTER VI

21147MC61A	**WELL-BEING WITH TRADITIONAL PRACTICES- YOGA, AYURVEDA AND SIDDHA**	**L T P C 3 0 0 0**

COURSE OBJECTIVES:

- To enjoy life happily with fun filled new style activities that help to maintain health also
- To adapt a few lifestyle changes that will prevent many health disorders
- To be cool and handbill every emotion very smoothly in every walk of life
- To learn to eat cost effective but healthy foods that are rich in essential nutrients
- To develop immunity naturally that will improve resistance against many health disorders

UNIT I HEALTH AND ITS IMPORTANCE 2+4

Health: Definition - Importance of maintaining health - More importance on prevention than treatment Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health - Occupational/Professional heath. **Present health status -** The life expectancy-present status - mortality rate - dreadful diseases - Non-communicable diseases (NCDs) the leading cause of death - 60% - heart disease – cancer – diabetes chronic pulmonary diseases - risk factors – tobacco – alcohol - unhealthy diet - lack of physicalactivities. **Types of diseases and disorders -** Lifestyle disorders – Obesity – Diabetes - Cardiovasculardiseases – Cancer – Strokes – COPD - Arthritis - Mental health issues. **Causes of the above diseases / disorders - Importance of prevention of illness -** Takes care of health - Improves quality of life - Reduces absenteeism - Increase satisfaction - Saves time **Simple lifestyle modifications to maintain health -** Healthy Eating habits (Balanced diet according to age) Physical Activities (Stretching exercise, aerobics, resisting exercise) - Maintaining BMI- Importance and actions to be taken

UNIT II DIET 4+6

Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes – arthritis – hypertension – PCOD – infertility – ADHD – sleeplessness -helps to reduce the risk of heart diseases - keeps the teeth and bones strong. **Balanced Diet and its 7 Components -** Carbohydrates – Proteins – Fats – Vitamins – Minerals -Fibre and Water. **Food additives and their merits & demerits -** Effects of food additives - Types of food additives -Food additives and processed foods - Food additives and their reactions

Definition of BMI and maintaining it with diet Importance - Consequences of not maintaining BMI - different steps to maintain optimal BM Common cooking mistakes Different cooking methods, merits and demerits of each method

UNIT III ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH 4+4

AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH asa soft therapy. **Secrets of traditional healthy living -** Traditional Diet and Nutrition - Regimen of Personal and Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life. **Principles of Siddha & Ayurveda systems -** Macrocosm and Microcosm theory - Pancheekarana Theory / **(**Five Element Theory) 96 fundamental Principles - Uyir Thathukkal **(**Tri-Dosha Theory) - Udal Thathukkal Prevention of illness with our traditional system of medicine Primary Prevention - To decrease the number of new cases of a disorder or illness - Health promotion/education, and - Specific protective measures - Secondary Prevention - To lower the rate of established cases of a disorder or illness in the population (prevalence) - Tertiary Prevention - To decrease the amount of disability associated with an existing disorder.

UNIT IV MENTAL WELLNESS **3+4**

Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life -Short term and long term effects of emotional disturbances - Leadinga healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion - Expressing a full range of emotions. **Stress management** - Stress definition - Stress in daily life - How stress affects one's life - Identifying the cause of stress - Symptoms of stress - Managing stress (habits, tools, training, professional help) - Complications of stress mismanagement. **Sleep** - Sleep and its importance for mental wellness - Sleep and digestion. **Immunity** - Types and importance - Ways to develop immunity

UNIT V YOGA **2+12**

Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders - What yoga can bring to our life.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Nutrition and Dietetics - Ashley Martin, Published by White Word Publications, New York, NY 10001, USA

2. Yoga for Beginners_ 35 Simple Yoga Poses to Calm Your Mind and Strengthen Your Body, by Cory Martin, Copyright © 2015 by Althea Press, Berkeley, California

REFERENCES:

1. WHAT WE KNOW ABOUT EMOTIONAL INTELLIGENCE How It Affects Learning, Work, Relationships, and Our Mental Health, by Moshe Zeidner, Gerald Matthews, and Richard D. Roberts A Bradford Book, The MIT Press, Cambridge, Massachusetts, London, England

2. The Mindful Self-Compassion Workbook, Kristin Neff, Ph.D Christopher Germer, Ph.D, Published by The Guilford Press A Division of Guilford Publications, Inc.370 Seventh Avenue, Suite 1200, New York, NY 10001

COURSE OUTCOMES:

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

- Learn the importance of different components of health
- Gain confidence to lead a healthy life
- Learn new techniques to prevent lifestyle health disorders
- Understand the importance of diet and workouts in maintaining health

CO's – PO's & PSO's MAPPING

Course Outcomes	Statement	Program Outcomes														
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	Understand the basic concept of safety.	3	3	3	1	1	3	2	2	3	3	1	3	3	3	3
CO2	Obtain knowledge of Statutory Regulations and standards.	2	3	2	2	1	3	2	3	3	2	1	3	3	3	3
CO3	Know about the safety Activities of the Working Place.	2	2	2	2	1	2	2	2	3	2	1	2	3	3	3
CO4	Analyze on the impact of Occupational Exposures and their Remedies	3	3	3	2	2	3	2	2	3	2	1	3	3	3	3
CO5	Obtain knowledge of Risk Assessment Techniques.	3	2	3	2	2	3	2	2	3	2	2	3	3	3	3
	Industrial safety	3	3		2	1	3	2	2	3	2	1	3	3	3	3

21147MC61B HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA **L T P C**
3 0 0 0

UNIT-I CONCEPTS AND PERSPECTIVES

Meaning of History Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, concept of historical inevitability, Historical Positivism. Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

UNIT-II HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA

Introduction to the works of D.D. Kosambi, Dharmpal, Debiprasad Chattopadhyay, Rehman, S. Irfan Habib, Deepak Kumar, Dhruv Raina, and others.

UNIT-III SCIENCE AND TECHNOLOGY IN ANCIENT INDIA

Technology in pre-historic period Beginning of agriculture and its impact on technology Science and Technology during Vedic and Later Vedic times Science and technology from 1st century AD to C-1200.

UNIT-IV SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA

Legacy of technology in Medieval India, Interactions with Arabs Development in medical knowledge, interaction between Unani and Ayurveda and alchemy Astronomy and Mathematics: interaction with Arabic Sciences Science and Technology on the eve of British conquest

UNIT-V SCIENCE AND TECHNOLOGY IN COLONIAL INDIA

Science and the Empire Indian response to Western Science Growth of techno-scientific institutions

UNIT-VI SCIENCE AND TECHNOLOGY IN A POST-INDEPENDENT INDIA

Science, Technology and Development discourse Shaping of the Science and Technology Policy Developments in the field of Science and Technology Science and technology in globalizing India Social implications of new technologies like the Information Technology and Biotechnology

TOTAL : 45 PERIODS

21147MC61C **POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY** **L T P C 3 0 0 0**

Pre-Requisite**:** None. (Desirable: Universal Human Values 1, Universal Human Values 2)

OBJECTIVES:

- This course will begin with a short overview of human needs and desires and how different political-economic systems try to fullfill them. In the process, we will end with a critique of different systems and their implementations in the past, with possible future directions.

COURSE TOPICS:

Considerations for humane society, holistic thought, human being's desires, harmony in self,harmony in relationships, society, and nature, societal systems. **(9 lectures, 1 hour each)** (Refs: A Nagaraj, M K Gandhi, JC Kumarappa)

Capitalism – Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism. Liberal democracy. **(5 lectures)** (Refs: Adam smith, J S Mill)

Fascism and totalitarianism. World war I and II. Cold war. **(2 lectures)**

Communism – Mode of production, theory of labour, surplus value, class struggle, dialectical materialism, historical materialism, Russian and Chinese models.

(Refs: Marx, Lenin, Mao, M N Roy) **(5 lectures)**

Welfare state. Relation with human desires. Empowered human beings, satisfaction. **(3 lectures)**

Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one's lives. Relationship with nature. **(6 lectures)** (Refs: M K Gandhi, Schumacher, Kumarappa)

Essential elements of Indian civilization. **(3 lectures)**(Refs: Pt Sundarlal, R C Mazumdar, Dharampal)

Technology as driver of society, Role of education in shaping of society. Future directions. **(4 lectures)** (Refs: Nandkishore Acharya, David Dixon, Levis Mumford) Conclusion (2 lectures)

TOTAL LECTURES: 39

REFERENCE BOOKS:

Authors mentioned along with topics above. Detailed reading list will beprovided.

21147MC61D STATE, NATION BUILDING AND POLITICS IN INDIA L T P C
3 0 0 0

OBJECTIVE:

The objective of the course is to provide an understanding of the state, how it works through its main organs, primacy of politics and political process, the concept of sovereignty and its changing contours in a globalized world. In the light of this, an attempt will be made to acquaint the students with the main development and legacies of national movement and constitutional development in India, reasons for adopting a Parliamentary-federal system, the broad philosophy of the Constitution of India and the changing nature of Indian Political System. Challenges/ problems and issues concerning national integration and nation-building will also be discussed in the contemporary context with the aim of developing a future vision for a better India.

TOPICS:

1. Understanding the need and role of State and politics.
2. Development of Nation-State, sovereignty, sovereignty in a globalized world.
3. Organs of State – Executive, Legislature, Judiciary. Separation of powers, forms of government-unitary-federal, Presidential-Parliamentary,
4. The idea of India.
5. 1857 and the national awakening.
6. 1885 Indian National Congress and development of national movement – its legacies. Constitutionmaking and the Constitution of India.
7. Goals, objective and philosophy. Why a federal system? National integration and nation-building.
8. Challenges of nation-building – State against democracy (Kothari) New social movements. The changing nature of Indian Political System, the future scenario. What can we do?

TOTAL : 45 PERIODS

OUTCOME OF THE COURSE:

It is expected that this course will make students aware of the theoretical aspect of the state, its organs, its operationalization aspect, the background and philosophy behind the founding of the present political system, broad streams and challenges of national integration and nation-building in India. It will equip the students with the real understanding of our political system/ process in correct perspective and make them sit up and think for devising ways for better participation in the system with a view to making the governance and delivery system better for the common man who is often left unheard and unattended in our democratic setup besides generating a lot of dissatisfaction and difficulties for the system.

SUGGESTED READING:

i. Sunil Khilnani, The Idea of India. Penguin India Ltd., New Delhi.

ii. Madhav Khosla, The Indian Constitution, Oxford University Press. New Delhi, 2012.

iii. Brij Kishore Sharma, Introduction to the Indian Constitution, PHI, New Delhi, latest edition.

iv. Sumantra Bose, Transforming India: Challenges to the World's Largest Democracy, Picador India, 2013.

v. Atul Kohli, Democracy and Discontent: India's Growing Crisis of Governability, Cambridge University Press, Cambridge, U. K., 1991.

vi. M. P. Singh and Rekha Saxena, Indian Politics: Contemporary Issues and Concerns, PHI, New Delhi, 2008, latest edition.

vii. Rajni Kothari, Rethinking Democracy, Orient Longman, New Delhi, 2005.

21147MC61E SAFETY IN ENGINEERING INDUSTRIES L T P C
3 0 0 0

OBJECTIVES

- To Understand the Introduction and basic Terminologies safety.
- To enable the students to learn about the Important Statutory Regulations and standards.
- To enable students to Conduct and participate the various Safety activities in the Industry.
- To have knowledge about Workplace Exposures and Hazards.
- To assess the various Hazards and consequences through various Risk Assessment Techniques.

UNIT I SAFETY TERMINOLOGIES

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold LimitValue (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

UNIT II STANDARDS AND REGULATIONS

Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006

UNIT III SAFETY ACTIVITIES

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment

UNIT IV WORKPLACE HEALTH AND SAFETY

Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety- Toxic gas Release

UNIT V HAZARD IDENTIFICATION TECHNIQUES

Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment

TOTAL : 45 PERIODS

COURSE OUTCOMES

On completion of this course the student will be able:

- Understand the basic concept of safety.
- Obtain knowledge of Statutory Regulations and standards.
- Know about the safety Activities of the Working Place.
- Analyze on the impact of Occupational Exposures and their Remedies
- Obtain knowledge of Risk Assessment Techniques.

TEXTBOOKS

1. R.K. Jain and Prof. Sunil S. Rao Industrial Safety, Health and Environment Management Systems KHANNA PUBLISHER
2. L. M. Deshmukh Industrial Safety Management: Hazard Identification and Risk Control McGraw-Hill Education

REFERENCES

1. Frank Lees (2012) 'Lees' Loss Prevention in Process Industries.Butterworth-Heinemann publications, UK, 4th Edition.
2. John Ridley & John Channing (2008)Safety at Work: Routledge, 7th Edition.
3. Dan Petersen (2003) Techniques of Safety Management: A System Approach.
4. Alan Waring.(1996).Safety management system: Chapman &Hall,England

LIST OF ELECTIVES
SEMESTER – V
ELECTIVE I

21155E54A	**AIRPORTS AND HARBOURS**	**LT P C**
		3 0 0 3

COURSE OBJECTIVE:

- To introduce the students about airport planning, design, construction and planning design principles of seaport

UNIT I AIRPORT PLANNING **7**

Air transport characteristics - airport classification – ICAO - airport planning: Site selection typical Airport Layouts, Case Studies, parking and Circulation Area

UNIT II AIRPORT COMPONENTS **9**

Airport Classification, Planning of Airfield Components – Runway, Taxiway, Apron, Hangar- Passenger Terminals- Geometric design of runway and taxiways-Runway pavement Design- Difference between Highway and airport pavements- Introduction to various design methods-Airport drainage.

UNIT III AIRPORT DESIGN **10**

Runway Design: Orientation, Wind Rose Diagram, Problems on basic and Actual Length, Geometric Design – Elements of Runway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings- Air Traffic Control Tower- Instrumental Landing.

UNIT IV SEAPORTS COMPONENTS AND CONSTRUCTION **10**

Definition of Basic Terms: Harbor, Port, Satellite Port, Docks- Dry and Floating Dock, Waves and Tides – Planning and Design of Harbors: Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins Floating Landing Stage – Navigational Aids-Inland Water Transport.

UNIT V SEAPORT REGULATIONS AND EIA **9**

Wave action on Coastal Structures and Shore Protection and Reclamation – Coastal RegulationZone, 2011-EIA – methods of impact analysis and its process

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Gain an insight on the planning and site selection of Airport Planning and design.
CO2 Knowledge on Design of various Airport components
CO3 Analyze and design the elements for orientation of runways and passenger facility systems.
CO4 Understand the various features in Harbours and Ports, their construction, coastal protection works
CO5 Knowledge on various Environmental Regulations and Acts

TEXTBOOKS:

1. Khanna.S.K. Arora.M.G and Jain.S.S, Airport Planning and Design, Nemachand and Bros, Roorkee,1994
2. Robert Honjeff and Francis X.Mckelvey, "Planning and Design of Airports", McGraw Hill, New York,1996 2. Richard De Neufille and Amedeo Odoni, "Airport Systems Planning and Design", McGraw Hill, New York,2003
3. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering,Scitech Publications (India), Chennai, 2010

REFERENCES:

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

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences		3		3	3	3
PO2	Problem analysis	3	3	3	3	2	3
PO3	Design / development of solutions	3		3		3	3
PO4	Investigation	2	2	2	2	3	2
PO5	Modern Tool Usage	3	2	3	2		2
PO6	Engineer and Society		3		3		3
PO7	Environment and Sustainability	2	2	2	2	2	2
PO8	Ethics	3	1	3	1		3
PO9	Individual and Team work		2		2		2
PO10	Communication						
PO11	Project Management and Finance	1		1		1	1
PO12	Life Long Learning	2	2	2	2		2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation				3	3	3
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	2	2	3	3	3	3

21155E54B **CONCRETE STRUCTURES** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

To acquire hands on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice using Computer Software Staad Pro, E-Tabs and any Structural design and analysis Software.

UNIT I INTRODUCTION AND CODES **9**

Geometric Parameters, Grade of concrete and steel for different elements, Exposure and c over requirements, Fire rating, Load Combinations, Serviceability Requirements, Analysis tools. Indian & International Codes for Reinforced concrete Design, Design loads, National Building Code 2016, Practical building example, drawing sizes and scale.

UNIT II LOADS ACTING ON STRUCTURES **9**

Introduction, Dead, Live loads, Wind loading and Calculations of - force coefficients, Wind pressure, storey forces and base shears. Earthquake loading and Calculations of - acceleration coefficient, Time period, Base shear. Scheme Design, Concrete floor systems, Sizing and design of various slab systems, Beams, Reinforced Concrete Columns - Location and Shape, Design Axial Load, sizing, Lateral LoadSystems, IS 1893- Requirements.

UNIT III MODELLING OF BASIC STRUCTURAL ELEMENTS **9**

Introduction to Analysis & Modelling, Modelling of Cantilever, Portal Frame, three bay Portal Frame, 3D structural models - Geometry, gravity loads, defining earthquake loads, defining wind loads, Modelling Shear walls, Practical Structural Model of building, Structural models of Floor System, Estimation of deflections

UNIT IV DESIGN OF STRUCTURAL ELEMENTS **9**

Design of Beams- flexural reinforcement, shear reinforcement, Design of flat slabs- Flexural Reinforcement, shear reinforcement, Design of 2-way continuous slabs. Design of Reinforcements in Columns, Post processing, Design and arrangement of vertical reinforcement, horizontal reinforcement in the design of buildings. Design of shear walls - Sizing of elements based on Constructability aspects like formwork, concrete placement and compaction, rebar arrangement to satisfy economy and optimum utilisation.

UNIT V DETAILING OF STRUCTURAL ELEMENTS **9**

Development of Reinforcement, Typical details of- flat slabs, two-way continuous slabs, beams, columns and shear wall, detailing and documentation. Case Studies : Structural analysis and design of a multi-storey building with load calculation (dead,live, wind and seismic) as per Indian standard codes using any Structural design and analysis Software.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will able to

CO1 Plan a layout of a structure

CO2 Calculate loads using IS codes and various computational tools

CO3 Analyse the structure for various loads and load combination according to the relevant IS codes

CO4 Design and Analysis of structures using computer software/tools

CO5 Prepare the complete structural drawings using computer software

REFERENCES:

1. Unnikrishna Pillai, S., Devdas Menon, “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., 2009.

2. Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.

3. Krishnaraju.N “ Design of Reinforced Concrete Structurres “, CBS Publishers & Distributors Pvt. Ltd., New Delhi.

4. Sinha, S.N., “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002.

5. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete",Laxmi Publication Pvt. Ltd., New Delhi, 2007.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	-	-	2	3	3	3
PO3	Design / development of solutions	3	-	-	2	2	2
PO4	Investigation	-	2	3	3	3	3
PO5	Modern Tool Usage	2	1	3	3	3	3
PO6	Individual and Team work	1	-	-	-	-	1
PO7	Communication	-	-	-	-	2	2
PO8	Engineer and society	3	-	3	1	1	3
PO9	Ethics	1	1	1	1	1	1
PO10	Environment and Sustainability	-	-	2	-	-	2
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	3	-	-	2	2	2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineeringdiscipline	3	3	3	2	2	3
PSO2	Critical analysis of Civil Engineering problems andinnovation	1	1	2	3	3	3
PSO3	Conceptualization and evaluation of engineering solutions to CivilEngineering Issues	2	2	3	3	3	3

21155E54C GROUNDWATER ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVE:

The objective of this course is enable the student to understand the principles of Groundwater governing Equations, Characteristics of different aquifers and techniques of groundwater model development and management.

UNIT I HYDROGEOLOGICAL PARAMETERS 9

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

UNIT II WELL HYDRAULICS 9

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

UNIT III GROUNDWATER MANAGEMENT 9

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

UNIT IV GROUNDWATER QUALITY 9

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

UNIT V GROUNDWATER CONSERVATION 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to:

CO1 Define the groundwater system basic, types of aquifers, aquifer parameters, movement and its potential for confined and unconfined aquifers

CO2 Apply the knowledge of groundwater flow in steady and unsteady flow characteristics of well hydraulics

CO3 Explain the concept of groundwater model development and data base management for groundwater management

CO4 Describe the importance of artificial recharge and groundwater quality concepts

CO5 Apply the creative and innovative technique on conservation of groundwater

TEXTBOOKS

1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi,2010.
2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York,2000.

REFERENCES

1. Fitts R Charles, "Groundwater Science". Elsevier, Academic Press,2002.
2. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.
3. Chahar BR, Groundwater hydrology, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2015.
4. RastogiA.K. , Numerical Groundwater Hydrology,2011

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s toPOs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	3	2	2	2	2
PO2	Problem analysis	3	3	2	2	2	2
PO3	Design / development of solutions	3	3	3	2	3	3
PO4	Investigation	-	-	-	-	3	3
PO5	Modern Tool Usage	1	2	3	3	3	3
PO6	Engineer and Society	3	3	2	3	3	3
PO7	Environment and Sustainability	-	-	3	3	3	3
PO8	Ethics	-	-	-	-	3	3
PO9	Individual and Team work	1	2	2	3	3	3
PO10	Communication	2	2	2	2	2	2
PO11	Project Management and Finance	1	2	3	2	2	2
PO12	Life Long Learning	2	2	2	3	2	2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineeringdiscipline	2	2	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems andinnovation	2	3	3	3	3	3
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	2	2	3	3	3	3

21155E54D DYNAMICS AND EARTHQUAKE RESISTANT STRUCTURES L T P C
3 0 0 3

COURSE OBJECTIVE

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

UNIT I INTRODUCTION TO DYNAMICS 9

Dynamics - Degree of freedom – Free and forced vibration - Idealization of structure as Single Degree of Freedom (SDOF) and Multi degree of freedom (MDOF) system – D'Alemberts Principles-Formulation of equation of motion for SDOF system and MDOF system –- Evaluation of naturalfrequencies and modes - Effect of damping.

UNIT II SEISMOLOGY 9

Elements of Engineering Seismology – Seismic hazard - Earthquake phenomenon – Seismotectonics-Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters – Soil Structure Interaction – Liquefaction of soil - Seismic zone map –Response spectra.

UNIT III EARTHQUAKE EFFECTS ON STRUCTURES 9

Inertia force on structures – load transfer path – Effect of architectural features on behavior of structures – Hysteretic Behaviour of RCC, steel and prestressed concrete - Pinching Effect – Bouchinger Effects - Energy dissipation - P-delta effect - storey drift - Behavior of brick masonry, stone masonry and reinforced concrete structures under past earthquakes – typical failures - Causes of damage –- Lessons learnt from past earthquakes.

UNIT IV EARTHQUAKE LOAD ANALYSIS 9

Design spectra – Codal provision – Different methods of earthquake analysis –- Analysis of structure by Equivalent static method – Analysis of structure by Response spectrum method – Introduction to time-history method of analysis

UNIT V EARTHQUAKE RESISTANT DESIGN 9

Philosophy of earthquake resistant design - Planning considerations and Architectural concepts - Design and detailing as per codal provisions - Design and detailing of typical flexural member and column member, Ductile detailing of beam-column joints and footing – Concept and principle of shear wall - Introduction to performance based seismic design - Seismic isolation principles and methods.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Develop the equations of motion for SDOF and MDOF system and to evaluate the natural frequencies and mode shapes.

CO2 Explain the elements of engineering seismology, characteristics of earthquake and seismic instrumentation.

CO3 Explain the behavior of various types of structures under earthquake

CO4 Determine the forces in a structure due to earthquake

CO5 Design earthquake resistant building structures

TEXTBOOKS:

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.

REFERENCES:

1. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.

2. Minoru Wakabayashi, Design of Earthquake Resistant Buildings, Mc Graw – Hill Book Company, 1986.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	2	3	3	3	3
PO3	Design/development of solutions	3	2	3	3	3	3
PO4	Investigation	2	2	3	2	3	2
PO5	ModernTool Usage	1	1	1	2	2	2
PO6	Engineerand Society	1	1	3	2	3	2
PO7	Environment and Sustainability	1	1	2	3	3	2
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	1	1	1	1	1	1
PO10	Communication	1	1	1	1	1	1
PO11	ProjectManagement and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	2	2	3	3	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	2	3	3	3	3

21155E54E INTRODUCTION TO FINITE ELEMENT METHOD L T P C
3 0 0 3

COURSE OBJECTIVE

To develop a thorough understanding of the finite element analysis techniques with an ability To effectively use the tools of the analysis for solving practical problems arising in Civil Engineering.

UNIT I INTRODUCTION 9

Historical Background – Mathematical Modeling of field problems in Engineering –Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT II STIFFNESS MATRIX FORMULATION 9

Introduction to Discrete and Continua elements – Discrete Elements - Direct stiffness method - Special characteristics of stiffness matrix - Assemblage of elements – Boundary condition & reaction - 2D – truss element - 2D - beam element - Analysis of framed Structures - Basic steps in finiteelement analysis - Differential equilibrium equations - strain displacement relation - linear constitutive relation - Numerical methods in finite element analysis- Gauss elimination method.

UNIT III ONE DIMENSIONAL PROBLEMS 9

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Continua Elements - Displacement models - convergence requirements. Natural coordinate systems - Shape function. Interpolation function. Linear and quadratic elements - Lagrange & Serendipity elements. Strain displacement matrix - element stiffness matrix and nodal load vector. Natural frequencies of longitudinal vibration and mode shapes.

UNIT IV TWO DIMENSIONAL PROBLEMS 9

Two dimensional isoparametric elements - Four noded quadrilateral elements - triangular elements. Computation of stiffness matrix for isoparametric elements - numerical integration (Gauss quadrature) Convergence criteria for isoparametric elements.

UNIT V ANALYSIS OF PLATES 9

Introduction to Plate Bending Problems - displacement functions – Analysis of Thin Plate - Analysis of Thick Plate - Analysis of Skew Plate, Finite Element Analysis of Shell, plane stress and plane strain analysis, Example problem using any general-purpose finite element software

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1 to understand the basics of finite element formulation.

CO2 to formulate the stiffness matrix for beam, truss and framed structures.

CO3 :to apply finite element formulations to solve one-dimensional problems.

CO4: to apply finite element method to solve two dimensional problems.

CO5 to apply finite element method to analyze plate bending problems.

TEXT BOOKS:

1. Rao, S.S., "The Finite Element Method in Engineering", 6th Edition, ButterworthHeinemann,2018.

2. Reddy,J.N. "Introduction to the Finite Element Method", 4thEdition, Tata McGrawHill,2018.

REFERENCES

1. Krishnamoorthy, C. S, Finite Element Analysis - Theory and Programming, McGraw - Hill, 1995.

2. David Hutton, Fundamentals of Finite Element Analysis, Tata McGraw Hill Publishing Company Limited, New Delhi, 2005.

3. G.R. Liu and S.S.Quek, Finite Element Method: A Practical Course, Butterworth-Heinemann; 1st edition (21 February 2003)

4. Chennakesava R. Alavala Finite Element Methods: Basic Concepts and Applications, Prentice Hall Inc., 2010.

COs-PO's&PSO'sMAPPING

PO/PSO		Course Outcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	2	3	3
PO2	Problemanalysis	3	3	3	3	3	3
PO3	Design/development of solutions	1	2	1	1	2	2
PO4	Investigation	1	1	2	1	1	2
PO5	ModernToolUsage	1	1	2	2	3	2
PO6	Engineer and Society	1	1	1	1	2	1
PO7	Environment and Sustainability						
PO8	Ethics						
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication						
PO11	Project Management and Finance	1	1	2	1	1	1
PO12	Life Long Learning	1	1	1	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	2	3	3	3	3

21155E54F STEEL CONCRETE COMPOSITE STRUCTURES L T P C
3 0 0 3

COURSE OBJECTIVE

To develop an understanding of the effect composite action and assess governing limit states for composite elements.

UNIT I INTRODUCTION TO COMPOSITE ACTION 9

Introduction to steel - concrete composite construction – codes – composite design – shear connectors – types of shear connectors – degrees of shear connections – partial and full shear connections.

UNIT II DESIGN OF COMPOSITE BEAM 9

Introduce composite beams, including shear studs – Determine the location of a beam's neutral axis/axes depending on the level of composite action. Calculate shear stud strength and understand strength modifiers - deflection of composite beams.

UNIT III DESIGN OF COMPOSITE COLUMN 9

Types of Composite columns – design of encased columns – design of in-filled columns – axial, uniaxial and bi-axially loaded columns.

UNIT IV DESIGN OF COMPOSITE SLAB 9

Introduction – Composite slabs – profiled sheeting – sheeting parallel to span – sheeting perpendicular to span.

UNIT V CASE STUDIES 9

Case studies on steel concrete composite construction in buildings - seismic behaviour of composite structures

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Describe the effect of composite action has on structural component behaviour.

CO2 Describe and assess governing limit states for composite beam.

CO3 Describe and assess governing limit states for composite slab.

CO4 Describe and assess governing limit states for composite column.

CO5 Study and evaluate the case studies related to steel concrete composite constructions of buildings.

TEXT BOOKS:

1. Johnson R.P., "Composite Structures of Steel and Concrete Beams, Slabs, Columns and Frames for Buildings", Vol.I, Fourth Edition, Blackwell Scientific Publications, 2018.

2. Oehlers D.J. and Bradford M.A., "Composite Steel and Concrete Structural Members, Fundamental behaviour", Revised Edition, Pergamon press, Oxford, 2000.

REFERENCES:

1. Owens.G.W and Knowles.P, "Steel Designers Manual", Seventh Edition, Steel Concrete Institute(UK), Oxford Blackwell Scientific Publications, 2011.

2. Teaching resource for, "Structural Steel Design," Volume 2 of 3, Institute for Steel Development and Growth (INSDAG), 2002.

3. Narayanan R, "Composite steel structures – Advances, design and construction", Elsevier, Applied science, UK, 1987

COs-PO's&PSO'sMAPPING

PO/PSO		Course Outcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	-	3
PO2	Problemanalysis	3	3	3	3	2	3
PO3	Design/development of solutions	3	3	3	3	-	3
PO4	Investigation	2	2	2	2	2	2
PO5	ModernToolUsage	-	2	2	2	-	2
PO6	Engineer and Society	-	-	-	-	2	2
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	2	2	2	2	2	2
PO9	Individual and Team work	3	2	2	2	2	2
PO10	Communication	2	2	2	2	2	2
PO11	Project Management and Finance	-	1	1	1	1	1
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	3	3	3	3	3

21155E54G ENVIRONMENTAL QUALITY MONITORING L T P C
3 0 0 3

COURSE OBJECTIVES:

To educate the students on the sample collection and various instrumental methods of monitoring the quality of air, water and solid waste.

UNIT I MONITORING AND CHARACRATERIZATION OF ENVIRONMENT 9

General approach to environmental analysis, Choice of Lab.Vs. Field analysis, Environmental monitoring-current and future status, Lab. Standards, Data quality objectives, statistics in environmental monitoring, Accuracy and precision, detection limit, types of errors, Automated Data acquisition and processing-sensors and transducers , Monitoring Network and real time monitoring

UNIT II ENVIRONMENTAL SAMPLING 9

Location, planning, sampling equipment's for water, solids and air, sample storage for physical and chemical contaminants ,types of sampling, representative samples, sample preparation techniquesSolvent Extraction, SPE, Head space, Purge and trap and SPME

UNIT III WATER ANALYSIS 9

Techniques for analysis of major ions-UV-visible Spectrophotometer, Flame photometer, AAS, ICP (AES and MS), Trace organic pollutants(PCB, dioxins, pecticides) GC and HPLC (Columns Detectors and Application)

UNIT IV ATMOSPHEREIC ANALYSIS 9

Ambient air and flue gas, Gaseous pollutants-Determination of time weighted average concentration(Absorption trains, solid adsorbents and differential tubes), Direct reading instruments(fluorescence ,chemiluminescent,IR and Electrochemical sensors, GC-MS for trace organics, Particulate sampling methods- High volume sampler, personal sampler, PM 10 and 2.5, Metals Direct(XRF) and dissolution methods(AAS/AES)

UNIT V ANALYSIS OF SOIL AND WASTE 9

Problem in analysis of soil and Waste -sampling, pretreatment -extraction and clean up, New extraction techniques, Automated soxhlet and solvent extraction,microwave digestion and sonication,SCF(CO2), Analysis for trace pollutants, Analysis of leachate.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1 Understand the basics of environmental monitoring
CO2 Able to select appropriate sampling protocol for chemical analysis
CO3 Understand various methods of analysis of pollutants in water
CO4 Select correct method for toxic pollutants estimation in air
CO5 Familiar with analysis of land and wastes

REFERENCES:

1. Reeve, R.N., "Introduction to Environmental Analysis", Analytical Techniques in the Sciences, John Wiley & Sons, Chichester, UK, 2002.
2. Barcelo, D.(editor), "Environmental analysis. Techniques, Applications and Quality Assurance", Elsevier, The Netherlands, 1996
3. Paul R. Loconto Trace Environmental Quantitative Analysis: Principles, Techniques, and Applications, Marcel Dekker; 2nd Edition , 2005,
4. Janick Artiola, Ian Pepper and Mark Brusseau, ENVIRONMENTAL MONITORING AND CHARACTERIZATION , Academic Press,2004.

COs-PO's&PSO'sMAPPING

PO/PSO		Course Outcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	2	3	3
PO2	Problemanalysis	2	2	3	1	3	2
PO3	Design/development of solutions				2	2	2
PO4	Investigation		2	2	1	2	2
PO5	ModernToolUsage	3	2	3	3	3	3
PO6	Engineer and Society				3	3	3
PO7	Environment and Sustainability	2					2
PO8	Ethics		2				2
PO9	Individual and Team work						
PO10	Communication	2				2	2
PO11	Project Management and Finance	2					2
PO12	Life Long Learning	2	2				2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	2	2		2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2				2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	2	2				2

21155E54H TRANSPORT AND ENVIRONMENT L T P C
3 0 0 3

COURSE OBJECTIVE:

The objective of this course is to create an awareness / overview of the impact of Transportation Projects on the environment and society.

UNIT I INTRODUCTION 8

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

UNIT II METHODOLOGIES 8

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

UNIT III ENVIRONMENTAL IMPACT, PREDICTION AND ASSESSMENT 10

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

UNIT IV ENVIRONMENTAL MITIGATION AND MANAGEMENT PLAN 10

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

UNIT V EIA CASE STUDIES 9

EIA Case Studies on Highway, Railway - EIA Case Studies on Transit Oriented Development (TOD), Compact Cities, Non-Motorised Transport (NMT)

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Understand the basic concepts of Environmental Impact of Assessment
CO2 Apply various methods of analyzing environmental Impact Analysis.
CO3 Gain knowledge on Stage Wise Assessment and Prediction of impact of transportation projects
CO4 Adopt environmental management plan and their impact on earth.
CO5 Reviewing various case studies on environmental impact assessment of transport projects.

TEXTBOOKS:

1. Canter, L.R., Environmental Impact Assessment, McGraw Hill, New Delhi, 1996.
2. Indian Road Congress (IRC), Environmental Impact of Highway Projects, IRC, Delhi, 1998.
3. EIA Guidance Manual- Highway- MOEF & Govt of India, 2010
4. P. Meenakshi, Elements of Environmental Science and Engineering, Prentice Hall of India, New Delhi, 2006
5. Thirumurthy A.M., Introduction to Environmental Science and Management, Shroff Publishers, Bombay, 2005.

REFERENCES:

1. John G.Rau and David, C.Hooten, Environmental Impact Analysis Handbook, McGraw Hill Book Company, 1995
2. James H.Banks, Introduction to Transportation Engineering, McGraw Hill Book Company, 2000
3. World Bank, A Handbook on Roads and Environment, Vol.I and II, Washington DC, 1997
4. Priya Ranjan Trivedi, International Encyclopedia of Ecology and Environment – EIA, Indian Institute of Ecology and Environment, New Delhi, 1998
5. Manual on Norms & Standards for Environmental Clearance of large construction projects, MOEF & Govt of India

COs-PO's&PSO'sMAPPING

PO/PSO		Course Outcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3				3
PO2	Problemanalysis		3	3	3	2	3
PO3	Design/development of solutions		3	3	2	1	3
PO4	Investigation			2	2	1	2
PO5	ModernToolUsage		2	3	2	2	2
PO6	Engineer and Society	3			3	3	3
PO7	Environment and Sustainability	1	1	2	3	1	2
PO8	Ethics			3	3	3	3
PO9	Individual and Team work	2	2			2	2
PO10	Communication					1	1
PO11	Project Management and Finance			2	2	3	2
PO12	Life Long Learning	2		2	1	1	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	1	2	3		2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues		2	3	2	3	3

21155E54I **RAINWATER HARVESTING** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

To impart knowledge and skills relevant to water conservation and management towards

achieving the sustainability in water resources and relate the engineering principles and practices in estimation of runoff, storage, recharge into the ground and maintain the system through the best management practices followed around the world.

UNIT I BASICS OF RWH **8**

Water and its sources - Need for water conservation – Types of water demand - Conservation Methods - Global and Indian perspectives - National mission and goals towards rainwater harvesting – National water policy - Legislation on rainwater harvesting in India and Tamil Nadu.

UNIT II HYDROLOGY AND GROUND WATER **10**

Hydrological cycle – Precipitation - Rainfall measurement - Rain-gauges – Hyetograph - Infiltration - Runoff estimation – Rooftop runoff estimation. Ground water - Aquifer Properties – Darcy law and well hydraulics - Steady flow.

UNIT III METHODS OF RAINWATER HARVESTING **7**

Rainwater harvesting potential of an area - Traditional harvesting practices – Rooftop harvesting - Methods of RWH structures – Site selection for rainwater harvesting - Surface runoff Harvesting - Ground water recharge - Artificial recharge.

UNIT IV DESIGN OF RAINWATER HARVESTING STRUCTURES **10**

Design Considerations - Components of Rainwater harvesting system - Simple roof water collection system - Design of Storage structure - Design of Recharge structures – Recharge pit - Recharge trench - Recharge well - Gully plug - Contour bund - Percolation tank - Check dam - Recharge shaft - Efficiency of RWH system

UNIT V MANAGEMENT OF RWH AND CASE STUDIES **10**

Difficulties in RWH - At catchment level - At household level - Evaluation of RWH systems – Maintenance of RWH structures - Modernisation of RWH system - Case studies on best practice of RWH in urban - Success stories of Contemporary practices of RWH in India.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Understand the need and importance of water conservation through global and Indian practices of rainwater harvesting

CO2 Understand and apply the concepts of hydrology and groundwater in the estimation of runoff and recharge potentials

CO3 Understand the various types of rainwater harvesting methods and apply it on the field

CO4 Design the various RWH structures to harvest the rainwater in surface and subsurface

CO5 Explain the difficulties of RWH, evaluation methods and maintenance through various case studies.

TEXT BOOKS

1. H.M Raghunath “Ground Water” 3rd Edition, New Age International 2007.

2. Jayarami Reddy.P, (2005) “A Text book of Hydrology” Firewall media Publication.

3. Ramakrishnan S, (2010), “Ground Water”, Scitech Publications (India) Pvt Ltd

REFERENCES:

1. Proceedings of UNHABITAT Blue water series "Rainwater harvesting and utilization", Book

2. 2 beneficiaries and capacity builders. 2. Rain water Harvesting Techniques to Augment Ground Water: Ministry of Water Resources Central Ground Water Board Faridabad,2003.

3. Rainwater Harvesting: Indian Railway Institute of Civil Engineering Pune, October 2015.

4. A Manual on "Rainwater Harvesting and Conservation": Government of India, Consultancy Service Organization Central Public Works Department, New Delhi.

5. "A Water Harvesting Manual for Urban Areas" issued by Centre for Science and Environment

6. Traditional Water Harvesting Systems of India" C.P.R. Environmental Education Centre, Chennai, India (2004).

7. Empowering Village Communities for A Sustainable Water Future - A Resource Book for Jaldoots, 2019, Prepared by Central Ground Water Board, Dept. of Water Resources, River Development and Ganga Rejuvenation, Ministry of Jal Shakti, Govt. of India and MARVI – Managing Aquifer Recharge and Sustaining Ground water Use through Village-level Intervention.

8. 8. Handbook on rainwater harvesting storage options, Ministry of Water & Environment, Uganda

F. COs-PO's&PSO'sMAPPING

PO/PSO		Course Outcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	3	2	3	2	2
PO2	Problemanalysis	1	3	2	3	2	2
PO3	Design/development of solutions		2	2	3	2	2
PO4	Investigation		2	2	3	2	2
PO5	ModernToolUsage	1	3	2	3	2	2
PO6	Engineer and Society	2	2	2	3	2	2
PO7	Environment and Sustainability	2	1	2	2	2	2
PO8	Ethics	2	1	1	2	2	2
PO9	Individual and Team work	1	1	1	2	2	1
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	1	2	1	3	2	2
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	2	2	3	3	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	3	3	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	1	2	2	3	3	2

21155E54J MARINE GEOTECHNICAL ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVE:

Students mainly focused in understanding the physical and engineering properties of marine soil deposits and select suitable marine foundation as per project requirements.

UNIT I MARINE SOIL DEPOSITS 9

Marine environment, Physical and engineering properties of marine soils - Specific problems related to marine soil deposits.

UNIT II SITE INVESTIGATION IN THE CASE OF MARINE SOIL DEPOSITS 9

Challenges of site investigation in marine environment, Different site investigation techniques, sampling techniques, Geophysical methods, Recent advancements in site investigation and sampling used for marine soil deposits.

UNIT III BEHAVIOR OF SOILS SUBJECTED TO REPEATED LOADING 9

Effect of wave loading on foundations of marine structures, Behavior of marine deposits under cyclic loading, Cyclic behavior of soils based on fundamental theory of mechanics, Approximate engineering methods

UNIT IV FOUNDATIONS IN MARINE SOIL DEPOSITS 9

Different offshore and nearshore foundations, Gravity platforms, Jack-up rigs, pile foundations. cassions, spudcans.

UNIT V MARINE FOUNDATIONS SUBJECTED TO WAVE LOADING 9

Cyclic behavior of soils, empirical models, elastic-plastic models, FEM analysis of marine foundations subjected to wave loading.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be ableto

CO1 Understand the physical and engineering properties of marine soil deposits

CO2 explain the effect of wave loading on physical and engineering properties of marine soil deposits

CO3 execute investigation program for marine soil deposits

CO4 design suitable marine foundation as per project requirement

CO5 develop numerical model and design marine foundation subjected to wave loading

REFERENCES:

1. H. G. Poulos. “Marine Geotechnics”, Unwin Hyman Ltd, London, UK, 1988

2. D. V. Reddy and M. Arockiasamy, “Offshore Structures”, Volume: 1, R.E. Kreiger Pub and Co., 1991

3. D. Thomson and D. J. Beasley, “Handbook of Marine Geotechnical Engineering”, US Navy, 2012

COs- PO’s & PSO’s MAPPING

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	2	2	2	3	2	2	2	1	2	3	3	3	2
CO2	2	2	3	2	1	2	1	2	1	1	2	2	2	2	3
CO3	3	2	1	1	1	2	1	2	2	1	1	2	2	1	2
CO4	3	3	2	1	1	1	2	1	2	2	2	1	3	2	2
CO5	2	2	2	1	2	1	1	1	2	1	1	2	3	2	3

ELECTIVE II

21155E55A **STEEL STRUCTURES** **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To acquire hands on experience in design and preparation of structural drawings for steel structures like industrial buildings, steel framed buildings using structural design software and detailed drawing softwares
- To introduce the students to design of light gauge steel structures

UNIT I DESIGN ASPECTS AND LOADS ON A STEEL BUILDING 9

Inputs for the design of a steel building - Design basis report, covering Site Data, geometrical, functional and structural requirements for its end usage - material specifications - Methods of designing a steel building. Calculating the various loads acting on a steel building - Vertical & Lateral loads - Effects of each loads separately and in combination – Dead, superimposed dead, live, temperature, MEP service loads - Lateral loads due to Wind and Seismic effects.

UNIT II SELECTION OF LOAD RESISTING SYSTEM AND MODELLING OF STRUCTURE 9

Studying the layout plans of the structure - Selection of load resisting systems - Load flow in each system - Satisfying Stability and strength of the structure - Vertical and Lateral load resisting systems - Analysis and design of Sway and non-sway frames - Manual and Computer aided modelling, analysis and design - Geometric and structural parameters of the structure - Loading the structure - Interpretation of the results of the software – Analysis and Design of a multi-storeyed building.

UNIT III DESIGN OF VARIOUS ELEMENTS OF A STEEL BUILDING 9

Manual and Software aided design – Beams, columns, floors, bracings, purlins/girts and facades, base plates and anchor bolts – Various loads, different conditions of supports, exposure, and purpose of use - Design of Connections between the members – bolted and welded, moment and shear connections

UNIT IV DESIGN OF AN INDUSTRIAL BUILDING 9

Functional requirements - Serviceability Requirements - Structural Configurations - Selection of sections as per requirements - Configuration of the elements, connectivity - Analysis and design of different types of trusses — Design of Gantry Girders – Design of gable frames – Design of steel columns for combined loading - Analysis and design of industrial buildings - Study of General assembly drawings - Fabrication processes - Fabrication, logistics & erection – Sequence of erection Inspection of a completed structure.

UNIT V DESIGN OF LIGHT GAUGE STEEL STRUCTURES 9

Philosophy of design of light gauge steel members, Direct Strength Method (DSM) ,Effective width method (EWM) – Concept of buckling, local buckling and post-buckling strength - Analysis and design of Compression members– Analysis and design of flexural members, Lateral buckling of beams, Shear Lag, Flange Curling – Design of wall panels

TOTAL : 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Plan the layout of the structure and calculate the loads of the steel structure.

CO2 Select a load resisting system, model the structure and interpret the results.

CO3 Design the various elements of a steel buildings

CO4 Design a typical industrial building

CO5 Design the various elements of a cold –formed steel buildings

TEXT BOOKS

1. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016
2. Negi L.S. “Design of steel structures” McGraw Hill Co., New Delhi, 2014
3. Duggal S.K., Design of Steel Structures, Tata McGraw Hill, Publishing Co. Ltd., New Delhi, 2010

REFERENCES

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. Gaylord E H, Gaylord N C and Stallmeyer J E, "Design of Steel Structures", 3rd edition, McGraw Hill Publications, 1992.
5. Salmon, Johnson & Malhas," Steel Structures: Design and Behavior, 4th Edition, Harper Collins College Publisher, 1996
6. Bhavikatti S.S, Design of Steel Structures, Ik International Publishing House, New Delhi, 2017.
7. Wie Wen Yu, Design of Cold Formed Steel Structures, McGraw Hill Book Company, 1996
8. www.nptel.ac.in
9. http://www.steel-insdag.org/TM_Contents.asp

INDIAN STANDARD CODES

1. IS: 800 – 2007, Code of Practice for general construction in steel, BIS, New Delhi
2. SP 6 (1) – Structural steel sections
3. IS 875 (1-5) - 1987 Code of practice for Design Loads (Other than Earthquake) for Buildings and Structures, BIS
4. IS 816 :1969 - Code of practice for Metal Arc Welding for general Construction in Mild Steel, BIS
5. IS: 808 – 1989 Dimensions For Hot Rolled Steel Beam, Column, Channel and Angle Sections.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	2	2	3	2	3	2
PO3	Design / development of solutions	1	1	2	2	2	2
PO4	Investigation	-	-	2	1	1	1
PO5	Modern Tool Usage	2	2	2	2	2	2
PO6	Engineer and Society	-	-	-	1	1	1
PO7	Environment and Sustainability	-	1	1	2	2	1
PO8	Ethics	1	1	2	2	2	2
PO9	Individual and Team work	-	1	1	2	1	1
PO10	Communication	2	1	1	1	1	1
PO11	Project Management and Finance	1	-	-	1	1	1
PO12	Life Long Learning	2	1	1	2	2	2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	3	3	3	3
PSO3	Conceptualization and evaluationof engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

21155E55B AIR AND NOISE POLLUTION CONTROL ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVE:

- To impart knowledge on the sources, effects and control techniques of air pollutants and noise pollution.

UNIT I GENERAL 9

Atmosphere as a place of disposal of pollutants – Air Pollution – Definition - Air Pollution and Global Climate - Units of measurements of pollutants - Air quality criteria - emission standards - National ambient air quality standards - Air pollution indices - Air quality management in India.

UNIT II SOURCES, CLASSIFICATION AND EFFECTS 9

Sources and classification of air pollutants - Man made - Natural sources - Type of air pollutants - Pollution due to automobiles - Analysis of air pollutants - Chemical, Instrumental and biological methods.Air pollution and its effects on human beings, plants and animals - Economic effects of air pollution - Effect of air pollution on meteorological conditions - Changes on the Meso scale, Micro scale and Macro scale.

UNIT III SAMPLING, METEOROLOGY AND AIR QUALITY MODELLING 9

Sampling and measurement of particulate and gaseous pollutants - Ambient air sampling - Stack sampling. Environmental factors - Meteorology - temperature lapse rate and stability – Adiabatic lapse rate - Wind Rose - Inversion – Wind velocity and turbulence - Plume behavior - Dispersion of air pollutants- Air Quality Modeling.

UNIT IV AIR POLLUTION CONTROL MEASURES 9

Control - Source correction methods - Control equipments - Particulate control methods – Bag house filter - Settling chamber - cyclone separators - inertial devices - Electrostatic precipitator – scrubbers - Control of gaseous emissions - Absorption - Absorption equipments - adsorption and combustion devices (Theory and working of equipments only).

UNIT V NOISE POLLUTION AND ITS CONTROL 9

Sources of noise – Units and Measurements of Noise - Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise – General Control Measures – Effects of noise pollution – auditory effects, non-auditory effects. Noise Menace– Prevention and Control of Noise Pollution – Control of noise at source, control of transmission, protection of exposed person - Control of other types of Noise Sound Absorbent

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Understand various types and sources of air pollution and its effects
CO2 Know the dispersion of air pollutants and their modeling
CO3 Know about the principles and design of control of particulate pollutants
CO4 Understand the principles and design of control of gaseous pollutant
CO5 Know the sources, effects and control of vehicular, indoor air and noise pollution

TEXTBOOKS:

1. C. S. Rao, “Environmental Pollution Control Engineering”, Wiley Eastern Limited, 2006.
2. M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 2017
3. Dr. Y. Anjaneyulu, “Air Pollution and Control Technologies”, Allied publishers Pvt. Ltd., 2019.

REFERENCES:

1. Noel De Nevers, "Air pollution control Engineering", McGraw Hill International Edition, McGraw Hill Inc, New Delhi, 2000.
2. Air Pollution act, India, 1987Peterson and E.Gross Jr., “Hand Book of Noise Measurement”, 7th Edition, 1974

3. Mukherjee, "Environmental Pollution and Health Hazards", causes and effects, 1986
4. Antony Milne, “Noise Pollution: Impact and Counter Measures”, David & Charles PLC, 1979.
5. Kenneth wark, Cecil F.Warner, “Air Pollution its Origin and Control”, Harper and Row Publishers, New York, 1998.

COs- PO’s & PSO’s MAPPING

CO	PO									PSO					
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3				3			2	1	2			2		
2	2			3		2						2	1	2	2
3	2		3		3		1				2		2	2	2
4	2		3		3		1				2		2	2	2
5	3	3	2	3	2					2			2		
AVg.	2	3	3	3	3			2	1	2	2	2	2	2	2

21155E55C REHABILITATION/HERITAGE RESTORATION L T P C
3 0 0 3

COURSE OBJECTIVE:

- To acquire the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures, Restoration of Heritage 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.

UNIT II STRENGTH AND DURABILITY OF CONCRETE 9

Quality assurance for concrete – Strength and Durability of concrete - Cracks, different types,causes- Effects due to climate, temperature, Sustained elevated Temperature, Corrosion –

UNIT III SPECIAL CONCRETES 9

Polymer concrete - Sulphur infiltrated concrete - Fibre reinforced concrete - High strength concrete- High performance concrete - Self compacting concrete - Geopolymer concrete - Concrete made with industrial wastes.

UNIT IV TESTING TECHNIQUES 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.

UNIT V STRENGTHENING, REPAIR, REHABILITATION AND RESTORATION OF STRUCTURES 9

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage and earthquake - Restoration of Heritage structures- Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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 various special concretes
CO4 Understand the testing techniques and various protection measures
CO5 Know the Repair of structures and Restoration of Heritage structures

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.

REFERENCES:

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. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth-Heinemann, Elsevier, New Delhi 2012

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	2	2	3
PO2	Problem analysis	2	2	2	2	2	2
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	-	-	-	-	-	-
PO5	Modern Tool Usage	-	-	-	-	-	-
PO6	Engineer and Society	-	-	-	-	-	-
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	2	1	1	1	1	1
PO10	Communication	-	-	-	-	-	-
PO11	Project Management and Finance	-	-	-	-	-	-
PO12	Life Long Learning	1	1	1	1	1	1
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	-	1	1	-	-	1
PSO2	Critical analysis ofCivil Engineering problemsand innovation	-	1	-	1	2	1
PSO3	Conceptualization andevaluation of engineering solutions to Civil Engineering Issues	-	1	2	-	2	2

21155E55D **FORM WORK ENGINEERING** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

On completion of this course the students will be able to know the detailed planning of formwork, design of forms and erection of form work.

UNIT I INTRODUCTION TO FORM WORK **9**

Introduction to Formwork and false work, Temporary work systems, Requirements, Construction planning and site constraints, Selection, and Classification (Types) of Formwork, General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples - Overall Planning - Detailed planning - Overall programme - Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant - Formwork beams - Scaffold frames - Framed panel formwork.

UNIT II FORMWORK MATERIALS ASSESORIES & PRESSURES **9**

Formwork Materials, Accessories and consumables – Application of tools, Reconstituted wood - Steel – Aluminum Plywood - Types and grades Standard units - Corner units – Pass units, Calculation of labour constants - Formwork hours - Labour Requirement. Hardware and fasteners - Nails in Plywood - Allowable withdrawal load and lateral load. Pressures on formwork - Examples - Finish - Sheathing boards working stresses - Repetitive member stress Vertical loads for design of slab forms - Uplift on shores - Laterals loads on slabs and walls.

UNIT III FORMWORK DESIGN **9**

Concepts, Formwork Systems – components, assembly, De-shuttering, safety of work and Design for Tall Structures, Foundation Wall, Column, Slab and Beam formworks. Design of Decks and False works. Effects of various loads. Loading and moment of formwork, IS Code provisions.

UNIT IV FORMWORK FOR SPECIAL STRUCTURES **9**

Formwork for Bridge Structures, Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Nuclear Reactor, Tunnel, Lift Shaft, stairs and Formwork for Precast Concrete. Various climbing system, Table lifting system.

UNIT V CASE STUDIES **9**

Formwork failures: Causes of failures – Inadequate shoring inadequate bracing of members – improper vibration – Premature stripping Errors in design – Case studies – Finish of exposed concrete design deficiencies – Safety factors – Prevention of rotation – Stripping sequence – failure formwork issues in multi - story building construction – vertical and horizontal elements used in the industry.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1 To understand the overall and detailed planning of formwork.

CO2 To impart knowledge on formwork materials, accessories, pressures and labour requirement.

CO3 To develop the conceptual understanding of design, construction and erection of formwork.

CO4 To impart the knowledge about different types of form work used for special structures.

CO5 To understand the errors in design and judge the formwork failures through case studies.

TEXT BOOKS

1. Peurify R.L and Oberlender G.D , Formwork for Concrete Structures, , McGraw Hill Education India ,2015

2. Jha K N, Formwork for Concrete Structures, Tata McGraw Hill Education, 2012.

REFERENCES:

1. Austin, C.K., Formwork for Concrete, Cleaver -Hume Press Ltd., London, 1996.

2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996

3. Michael P. Hurst, Construction Press, London and New York, 2003.

4. Christopher Souder , (2014), Temporary Structure Design, Wiley Publications, London.

5. IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	3	3	2	2	2
PO2	Problem analysis		3	3	3	1	3
PO3	Design/development of solutions		3	3		2	3
PO4	Investigation		2	2		3	2
PO5	ModernTool Usage			2			1
PO6	Engineerand Society	2					1
PO7	Environment and Sustainability	2	2				2
PO8	Ethics						
PO9	Individual and Team work	3	3	3	2	2	3
PO10	Communication						
PO11	ProjectManagement and Finance	3	2	2	2	3	2
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation		3	3			2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues		2	3			2

21155E55E DIGITALIZED CONSTRUCTION LAB L T P C
0 0 6 3

COURSE OBJECTIVE:

To train the students in field of digitalization of construction. Students can be trained in the latest softwares relevant to construction industry List of experiments: To implement the digital knowledge in construction (use relevant softwares)

1. Introduction and understanding of Primavera project planner for construction
2. Using Primavera project planner, update the schedule of the project of a construction project.
3. Introduction and understanding of MS Project for a construction project
4. Using MS project, schedule the construction project planning
5. Introduction to BIM in construction projects a. Development of BIM for small construction project
6. Progress the work flows in construction project using BIM
7. Development of bid management for a small firm construction industry using software.

TOTAL: 90 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to understand the output ofdigitalization of construction

CO1 To understand the importance of latest softwares in a construction industry.
CO2 To plan a construction project using Primervera
CO3 To plan a construction project using MS project
CO4 To develope a BIM information model
CO5 To analyse the bid management and its effectiveness using bid management software

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	3	2	2	3	2
PO2	Problem analysis	2	3	3	2	2	2
PO3	Design/development of solutions	3	2	2	3	3	3
PO4	Investigation	2	2	2	3	2	2
PO5	ModernTool Usage	3	3	3	3	3	3
PO6	Engineerand Society	3	2	3	3	2	3
PO7	Environment and Sustainability	2	2	2	3	3	3
PO8	Ethics	2	2	2	2	3	2
PO9	Individual and Team work	3	2	3	3	3	3
PO10	Communication	2	2	2	2	2	2
PO11	ProjectManagement and Finance	2	3	2	3	3	3
PO12	Life Long Learning	2	3	2	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	2	3	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	3	2	2	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	3	2	3	3	3

21155E55F SUSTAINABLE CONSTRUCTION AND LEAN CONSTRUCTION L T P C
3 0 0 3

COURSE OBJECTIVE:

To impart knowledge about sustainable construction and to understand the concepts of sustainable materials, energy calculations, green buildings and environmental effects.

UNIT I INTRODUCTION & MATERIALS USED IN SUSTAINABLE CONSTRUCTION 9

Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. contribution from cement and other construction materials - Recycled and manufactured aggregate - Role of QC and durability - Life cycle and sustainability.

UNIT II ENERGY CALCULATIONS 9

Components of embodied energy - calculation of embodied energy for construction materials - Energy concept and primary energy - Embodied energy via-a-vis operational energy in conditioned building - Life Cycle energy use.

UNIT III GREEN BUILDINGS 9

Control of energy use in building – National Building Code (NBC), ECBC code, codes in neighboring tropical countries - OTTV concepts and calculations – Features of LEED and TERI – Griha ratings - Role of insulation and thermal properties of construction materials - influence of moisture content and modeling -Performance ratings of green buildings - Zero energy building'

UNIT IV CORE CONCEPTS IN LEAN 9

Introduction to the Course; Lean Overview; Need for Productivity Measurement and improvement; Productivity Measurement System (PMS).

UNIT V LEAN CONSTRUCTION TOOLS AND TECHNIQUES 9

Sampling/ Work Sampling; Survey/ Foreman delay survey; Value Stream/ Process Mapping– 5S , Collaborative Planning System (CPS)/ Last Planner™ System (LPS) – Big Room Approach, IT/BIM and Lean, How to Start Practicing Lean Tools in Project Site.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Describe the various sustainable materials used in construction.

CO2 Explain the method of estimating the amount of energy required for building.

CO3 Describe the features of LEED, TERI and GRIHA ratings of buildings.

CO4 Explain the core concepts of lean construction tools and techniques and their importance in achieving better productivity.

CO5 Apply lean tools & techniques to achieve sustainability in construction projects.

REFERENCES:

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition, Wiley Publishers 2016. 2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.
3. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
4. Ballard, G., Tommelein, I., Koskela, L. and Howell, G., Lean construction tools and techniques, 2002.
5. Salem, O., Solomon, J., Genaidy, A. and Luegring, M., Site implementation and Assessment of Lean Construction Techniques, Lean Construction Journal, 2005.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	3	2	3	3	3
PO2	Problem analysis	-	1	2	1	1	1
PO3	Design/development of solutions	1	3	3	3	2	3
PO4	Investigation	1	2	1	2	2	2
PO5	ModernTool Usage	-	1	1	2	2	2
PO6	Engineerand Society	2	2	1	1	2	2
PO7	Environment and Sustainability	3	2	1	3	3	3
PO8	Ethics	1	-	-	1	1	1
PO9	Individual and Team work	1	1	-	1	-	1
PO10	Communication	-	1	-	1	1	1
PO11	ProjectManagement and Finance	2	1	3	3	3	3
PO12	Life Long Learning	1	2	1	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	2	3	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	3	2	2	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	3	2	3	3	3

21155E55G ENVIRONMENTAL QUALITY MONITORING L T P C
3 0 0 3

COURSE OBJECTIVES:

To educate the students on the sample collection and various instrumental methods of monitoring the quality of air, water and solid waste.

UNIT I MONITORING AND CHARACRATERIZATION OF ENVIRONMENT 9

General approach to environmental analysis, Choice of Lab.Vs. Field analysis, Environmental monitoring-current and future status, Lab. Standards, Data quality objectives, statistics in environmental monitoring, Accuracy and precision, detection limit, types of errors, Automated Data acquisition and processing-sensors and transducers , Monitoring Network and real time monitoring

UNIT II ENVIRONMENTAL SAMPLING 9

Location, planning, sampling equipment's for water, solids and air, sample storage for physical and chemical contaminants ,types of sampling, representative samples, sample preparation techniquesSolvent Extraction, SPE, Head space, Purge and trap and SPME

UNIT III WATER ANALYSIS 9

Techniques for analysis of major ions-UV-visible Spectrophotometer, Flame photometer, AAS, ICP (AES and MS), Trace organic pollutants(PCB, dioxins, pecticides) GC and HPLC (Columns Detectors and Application)

UNIT IV ATMOSPHEREIC ANALYSIS 9

Ambient air and flue gas, Gaseous pollutants-Determination of time weighted average concentration(Absorption trains, solid adsorbents and differential tubes), Direct reading instruments(fluorescence ,chemiluminescent,IR and Electrochemical sensors, GC-MS for trace organics, Particulate sampling methods- High volume sampler, personal sampler, PM 10 and 2.5, Metals Direct(XRF) and dissolution methods(AAS/AES)

UNIT V ANALYSIS OF SOIL AND WASTE 9

Problem in analysis of soil and Waste -sampling, pretreatment -extraction and clean up, New extraction techniques, Automated soxhlet and solvent extraction,microwave digestion and sonication,SCF(CO_2), Analysis for trace pollutants, Analysis of leachate.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1 Understand the basics of environmental monitoring
CO2 Able to select appropriate sampling protocol for chemical analysis
CO3 Understand various methods of analysis of pollutants in water
CO4 Select correct method for toxic pollutants estimation in air
CO5 Familiar with analysis of land and wastes

REFERENCES:

1. Reeve, R.N., "Introduction to Environmental Analysis", Analytical Techniques in the Sciences, John Wiley & Sons, Chichester, UK, 2002.
2. Barcelo, D.(editor), "Environmental analysis. Techniques, Applications and Quality Assurance", Elsevier, The Netherlands, 1996
3. Paul R. Loconto Trace Environmental Quantitative Analysis: Principles, Techniques, and Applications, Marcel Dekker; 2nd Edition , 2005,
4. Janick Artiola, Ian Pepper and Mark Brusseau, ENVIRONMENTAL MONITORING AND CHARACTERIZATION , Academic Press,2004.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	2	3	3
PO2	Problem analysis	2	2	3	1	3	2
PO3	Design/development of solutions				2	2	2
PO4	Investigation		2	2	1	2	2
PO5	ModernTool Usage	3	2	3	3	3	3
PO6	Engineerand Society				3	3	3
PO7	Environment and Sustainability	2					2
PO8	Ethics		2				2
PO9	Individual and Team work						
PO10	Communication	2				2	2
PO11	ProjectManagement and Finance	2					2
PO12	Life Long Learning	2	2				2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	2	2		2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2				2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	2	2				2

21155E55FH **COASTAL ENGINEERING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To provide the students the knowledge of coastal environment and to determine the characteristics of waves.
- To provide the students the knowledge of wave transformation, sediment transport, coastal protection measures and coastal structure design.

UNIT I COASTAL ENVIRONMENT **9**

Beaches - Coastal features - Coastal Zonation - EEZ -Inshore and Offshore Areas - Mean Sea level - Basics of Tides and Waves - Coastal Morphology.

UNIT II WAVES DYNAMICS **9**

Basics of waves - Classification - Wave Theory - Physical Characteristics of different types of waves - Linear Wave Theory - Wave celerity - Velocities -Accelerations - Displacements - Wave dynamics in shallow and deep water conditions.

UNIT III NEARSHORE WAVE TRANSFORMATION **9**

Shoaling, refraction, diffraction and breaking– Interaction currents and waves- near shore currentswave run-up and overtopping

UNIT IV SEDIMENT DYNAMICS AND TRANSPORT **9**

Introduction to sediments, Sediment Analysis, types and sizes of sediments, sedimentation processes, sediment Supply & movement - Cross-shore sediment transport - Long shore sediment transport - Shoreline Changes - Shoreline Evolution - Erosion & Accretion.

UNIT V SHORE PROTECTION **9**

Design of shore defense structures; Hard Engineering measures - Sea walls, Revetments, Bulkheads, Dikes, Groynes, Breakwaters; Soft Engineering measures – Artificial Reefs, Beach nourishment, Dune regeneration, Salt marsh Creation, Bioshields - Case studies

TOTAL: 45 PERIODS

COURSE OUTCOME:

On successfully completing this course unit, students will be able to:

CO1 Understand the basic concepts of coastal environment.

CO2 Calculate sea state parameters (wave height, wave period, water levels) in shallow and deep water conditions.

CO3 Understand the principles of near-shore wave transformation.

CO4 Analysis the sediment and its transport processes.

CO5 Evaluate measures to protect beaches from erosion due to waves and currents.

TEXTBOOKS:

1. Kamphuis, J.W., Introduction to coastal engineering and management, 2000

2. Dean, R.G. and Dalrymple, R.A., Water wave mechanics for Engineers and Scientists, PrenticeHall, Inc., Englewood Cliffs, New Jersey, 1994.

3 Mani J.S, “Coastal Engineering book”, PHI Publishing Company, 2nd Edition, 2021.

REFERENCES:

1. Ippen, A.T., Estuary and Coastline Hydrodynamics, McGraw-Hill Book Company, Inc., New York, 1978.

2. Sorenson, R.M., Basic Coastal Engineering, A Wiley-Interscience Publication, NewYork, 1978.

3. Coastal Engineering Manual, Vol. I-VI, Coastal Engineering Research Centre, Dept. of the Army, US Army Corps of Engineers, Washington DC,2006.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences		3	3	3	3	3
PO2	Problem analysis		3	3	3	3	3
PO3	Design/development of solutions		3	2	3	3	3
PO4	Investigation					3	3
PO5	ModernTool Usage			2	3	3	3
PO6	Engineerand Society			2	3	3	3
PO7	Environment and Sustainability	2					2
PO8	Ethics		3	2	3	3	3
PO9	Individual and Team work						
PO10	Communication	3	3	2		3	3
PO11	ProjectManagement and Finance						
PO12	Life Long Learning	3	2	2		3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	1	3	2	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation		3	3	3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues				2	3	2

21155E55I **OCEAN WAVE DYNAMICS** **L T P C**
3 0 0 3

COURSE OBJECTIVE

To make the students be aware of ocean wave classification, the mass, momentum and wave energy transformations and wave kinematics that are happening in nature and enable them in the prediction and analysis of the wave data.

UNIT I CONSERVATION EQUATIONS OF FLUID FLOW **9**

Basic equations – Conservation of mass, moment and Energy - Continuity Equation, Euler's Equation, Newtonian Fluids, Navier-Stokes Equation.

UNIT II WAVE THEORIES **9**

Linear wave theory : Governing Equation, Boundary Conditions and solutions, Dispersion relation, Constancy of wave period. Introduction to non-linear wave theories - Stokes, Cnoidal and Solitary wave theory.

UNIT III WAVE KINEMATICS **9**

Wave celerity, water particle velocities, accelerations, displacements and pressures. Integral properties of waves: Mass flux, Energy and energy flux, Group speed, Momentum and momentum flux.

UNIT IV WAVE TRANSFORMATIONS **9**

Shoaling, bottom friction and damping, refraction, reflection and diffraction. Wave Breaking: Type of breaking, Surf similarity parameter. Keulegan-Carpenter number, Ursell Parameter, Scattering parameter, Reynolds Number

UNIT V WAVE ANALYSIS **9**

Short term wave analysis- Short term wave Height Distribution – Wave period Distribution - Time and Frequency domain Analysis of Wave Records - Long term wave analysis – Gumbel Distribution – Weibull Distribution - Statistics analysis of grouped wave data.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Understand the concept of mass, momentum and wave energy transformations

CO2 Classify the linear and nonlinear wave theories including the Stokes theory, solitary and cnoidal wave theories.

CO3 Explain the wave kinematics and its properties.

CO4 Understand the principles of wave transformation.

CO5 Analyze of the long term and short term waves

REFERENCES:

1. Sarpkaya, T. and Isaacson, M., Mechanics of Wave Forces on Offshore Structures, Van Nostrand Reinhold Co., New York, 1981

2. Dean, R.G. and Dalrymple, R.A., Water wave mechanics for Engineers and Scientists, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1994

3. Ippen, A.T., Estuary and Coastline Hydrodynamics, McGraw-Hill Book Company, inc., New York, 1978

4. Coastal Engineering Manual Volume I and II, Coastal Engineering Research Centre, Dept, of the Army, US Army Corps of Engineers, Washington DC, 2006

5. Sorenson, R.M., Basic Coastal Engineering, A Wiley-Interscience Publication, New York, 1978.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis		2	3	3	3	3
PO3	Design/development of solutions			2	3	3	3
PO4	Investigation					3	3
PO5	ModernTool Usage			2	3	3	3
PO6	Engineerand Society		3	2	3	3	3
PO7	Environment and Sustainability	2					2
PO8	Ethics		3	2	3	3	3
PO9	Individual and Team work					2	2
PO10	Communication				2		2
PO11	ProjectManagement and Finance		2	3	2	3	3
PO12	Life Long Learning	3	2	2	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	2	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	3	2	2	3	2

ELECTIVE III

21155E56A WATER QUALITY AND MANAGEMENT L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the fundamentals of mathematical models and their importance in water quality modelling, and to impart the skills to use water quality modelling software for surfaceand groundwater qualitymodelling.

UNIT I MODELLING INSIGHTS 9

Engineers and Mathematical models-Water quality models – historical development - different types of models-- steps in model development - importance of model building.- calibration and verificationof models- finite element, finite difference and finite volume methods.

UNIT II POLLUTION TRANSPORT 9

Transport phenomena – advection, diffusion, dispersion- contamination transport in surface and subsurface water - Simple transport models –steady state and time variable solutions- conservation of mass, momentum and energy balance, governing equation for contaminant fate and transport

UNIT III SURFACE WATER QUALITY MODELLING 9

Water quality modeling of streams, lakes and estuaries – water quality– model sensitivity – assessing model performance; Models for dissolved oxygen, pathogens and COD, BOD-Streeter Phelp's model for point and distributed sources – modified streeter Phelp's equations.

UNIT IV GROUNDWATER QUALITY MODELLING 9

Groundwater flow and mass transport of solutes – groundw ater quality modelling using numerical methods – Parameters, Input-output stresses, Initial and Boundary conditions- degradation of organic compounds in subsurface – Model calibration : steady state and unsteady state – sensitivity analysis-Model validation –seawater intrusion – basic concepts and modelling.

UNIT V WATER QUALITY MANAGEMENT MODEL 9

Exposure to surface water and groundwater quality modelling software's – MIKE 21, WASP, QUAL2E and MODFLOW – demonstration – case studies – Modeling multilayer groundwater flow system – Artificial recharge feasibility through modeling – Groundwater contamination, restoration and management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the students are able to

CO1 Know about the principles of water quality modelling.

CO2 Understand the pollutant transport phenomena in surface and groundwater.

CO3 Apply the knowledge of surface water quality modelling to predict the water quality of rivers, lakes and estuary.

CO4 Predict the groundwater contamination transport.

CO5 Predict water quality of surface and sub surface water using numerical solution.

REFERENCES:

1. Steven C. Chapra, "Surface Water Quality Modelling", Tata McGraw-Hill Companies, Inc., New Delhi2018.

2. "Water Quality Modelling for Rivers and Streams" Authors: Benedini, Marcello, Tsakiris, George, Springer Netherlands2017.

3. **"**Hydrodynamics and Water Quality**:** Modelling Rivers, Lakes, and Estuaries", Zhen-Gang Ji, John Wiley & Sons,2018.

4. "Modelling Groundwater Flow and Contaminant Transport By Jacob Bear, A. H.-D. Cheng, Springer Science & Business Media,2010.

5. "Mathematical Modelling of Groundwater Pollution" Ne-Zheng Sun, Alexander Sun, Springer New York, 2012

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3				3
PO2	Problem analysis				2	3	3
PO3	Design/development of solutions			3	3	2	3
PO4	Investigation		3	2	3		3
PO5	ModernTool Usage				3	2	3
PO6	Engineerand Society					2	2
PO7	Environment and Sustainability				2		2
PO8	Ethics			2	3	3	3
PO9	Individual and Team work			2	2		2
PO10	Communication				3	3	3
PO11	ProjectManagement and Finance			2	2	2	2
PO12	Life Long Learning	3	2			3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline					3	3
PSO2	Critical analysis of Civil Engineering problems and innovation				3	2	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues		2	3			3

21155E56B **PREFABRICATED STRUCTURES** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

- To introduce the basic concepts of prefabrication
- To acquire the knowledge of prefabrication components and systems
- To understand the design principles in prefabrication
- To perceive the types of joints and connections in structural members
- To impart knowledge about the structural stability.

UNIT I INTRODUCTION **9**

Need for prefabrication -Advantages and limitations – Principles of prefabrication – Modular coordination – Standarization– Loads and load combinations– Materials – Production – Transportation – Erection.

UNIT II PREFABRICATED COMPONENTS AND SYSTEMS **9**

Behaviour and types of structural components– roof and floor slabs – Walls panels - Shear walls - Beams - Columns – skeletal system- portal frame system-Large panel systems- block system

UNIT III DESIGN PRINCIPLES **9**

Design philosophy- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems- Design for stripping , stacking ,transportation and erection of elements

UNIT IV JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS **9**

Types of Joints – based on action of forces - compression joints - shear joints - tension joints - based on function - construction joints , contraction joints, expansion joints. Design of expansion joints - Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation.

UNIT V DESIGN FOR ABNORMAL LOADS **9**

Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effectssuch as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse -case study.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

CO1 Understand concepts about principles of prefabrication, production, transportation, erection.

CO2 Acquire knowledge about panel systems, slabs, beams, shear walls and columns used in precast construction.

CO3 Acquire knowledge about design of cross section, joint flexibility.

CO4 Acquire knowledge about joints and connection in precast construction.

CO5 Acquire knowledge about structural stability.

TEXTBOOKS:

1. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers, USA,1991.

2. Lewitt,M. " Precast Concrete- Materials, Manufacture, Properties And Usage ,CRC Press, 2019

3. Alfred Steinle, Hubert Bachmann, Mathias Tillmann, Philip Thrift . "Precast Concrete Structures", Ernst & Sohn, Berlin, 2019.

REFERENCES:

1. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.

2. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.

3. " Precast concrete connection details", Structural Design manual, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	2	2	3
PO2	Problem analysis	3	2	2	2	2	2
PO3	Design/development of solutions	3	3	3	3	3	3
PO4	Investigation	1	1	1	1	1	1
PO5	ModernTool Usage	1	1	1	1	1	1
PO6	Engineerand Society	1	1	1	1	1	1
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	2	2	2	2	2	2
PO9	Individual and Team work	1	1	1	1	1	1
PO10	Communication	1	1	1	1	1	1
PO11	ProjectManagement and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	1	3	3	2	3	1
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	1	2	2	2	2	2

21155E56C TOTAL STATION AND GPS SURVEYING L T P C
3 0 0 3

COURSE OBJECTIVE:

- 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 - Applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies – 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 -pressure, transducers.

UNIT II ELECTRO-OPTICAL AND MICROWAVE 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. COGO functions: Area, Inverse / MLM, REM, Resection, offsets and stakeout - Land surveyapplications.

UNIT III 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 and IRNSS – SBAS: GAGAN and WAAS Differentsegments - 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.

UNIT IV 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 - Multi path and other observational errors – satellite geometry and accuracy measures – Continuously Operating Reference System (CORS)– long base line processing - use of different processing software's: Open Source, Scientific and Commercial.

UNIT V SURVEYING METHODS AND APPLICATIONS 9

Total Station: Traversing and Trilateration measurement and adjustment –Planimetric map and Contour map and Topography Mapping. GNSS: Concepts of rapid, static, semi-Kinematic, pure Kinematic and RTK methods. Observation by Radiation, Lee frog and Trilateration measurement and processing -Topography mapping using PPK and RTK methods Total Station and GNSS applications

TOTAL:45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to

CO1 Learn about the fundamental concept of Total station.
CO2 Provide knowledge about electromagnetic waves and its usage in Total station and GNSS.
CO3 Gain Knowledge on basic concepts of GNSS
CO4 Understand the measuring and working principle of electro optical and Microwave Totalstation and GPS
CO5 Gain knowledge about Total station and GNSS data processing and Mapping.

TEXTBOOKS:

1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 4th Edition,1996.

2. SatheeshGopi, rasathishkumar, N.madhu, — Advanced Surveying , Total Station GPS andRemote Sensing — Pearson education , 2nd Edition,2017. isbn: 978-81317 00679.
3. Gunter Seeber , Satellite Geodesy, Walter De Gruyter, Berlin, 2nd Edition, 2003

REFERENCES:

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, 3rdEdition, 2016.
4. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 4th Edition, 2015.

5. COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	2	2	2	2	3	2
PO3	Design/development of solutions	2	3	2	3	3	3
PO4	Investigation	2	2	2	3	3	2
PO5	ModernTool Usage	3	3	3	3	3	3
PO6	Engineerand Society	2	3	2	3	3	3
PO7	Environment and Sustainability						
PO8	Ethics						
PO9	Individual and Team work	1	1	1	1	2	1
PO10	Communication						
PO11	ProjectManagement and Finance						
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	3	3	3	3	3

21155E56D **ROCK MECHANICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

Students are expected to classify, understand stress-strain characteristics, failure criteria, and influence of in-situ stress in the stability of various structures and various technique to improve the in-situ strength of rocks.

UNIT I CLASSIFICATION OF ROCKS **9**

Types of Rocks - Index properties and classification of rock masses, competent and incompetent rock - value of RMR and ratings in field estimations.

UNIT II STRENGTH CRITERIA OF ROCKS **9**

Behaviour of rock under hydrostatic compression and deviatric loading - Modes of rock failure planes of weakness and joint characteristics - joint testing, Mohr - Coulomb failure criterion and tension cutoff. Hoek and Brown Strength criteria for rocks with discontinuity sets.

UNIT III INSITU STRESSES IN ROCKS **9**

In-situ stresses and their measurements, Hydraulic fracturing, flat jack, over coring and under coring methods - stress around underground excavations – Design aspects of openings in rocks.

UNIT IV SLOPE STABILITY AND BEARING CAPACITY OF ROCKS **9**

Rock slopes - role of discontinuities in slop failure, slope analysis and factor of safety - remedial measures for critical slopes – Bearing capacity of foundations on rocks.

UNIT V ROCK STABILIZATION **9**

Stabilization of rocks-rock support and rock reinforcement-active and passive supports-ground response curve-support reaction curve-reinforcement of fractured and joined rocks-Shotcretingbolting-anchoring-installation methods.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Classify the Rock mass and rate the quality of rock for tunnelling and foundations works and suggest the safer length of tunnelling and stand-up time.

CO2 Apply the knowledge of engineering and understand the stress – strain characteristics and failure criteria of rock and apply them to arrive at the shear strength parameters of rocks to be used for the design of structures resting on rock and also for the design of underground excavation in rocks.

CO3 Apply the knowledge of engineering and assess the influence of in-situ stress in the stability of various underground excavations and also acquire the knowledge of design of opening in rocks. **CO4** Apply the knowledge on rock mechanics and analyze the stability of rock slopes and arrive at the bearing capacity of shallow and deep foundations resting on rocks considering the presence of joints. design the foundations resting on rocks. Able to carry-out suitable foundation for the structure resting on rock.

CO5 Improve the in-situ strength of rocks by various methods such as rock reinforcement and rock support. Able to select suitable support system considering the interaction between rock and support. Also capable of executing the same in the field.

REFERENCES:

1. Goodman, R.E., Introduction to rock mechanics, John Willey and Sons, 1989.
2. Hudson, A. and Harrison, P., Engineering Rock mechanics – An introduction to the principles, Pergamon publications, 1997.
3. Hoek, E and Bray, J., Rock slope Engineering, Institute of Mining and Metallurgy, U.K. 1981.
4. Hoek, E and Brown, E.T., Underground Excavations in Rock, Institute of Mining and Metallurgy, U.K. 1981.
5. Obvert, L. and Duvall, W., Rock Mechanics and the Design of structures in Rock, John Wiley, 1967.

6. Bazant, Z.P., Mechanics of Geomaterials Rocks, Concrete and Soil, John Wiley and Sons, Chichester, 1985.Wittke, W., Rock Mechanics. Theory and Applications with case Histories, Springerverlag, Berlin, 1990.
7. Waltham, T, Foundations of Engineering Geology, Second Edition, Spon Press, Taylor & Francis Group, London and New York, 2002.
8. Ramamurthy T., "Engineering in Rocks for Slopes Foundations and Tunnels", PHI Learning Pvt. Ltd., 2007.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	3	3	3	2	3
PO2	Problem analysis	2	3	3	3	2	3
PO3	Design/development of solutions	2	3	3	3	3	3
PO4	Investigation	3	2	3	2	1	2
PO5	ModernTool Usage	1	3	2	3	3	3
PO6	Engineerand Society	2	2	3	3	3	3
PO7	Environment and Sustainability	1	2	2	3	3	3
PO8	Ethics	3	1	1	1	3	2
PO9	Individual and Team work	2	2	2	3	3	2
PO10	Communication	1	1	2	2	1	1
PO11	ProjectManagement and Finance	2	2	3	3	3	3
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	3	3	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	2	2	2	3	3	2

21155E56E EARTH AND EARTH RETAINING STRUCTURES L T P C
3 0 0 3

COURSE OBJECTIVES:

At the end of this course, students are expected to analyse and design rigid, flexible earth retaining structures, slurry supported trenches and deep cuts.

UNIT I EARTH PRESSURE THEORIES 9

Introduction – State of stress in retained soil mass – Earth pressure theories – Classical and graphical techniques (Culmann's method) – Active and passive cases – Earth pressure due to external loads.

UNIT II COMPACTION, DRAINAGE AND STABILITY OF RETAINING STRUCTURES 9

Retaining structure – Selection of soil parameters - Lateral pressure due to compaction, strain softening, wall flexibility, drainage arrangements and its influence. – Stability analysis of retaining structure both for regular and earthquake forces.

UNIT III SHEET PILE WALLS 9

Types of sheet piles - Analysis and design of cantilever and anchored sheet pile walls – free earth support method – fixed earth support method. Design of anchor systems - isolated and continuous.

UNIT IV SUPPORTED EXCAVATIONS 9

Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving. Earth pressure around tunnel lining, shaft and silos – Soil anchors – Soil pinning –Basic design concepts.

UNIT V SLURRY SUPPORTED EXACAVATION 9

Slurry supported trenches-basic principles-slurry characteristics-specifications-diaphragm wallsbored pile walls-contiguous pile wall-secant piles-stability analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Analyse the earth pressure acting on retaining structures by applying classical theories considering all influencing parameters and suggest the earth pressure to be considered for the design of retaining structures.

CO2 Apply the knowledge of engineering and earth pressure to analyse and design rigid retaining structures considering effect of compaction, wall flexibility, pore water pressure and earth quake forces.

CO3 Apply the knowledge of engineering and earth pressure to analyse and design flexible earth retaining walls and also acquire the knowledge of design of anchors

CO4 Apply the knowledge on lateral earth pressure behind and around excavation to analyse and design braced excavations, slurry supported excavations and underground utilities. CO5 To understand the role of slurry in supporting excavations and to perform stability analysis by considering the actual shape of slurry support

REFERENCES:

1. Clayton, C.R.I., Militisky, J. and Woods, R.I., Earth pressure and Earth-Retaining structures, Second Edition, Survey University Press, 1993.

2. Das, B.M., Principles of Geotechnical Engineering, Fourth Edition, The PWS series in Civil Engineering, 1998.

3. Militisky, J. and Woods, R., Earth and Earth retaining structures, Routledge,1992.

4. Winterkorn, H.F. and Fang, H.Y., Foundation Engineering Handbook, GalgotiaBooksource, 2000.

5. Rowe, R.K., Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001. 6. Koerner, R.M. Designing with Geosynthetics, Third Edition, Prentice Hall, 1997.

7. Day, R.W., Geotechnical and Foundation Engineering: Design and Construction, McGraw Hill, 1999.

8. Mandal, J.N., Reinforced Soil and Geotextiles, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1993.

9. McCarthy, D.F., Essentials of Soil Mechanics and Foundations: Basic Geotechnics, Sixth Edition, Prentice Hall, 2002.

10. Hajnal, I., Marton, J. and Regele, Z., Construction of diaphragm walls, A Wiley – Interscience Publication, 1984

COs-PO's&PSO'sMAPPING

		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	3	3	3	2	3
PO2	Problem analysis	2	3	3	3	2	3
PO3	Design/development of solutions	2	3	3	3	3	3
PO4	Investigation	3	2	3	2	1	2
PO5	ModernTool Usage	1	3	2	3	3	3
PO6	Engineerand Society	2	2	3	3	3	3
PO7	Environment and Sustainability	1	2	2	3	3	3
PO8	Ethics	3	1	1	1	3	2
PO9	Individual and Team work	2	2	2	3	3	2
PO10	Communication	1	1	2	2	1	1
PO11	ProjectManagement and Finance	2	2	3	3	3	3
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	3	3	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	2	2	3	3	3	3

21155E56F **TUNNELING ENGINEERING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Students mainly focused in visualizing and critically analyzing the behavior of underground structures with reference to various supporting systems under different loading conditions due to induced earth pressure on the underground structures.
- To give idea about the equipment used in underground excavations

UNIT I TUNNELS AND UNDERGROUND SPACE APPLICATION **9**

History-caves-tunnels for transport-water,power supply-storage of LPG –nuclear waste disposaldefence facilities-submerged tunnels-underground library,museums.

UNIT II EXCAVATION TECHNIQUES **9**

Types and purpose of tunnels-choice of excavation methods-soft ground tunneling-hardrock tunneling-tunnel drilling-blasting-impact hammers-problems encountered and remedial measures.

UNIT III PLANNING AND GEOMETRIC DESIGN OF TUNNELS **9**

Topographical –geological survey-rock sampling-testing-determination of location size shape and alignment-subsidence problem on soft ground –tunneling design in hard rock.

UNIT IV CONSTRUCTION OF TUNNEL **9**

Advanced drilling techniques –TBM-cuttability assessment-shield tunneling-advantages-types of shield tunneling-factors affecting selection of shield-twin tunnel-NATM.

UNIT V DESIGN OF TUNNEL SUPPORTING SYSTEMS AND VENTILATION **9**

Classification of supports-active –passive-permanent-temporary-excavation support-steel supportslining-grouting-ground freezing-environment in underground-various methods of ventilation.

TOTAL: 45 PERIODS

COURSE OUTCOME:

On completion of the course, the student is expected to be able to

CO1 To Understand need of utilization of underground space for various applications.

CO2 To study various methods of excavations and tunneling methods.

CO3 Planning and design process of tunnels.

CO4 To identify the suitable method of tunneling.

CO5 To study various types of support system and its merit and demerits.

REFERENCES:

1. Underground infrastructure planning design construction-R.K.Goel, Bhavani singh, Jian Zhao, Butterworth heinemunn publishers.

2. Practical tunnel construction, Hemphill G.B 2012 Johnwileyand Son.

3. Introduction to tunnel construction, David chapran, Nicole metse and Alfred stark,Spor press.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	2	2	2	2	2
PO2	Problem analysis	2	3	2	2	2	2
PO3	Design/development of solutions	1	1	3	3	2	2
PO4	Investigation	1			1	1	1
PO5	ModernTool Usage	1	1	1	1		1
PO6	Engineerand Society	2				1	2
PO7	Environment and Sustainability					1	1
PO8	Ethics	1					1
PO9	Individual and Team work	1					1
PO10	Communication					1	1
PO11	ProjectManagement and Finance					1	1
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	2	3	3	3	3	3

21155E56G SOIL DYNAMICS AND MACHINE FOUNDATIONS L T P C
3 0 0 3

COURSE OBJECTIVE:

To design different types of machine foundations based on the dynamic properties of soils and to get an exposure on vibration isolation techniques.

UNIT I THEORY OF VIBRATION 9

Introduction – Nature of dynamic loads – Basic definitions – Simple harmonic motion – Fundamentals of vibration – Single degree and multi degree of freedom systems – Free vibrations of spring – Mass systems – Forced vibrations – Resonance – Viscous damping – Principles of vibrations measuring systems – Effect of transient and pulsating loads.

UNIT II DYNAMIC SOIL PROPERTIES 9

Dynamic stress-strain characteristics – Principles of measuring dynamic properties – Laboratory techniques – Field tests – Block vibration test – Factors affecting dynamic properties – Typical values. Mechanism of liquefaction – Influencing factors – Evaluation of liquefaction potential – Analysis from SPT test – Dynamic bearing capacity – Dynamic earth pressure.

UNIT III MACHINE FOUNDATIONS 9

Introduction – Types of machine foundations – General requirements for design of machine foundations – Design approach for machine foundation – Vibration analysis – Elastic Half-Space theory – Mass-spring-dashpot model – Permissible amplitudes – Permissible bearing pressures.

UNIT IV DESIGN OF MACHINE FOUNDATION 9

Evaluation of design parameters – Types of Machines and foundations – General requirements – their importance – Analysis and design of block type and framed type machine foundations – Modes of vibration of a rigid foundation – Foundations for reciprocating machines, impact machines, Two – Cylinder vertical compressor, Double-acting steam hammer –Codalrecommendations - Emprical approach – Barken's method – Bulb of pressure concept – Pauw's analogy – Vibration table studies.

UNIT V VIBRATION ISOLATION 9

Vibration isolation – Types of isolation – Transmissibility – Passive and active isolation – Methods of isolation – Use of springs and damping materials – Properties of isolating materials – Vibration control of existing machine foundation.

TOTAL:45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Acquire knowledge to apply theories of vibration to solve dynamic soil problems.

CO2 Evaluate the dynamic properties of soil using laboratory and field tests.

CO3 Acquire basic knowledge about machine foundations and design various types of machine foundation.

CO4 To know and capable of selecting the types of vibration isolation materials.

CO5 To apply vibration isolation techniques for various field problems.

REFERENCES:

1. KameswaraRao, N.S.V., Dynamics soil tests and applications, Wheeler Publishing, New Delhi, 2000.
2. Prakash, S and Puri, V.K., Foundations for machines, McGraw Hill, 1987.
3. Moore, P.J.,Analysis and Design of Foundations for Vibrations, Oxford and IBH, 1985.
4. Vaidyanathan, C.V., and Srinivasalu, P., Handbook of Machine Foundations, McGraw Hill, 1995.
5. Arya, S., O'Nelt; S., Design of Structures and Foundations for Vibrating Machines, Prentice Hall, 1981.

6. Major, A., Vibration Analysis and Design of Foundations for Machines and Turbines, Vol. I. II and III Budapest, 1964.
7. Barkan, D.D., Dynamics of Basis of Foundation, McGraw Hill, 1974.
8. Swami Saran, Soil Dynamics and Machine Foundation, Galgotia publications Pvt. Ltd. New Delhi 2010.
9. Das B.M., Principles of Soil Dynamics, McGraw Hill, 1992.
10.Krammer S.L., Geotechnical Earthquake Engineering, Prentice Hall, International series, Pearson Education (Singapore) Pvt Ltd, 2004.
11.KameswaraRao, Vibration Analysis and Foundation Dynamics, Wheeler Publishing, New Delhi, 1998.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	2	2	2	2	2
PO2	Problem analysis	2	2	3	3	3	3
PO3	Design/development of solutions	1	2	3	3	3	3
PO4	Investigation	1	3	3	3	3	3
PO5	ModernTool Usage	1	2	2	2		2
PO6	Engineerand Society	2	2	3	3	3	3
PO7	Environment and Sustainability	2	1	2	2	3	2
PO8	Ethics	1	2	3	3	3	3
PO9	Individual and Team work	1	2	2	2	2	2
PO10	Communication	1	1		1	1	1
PO11	ProjectManagement and Finance	1	1			1	1
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	2	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	3	3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	2	2	3	3	3	3

21155E56H PORT AND HARBOUR ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVE

The purpose of this course is to impart the concepts of port and harbour planning, design, implementation and maintenance.

UNIT I INTRODUCTION 9

Ports and harbors: Classification of ports & harbours – Port and harbor planning and layout Meteorological, hydrographic and oceanographic data requirements and measurements for port and harbor design.

UNIT II PORT AND HARBOURLAYOUT OPERATIONS 9

Port and harbour layout for vessels navigation and cargo handling- port buildings, navigation channels –shore infrastructure and utilities, land reclamation – Dredging -equipment, navigation improvement, pipelines and cables.

UNIT III DESIGN OF PORT 9

Types and classification of ports and harbours in India, Natural ports and manmade ports, major ports, minor ports; Design of port infrastructures with regards to cargo handling , cargo storage and integrated transport of goods

UNIT IV DESIGN OF HARBOUR 9

Design harbour Infrastructures - design of break water - shore attached and offshore breakwaters design - harbour basin design, approach channel design, turning basin design, with regards to cargo and passenger terminals

UNIT V CONSTRUCTION ASPECTS AND SMART PORT 9

Planning and construction, expansion of existing jetties and renovation of port –Inland Port Infrastructure - Smart Port : Levels of transformation into a smart port, Artificial Intelligence and Machine Learning, Smart application for ports.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1 Understand the classification of port and harbor and study about the data requirement and measurements for port and harbour structures.

CO2 Discuss the layout operations for vessel navigation and cargo handling.

CO3 Explain the design guidelines for port structure.

CO4 Explain the design guidelines for harbour structure. CO5 Describe the construction, maintenance and renovation aspects of ports and understand the concept of Smart Port and Smart application for ports

TEXTBOOKS

1. Bruun, Per. Port engineering: vol. 1. Harbor planning, breakwaters, and marine terminals.1989.
2. A. D. Quinn, “Design and Construction of Port and Marine Structures”, McGraw-Hill Book Company, 2nd Edition, 1972.
3. C. A. Thoresen, “Port Design- Guidelines and recommendations”, Tapir Publications, Edition 1, 1988.
4. J. W. Gaythwaite, Van Nostrand , “Design of Marine Facilities for the Berthing, Mooring and Repair of Vessels” 1990
5. Muir Wood, A.M., and Fleming. C.A., “Coastal Hydraulics Sea and Inland Port Structures”, 1st Edition, Hallstead Press, 2002.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis			3	3		3
PO3	Design/development of solutions			3	3		3
PO4	Investigation	2	2	2	2	3	2
PO5	ModernTool Usage			2	2	2	2
PO6	Engineerand Society			2	2		2
PO7	Environment and Sustainability			2	2		2
PO8	Ethics			2	2		2
PO9	Individual and Team work					2	2
PO10	Communication			2	2	3	2
PO11	ProjectManagement and Finance	2		1	1	3	1
PO12	Life Long Learning						
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	2		3	3	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2		3	3	2	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	2		2	2	1	2

21155E56I WATERSHED CONSERVATION AND MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- To provide the technical and sociological understanding of a watershed.
- To provide a comprehensive discourse on the engineering practices of watershed management for realizing the higher benefits.

UNIT I WATERSHED CONCEPTS 9

Watershed – Definition, Need and Elements – Principles - Influencing Factors: Geology – Soil – Morphological Characteristics - Toposheet - Delineation – Codification – Prioritization – Watershed Atlas.

UNIT II SOIL CONSERVATION MEASURES 9

Types of Erosion – Water and Wind Erosion: Causes, Factors, Effects and Management – Soil Conservation Measures: Agronomical and Mechanical – Design of Terraces and Bunds - Estimation of Soil Loss – USLE Equation - Sedimentation.

UNIT III WATER HARVESTING AND CONSERVATION 9

Yield from a Catchment - Traditional Water Harvesting Techniques – Micro-Catchments - Design of Small Water Harvesting Structures: Farm Ponds, Percolation Tanks, Check dams, Grassed Waterways.

UNIT IV GIS FOR WATERSHED MANAGEMENT 9

Applications of Remote Sensing and Geographical Information System - Role of Decision Support System – Conceptual Models and Case Studies.

UNIT V WATERSHED MANAGEMENT 9

Project Proposal Formulation - Watershed Development Plan – Entry Point Activities – Watershed Economics - Agroforestry – Grassland Management – Wasteland Management – Watershed Approach in Government Programmes – People's Participation – Evaluation of Watershed Management Programmes – Integrated Watershed Management – Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOME :

On Completion of the course the student is expected to

CO1 Recognize and Interpret the morphological features of a watershed.

CO2 State, design and sketch the soil conservation structures.

CO3 Describe the micro catchment and apply the concepts to design the small water harvesting structures.

CO4 Illustrate the application of modern tools and technology in the management of watershed.

CO5 Classify the management activities and to develop an integrated watershed development plan.

TEXTBOOKS:

1. Ghanashyam Das, Hydrology and Soil Conservation Engineering, Prentice Hall of India Private Limited, New Delhi, Second Edition, 2009.

2. Suresh, R. Soil and Water Conservation Engineering, Standard Publishers and Distributors Private Limited, New Delhi, 2020.

REFERENCES:

1. Glenn O Schwab. etal, Soil and Water Conservation engineering, Wiley India Private Limited, 2009.

2. Heathcote, I. W. Integrated Watershed Management: Principles and Practice. John Wiley and Sons, Inc., New York, Second Edition 2009.

3. John G. Lyon, GIS for Water Resources and Watershed Management, CRC Press, 2002.

4. Vijay P. Singh, Donald K. Frevert, Watershed Models, CRC Press, 2005. 5. Vir Singh, Raj, Watershed Planning and Management, Bio- Green Publisher, 2016.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	-	-	2
PO2	Problem analysis	-	2	2	-	2	2
PO3	Design/development of solutions	-	2	2	-	2	2
PO4	Investigation	1	2	2	-	2	2
PO5	ModernTool Usage	1	1	1	3	-	1
PO6	Engineerand Society	-	2	2	-	2	2
PO7	Environment and Sustainability	1	2	2	-	2	2
PO8	Ethics	-	1	1	-	3	1
PO9	Individual and Team work	3	1	1	3	3	2
PO10	Communication	2	2	2	2	3	2
PO11	ProjectManagement and Finance	-	1	1	2	2	1
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	1	2	2	1	2	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	1	2	2	2	2	2

SEMESTER – VI

ELECTIVE IV

21155E65A PRESTRESSED CONCRETE STRUCTURES L T P C

3 0 0 3

COURSE OBJECTIVE

- To understand the methods and types of prestressing and to enable the students to design prestressed concrete structural elements and systems

UNIT I INTRODUCTION – THEORY AND BEHAVIOUR 9

Basic principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems – Analysis of sections of stresses by stress concept, strength concept and load balancing concept – Losses of prestress in post -tensioned and pre-tensioned members.

UNIT II DESIGN FOR FLEXURE AND SHEAR 9

Basic assumptions of flexural design – Permissible stresses in steel and concrete as per I.S.1343 Code – Different Types of sections - Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for flexural capacity based on I.S. 1343 Code – Influence of Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code.

UNIT III DEFLECTION AND DESIGN OF ANCHORAGE ZONE 9

Factors influencing deflections – Short-term deflections of uncracked members – Prediction of long-term deflections due to creep and shrinkage – Check for serviceability limit states. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and I.S.1343 code – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams– design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS 9

Analysis and design of composite beams – Shrinkage strain and its importance – Differential shrinkage - Methods of achieving continuity in continuous beams – Analysis for secondary moments Concordant cable and linear transformation – Calculation of stresses – Principles of design.

UNIT V MISCELANEOUS STRUCTURES 9

Role of prestressing in members subjected to Tensile forces and compressive forces – Design of Tension members and Compression members - Design of Tanks, Pipes, Sleepers and Poles – Partial prestressing – methods of achieving partial prestressing, merits and demerits of partial prestressing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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 estimate the deflection in beams.

CO4 Design composite members and continuous beams.

CO5 Design water tanks, pipes, poles and sleepers.

TEXTBOOKS:

1. Krishna Raju N., "Prestressed concrete", 5th Edition, Tata McGraw Hill Company, New Delhi, 2012

2. Pandit.G.S. and Gupta. S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2014

REFERENCES:

1. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.

2. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2017.

3. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2017
4. Sinha.N.C. And Roy.S.K. Fundamentals of Prestressed Concrete, S.Chand and Co. Ltd., 2011

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	2	2	3
PO2	Problem analysis	3	2	2	2	2	2
PO3	Design/development of solutions	3	3	3	3	3	3
PO4	Investigation	1	1	1	1	1	1
PO5	ModernTool Usage	1	1	1	1	1	1
PO6	Engineerand Society	1	1	1	1	1	1
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	2	2	2	2	2	2
PO9	Individual and Team work	1	1	1	1	1	1
PO10	Communication	1	1	1	1	1	1
PO11	ProjectManagement and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	1	3	3	2	3	1
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	1	2	2	2	2	2

21155E65B WATER RESOURCES SYSTEMS ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVE:

- To introduce the student to the concept of Mathematical approaches for managing the water resources system and apply to operate a water resource system optimally.

UNITI SYSTEM APPROACH 9

Definition, classification, and characteristics of systems - Philosophy of modelling – Goals and Objectives – Basics of system analysis concept – steps in systems engineering.

UNITII LINEARPROGRAMMING 9

Introduction to Operation research - Linear programming Problem Formulation-graphical solution Simplex method –Sensitivity analysis - application to operation of single purpose reservoir

UNITIII DYNAMICPROGRAMMING 9

Bellman's optimality criteria, problem formulation and solutions – Water Allocation for three state (user), Forward and Backward Recursion techniques in Dynamic Programming - Shortest pipe line route problem - Application to reservoirs capacity expansion

UNITIV SIMULATION 9

Basic principles and concepts – Monte Carlo techniques – Model development – Inputs and outputs Single and multipurpose reservoir simulation models – Deterministic simulation – Rule Curve development for reservoir

UNITV ADVANCEDOPTIMIZATIONTECHNIQUES 9

Integer and parametric linear programming – Goal programming types – Applications to reservoir release optimization – application of evolutionary algorithms like Genetic algorithm, Particle swarm, Simulated Annealing to reservoir release optimization

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to:

CO1 Define the economic aspects and analysis of water resources systems for comprehensive and integrated planning of a water resources project.

CO2 Apply the concept of linear programming for optimisation of water resources problems.

CO3 Explain the concept of dynamic programming and apply in water resource system.

CO4 Develop the simulation model based on deterministic and stochastic simulation for reservoir operating policy

CO5 Apply advance optimisation techniques like goal programming, heuristic algorithm in the field of water resources planning and management.

TEXT BOOKS

1. Vedula, S., and Majumdar, P.P. Water Resources Systems – Modeling Techniques and Analysis Tata McGraw Hill, New Delhi, Fifth reprint,2010.

2. Bhave PR, Water Resources Systems, Narosa Publishers,2011

REFERENCES:

1. Gupta, P.K., and Man Mohan, "Problems in Operations Research", (Methods and Solutions), Sultan Chand and Sons, New Delhi,1995.

2. Chaturvedi, M.C., "Water Resources Systems Planning and Management", Tata McGraw Hill, New Delhi,1997.

3. Taha, H.A., "Operations Research", McMillan Publication Co., New York,1995.

4. Hiller, F.S., and Liebermann, G.J., "Operations Research", CBS Publications and Distributions, New Delhi,1992.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	-	2	3	3	3	3
PO3	Design/development of solutions	-	-	2	3	3	3
PO4	Investigation	-	-	-	-	3	3
PO5	ModernTool Usage	-	-	2	3	3	3
PO6	Engineerand Society	-	3	2	3	3	3
PO7	Environment and Sustainability	-	-	-	2	-	2
PO8	Ethics	-	-	-	-	2	2
PO9	Individual and Team work		3	2	3	3	3
PO10	Communication	2	-	-	-	-	2
PO11	ProjectManagement and Finance	-	2	3	2	3	3
PO12	Life Long Learning	3	2	2	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	2	1	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	2	2	3	3	3	3

21155E65C **REMOTE SENSING CONCEPTS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To introduce the concepts of remote sensing processes and its components.
- To expose the various remote sensing platforms and sensors and to introduce the elements of data interpretation

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

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.

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.

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

UNIT V DATA PRODUCTS AND INTERPRETATION **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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to be able to

CO1 understand the concepts and laws related to remote sensing
CO2 understand the interaction of electromagnetic radiation with atmoshphere 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

TEXTBOOKS:

1. Thomas M.Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York,2015.
2. George Joseph and C Jeganathan, Fundamentals of Remote Sensing,Third Edition Universities Press (India) Private limited, Hyderabad, 2018

REFERENCES:

1. Janza, F.Z., Blue H.M. and Johnson,J.E. Manual of Remote Sensing. Vol.I, American Society of Photogrametry, Virginia, USA, 2002.
2. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press, 1995

3. Paul Curran P.J. Principles of Remote Sensing. Longman, RLBS, 1988.
4. Introduction to Physics and Techniques of Remote Sensing , Charles Elachi and Jacob Van Zyl, 2006 Edition II, Wiley Publication.
5. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, 2011

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	2	2	2	2
PO2	Problem analysis				3	3	3
PO3	Design/development of solutions				2	2	2
PO4	Investigation				3	3	3
PO5	ModernTool Usage				3	3	3
PO6	Engineerand Society					3	3
PO7	Environment and Sustainability				3	3	3
PO8	Ethics				3		3
PO9	Individual and Team work			3		3	3
PO10	Communication			3		3	3
PO11	ProjectManagement and Finance				1	1	1
PO12	Life Long Learning				2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation				3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	2	2	3	3	3	3

21155E65D SATELLITE IMAGE PROCESSING L T P C
3 0 0 3

COURSE OBJECTIVE

To make the undergraduate Engineering Students understand the concepts, principles, processing of Satellite data in order to extract useful information from them.

UNIT I FUNDAMENTALS OF IMAGE PROCESSING 9

Information Systems - Encoding and decoding - acquisition, storage and retrieval –data products - satellite data formats - Digital Image Processing Systems - Hardware and software design consideration Scanner, digitizer - photo write systems.

UNIT II SENSORS MODEL AND PRE PROCESSING 9

Image Fundamentals – Sensor models – spectral response – Spatial response – IFOV,GIFOV& GSI – Simplified Sensor Models – Sampling & quantization concepts – Image Representation& geometry and Radiometry – Colour concepts – Sources of Image degradation and Correction procedures-Atmospheric, Radiometric, Geometric CorrectionsImage Geometry Restoration- Interpolation methods and resampling techniques.

UNIT III IMAGE ENHANCEMENT 9

Image Characteristics - Histograms - Scattergrams – Univariate and multi variate statisticsenhancement in spatial domain – global, local & colour Transformations – PC analysis, edge detections, merging - filters - convolution – LPF, HPF , HBF, directional box, cascade – Morphological and adaptive filters – Zero crossing filters – scale space transforms – power spectrum – texture analysis – frequency transformations - Fourier, wavelet and curvelet transformations.

UNIT IV IMAGE CLASSIFICATION 9

Spectral discrimination - pattern recognition concepts - Baye‘s approach - Signature and training sets – Separability test –Supervised Classification – Minimum distance to mean, Parallelepiped, MLC – Unsupervised classifiers – ISODATA,K-means-Support Vector Machine – Segmentation (Spatial, Spectral) – Tree classifiers - Accuracy assessment – Error matrix – Kappa statistics – ERGAS, RMS.

UNIT V ADVANCED CLASSIFIERS 9

Fuzzy set classification – sub- pixel classifier – hybrid classifiers, Texture based classification – Object based classifiers – Artificial Neural nets – Hebbian leaning – Expert system, types and examples – Knowledge systems.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Understand about Remote sensing and Image processing systems

CO2 Acquire knowledge about the source of error in satellite image and also toremove the error from satellite image.

CO3 Select appropriate image Enhancement techniques based on image characteristics

CO4 Classify the satellite image using various method and also evaluate theaccuracy of classification.

CO5 Apply the advanced image classification methods and conduct lifelong researchin the field of image processing.

TEXTBOOKS :

1. John, R. Jensen, Introductory Digital Image Processing, Prentice Hall, New Jersey, 4 th Edition, 2015.

2. Robert, A. Schowengergt, Techniques for Image Processing and classification in Remote Sensing, Academic Press, 2012.

REFERENCES:

1. Robert, G. Reeves,- Manual of Remote Sensing Vol. I & II - American Society of Photogrammetry, Falls, Church, USA, 1983.

2. Richards, Remote sensing digital Image Analysis - An Introduction 5th Edition, 2012,Springer - Verlag 1993. 3. Digital Image Processing by Rafael C. Gonzalez,Richard Eugene Woods-Pearson/Prentice Hall,2008

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis		3	3	3	3	3
PO3	Design/development of solutions			3	3	3	3
PO4	Investigation			3	3	3	3
PO5	ModernTool Usage	3	3	3	3	3	3
PO6	Engineerand Society				3	3	3
PO7	Environment and Sustainability			2	2	2	2
PO8	Ethics			2	2	2	2
PO9	Individual and Team work				2		2
PO10	Communication			2	2	2	2
PO11	ProjectManagement and Finance			3	3	3	3
PO12	Life Long Learning	2	2	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	3	3	3	3	3

21155E65E **CARTOGRAPHY AND GIS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

To introduce concepts of Cartography and GIS

To expose the process of map making and production

To introduce GIS data structures, data input and data presentation

UNIT I ELEMENTS OF CARTOGRAPHY **9**

Definition of Cartography – Maps – Functions – Uses and Types of Maps – Map Scales and Contents – Map Projections – Shape, Distance, Area and Direction Properties – Perspective and mathematical Projections – Indian Maps and Projections – Map Co-ordinate System – UTM and UPS References

UNIT II MAP DESIGN AND PRODUCTION **9**

Elements of a Map – Map Layout Principles – Map Design Fundamentals – Symbols and Conventional Signs – Graded and Ungraded Symbols – Color Theory – Colours and Patterns in Symbolization – Map Lettering – Map Production – Map Printing – Colours and Visualization – Map Reproduction – Map Generalization – Geometric Transformations – Bilinear and Affine Transformations.

UNIT III FUNDAMENTALS OF GIS **9**

Introduction to GIS – Definitions – History of GIS – Components of a GIS – Hardware, Software, Data, People, Methods – Introduction to data quality – Types of data – Spatial, Attribute data – types of attributes – scales/levels of measurements – spatial data models – Raster Data Structures – Raster Data Compression – Vector Data Structures – Raster Vs Vector Models – TIN and GRID data models.

UNIT IV DATA INPUT AND TOPOLOGY **9**

Scanner – Raster Data Input – Raster Data File Formats – Georeferencing– Vector Data Input – Digitizer– 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 – Raster to Vector and Vector to Raster Conversion.

UNIT V DATA QUALITY AND OUTPUT **9**

Assessment of Data Quality - Basic Aspects - Completeness, Logical Consistency, Positional Accuracy, Temporal Accuracy, Thematic Accuracy and Lineage – Metadata – GIS Standards – Interoperability – OGC - Spatial Data Infrastructure – Data Output – Map Compilation – Chart / Graphs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Be familiar with appropriate map projection and co-ordinate system for production of Maps and shall able to compile and design maps for their required purpose.

CO2 Be familiar with co-ordinate and Datum transformations

CO3 Understand the basic concepts and components of GIS, the techniques used for storage of spatial data and data compression

CO4 Understand the concepts of spatial data quality and data standard

CO5 Understand the concept of spatial data inputs

TEXTBOOKS:

1. Arthur H. Robinson et al, “Elements of Cartography”, 7th Edition, Wiley, 2002

2. . 2. Kang – Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, Fourth Edition, 2017.

3. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, “An Introduction to Geographical Information Systems, Pearson Education, Fourth Edition, 2011.

REFERENCES:

1. John Campbell, "Introductory Cartography", Wm. C.BrownPublishers,3 rd Edition,2004
2. Chor Pang LO, Albert K. W. Yeung, “Concepts and Techniques of Geographic Information Systems”, Pearson Education, 2nd Edition, November 2016. ISBN: 9789332581883

COs-PO’s&PSO’sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	3	2	2	2	2
PO2	Problem analysis	1	2	1	1	2	1
PO3	Design/development of solutions	2	1	1	2	2	2
PO4	Investigation	1	1	1	1	1	1
PO5	ModernTool Usage	1	1	3	2	2	2
PO6	Engineerand Society	1	1	1	1	2	1
PO7	Environment and Sustainability						
PO8	Ethics						
PO9	Individual and Team work						
PO10	Communication						
PO11	ProjectManagement and Finance						
PO12	Life Long Learning						
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	3	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	2	3	2	2	3	2

21155E65F **PHOTOGRAMMETRY** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

To introduce basics and concepts of optics, aerial photography acquisition and mapping from aerial photographs.

UNIT I PRINCIPLES AND PROPERTIES OF PHOTOGRAPHY 9

History - Definition, Applications – Types of Photographs, Classification – Photographic overlaps – Camera: metric vs. non-metric, Digital Aerial cameras – Multiple frame and Line cameras – Linear array scanner – Flight Planning – Crab & Drift– Computation of flight plan - Photogrammetry project Planning.

UNIT II GEOMETRIC PROPERTIES OF AERIAL PHOTOGRAPHS 9

Photo coordinate measurement – Vertical photographs -geometry, scale, Coordinate system, Relief displacement – Stereoscopes – Stereoscopic parallax – parallax equations -Geometry, Scale, Coordinate system – Relief displacement –- Photo Interpretation.

UNIT III STEREOPLOTTERS & ORIENTATION 9

Projection system, Viewing, Measuring and Tracing system Stereo plotters–Classification: Analog, semi analytical, Analytical and Digital systems – Interior orientation - Relative orientation – Absolute orientation - Collinearity condition and Coplanarity condition - Orientation: Two-dimensional coordinate transformations –Three-dimensional conformal coordinate transformation

UNIT IV AEROTRIANGULATION, TERRAIN MODELING, ORTHOPHOTO 9

model – Strip and blocks of photographs – Aerotriangulation: strip adjustment, independent model triangulation, Bundle block Adjustment and GPS Aerotriangulation (INS and GNSS integration) - feature collection – DTM generation and Contour mapping – ortho rectification - mono plotting – stereo plotting

UNIT V DIGITAL PHOTOGRAMMETRY 9

Photogrammetric Scanner – Digital Photogrammetry WorkStation – Work Station Basic system function – Storage System – Stereoscopic Viewing and Measuring System – Image properties - Image matching: template matching, feature based matching - DEM and DSM - Satellite photogrammetry principles

TOTAL:45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Understand and appreciate the importance of photography as means of mapping, functional and physical elements of photography.

CO2 Understand the need of the photogrammetric mapping and the relevance of accuracy standards and means to achieve them for precise large-scale maps with scientific methods.

CO3 Evaluate the standards of map based on the state-of-the-art tool and techniques and assess the production standards for photogrammetric map making.

CO4 Acquire knowledge on the current development, issues methods and solutions in map making and evaluate methods of production.

CO5 Analyze critically and evaluate methods by applying the knowledge gained and to be a part of innovation and integration of mapping technology.

TEXTBOOKS:

1. Paul. R Wolf., Bon A. De Witt, Elements of Photogrammetry with Application in GIS McGraw Hill International Book Co., 4thEdition, 2014.

2. E. M. Mikhail, J. S. Bethel, J. C. McGlone, Introduction to Modern Photogrammetry, Wiley Publisher, 2001.

REFERENCES:

1. Gollfried Konecny, Geoinformation: Remote Sensing, Photogrammetry and Geographical Information Systems, CRC Press, 2nd Edition, 2014.

2. Karl Kraus, Photogrammetry: Geometry from Images and Laser Scans, Walter de Gruyter GmbH & Co.2nd Edition, 2007.
3. Manual of Photogrammetry – American society of Photogrammetry & amp; R. S by Albert. D, 1980.
4. Digital Photogrammetry – A practical course by Wilfried Linder, 3rd edition, Springer, 2009.
5. Digital Photogrammetry by – Y. Egels& amp; Michel Kasser, Taylor & amp; Francis group, 2003.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	2	3	3	3	3
PO2	Problem analysis	1	3	2	3	3	2
PO3	Design/development of solutions	2	3	3	2	3	3
PO4	Investigation	2	3	2	3	3	3
PO5	ModernTool Usage	2	2	2	3	3	3
PO6	Engineerand Society	2	3	2	3	3	3
PO7	Environment and Sustainability	1	1	2	3	3	2
PO8	Ethics	2	3	2	3	2	3
PO9	Individual and Team work	1	3	3	3	2	2
PO10	Communication	3	2	2	3	2	2
PO11	ProjectManagement and Finance	2	3	3	2	3	2
PO12	Life Long Learning	2	3	1	3	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	2	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	2	2	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	2	2	3	3	3

21155E65G AIRBORNE AND TERRESTRIAL LASER MAPPING L T P C
3 0 0 3

COURSE OBJECTIVE:

To introduce the concepts of Space Borne, Air Borne, Terrestrial and Bathymetric LASER Scanners for Topographic and Bathymetric Mapping

UNIT I SPACE BORNE RADAR AND LIDAR ALTIMETER 9

Principle and Properties of LASER- Production of Laser – Components of LASER – LiDAR – Types of LiDAR:Range Finder, DIAL and Doppler LiDAR - Platforms: Terrestrial, Airborne and Space borne LiDAR – Space Borne LiDAR Missions – Space Borne Radar Altimeter for mapping Sea Surface Topography , Moon Topography - Merits of ALS in comparison to Levelling, echo sounding, GPS leveling, Photogrammetry and Interferometry

UNIT II AIRBORNE LASER SCANNERS 9

Airborne Topographic Laser Scanner – Ranging Principle – Pulse Laser and Continuous Wave Laser –First Return and Last Return – Ellipsoidal and Geoidal Height - Typical parameters of Airborne Laser Scanner (ALS) – Specifications of Commercial ALS –- Components of ALS - GPS, IMU, LASER Scanner, Imaging Device, Hardware and Software - Various Scanning Mechanisms: Oscillating Mirror, Rotating Polygon, Nutating Mirror, Fibre Optic

UNIT III DATA ACQUISITION AND PRE-PROCESSING 9

Laser Classification – Class I to Class IV Laser – Eye Safety - Synchronization of GPS, IMU and ALS Data -Reflectivity of terrain objects –- Flight Planning – Determination of various data acquisition parameters – Swath Width, Point Density, No. of Strips, Area Covered, Point Spacing - Data Processing – Determination of optimal flight trajectory- Quality Assurance

UNIT IV POST PROCESSING of LIDAR Data 9

Post Processing – Geo location of Laser Foot Prints – Various Co-ordinate Transformations involved Filtering - Ground Point filtering – Digital Surface Model and Digital Elevation Model - LIDAR data file formats – LAS File format and other proprietary file formats – Post Processing Software: Open Source and COTS Software – Quality Control Measures – Error Budget - Overview of LIDAR Applications in various domains - 3D city models – Corridor Mapping Applications – Forestry Applications.

UNIT V TERRESTRIAL LASER SCANNERS 9

Terrestrial Laser Scanners (TLS) – Working Principle – Static TLS – Dynamic TLS –- Commercial TLS Specifications – Mobile Mapping Lasers :Vehicle Mounted TLS, Back Pack Wearable Laser Scanners – Asset Management Studies – Highways and Railway Asset Management – Indoor Mapping : Laser Scanning of interior of buildings/monuments – Immersive Applications - BIM Model – Applications in Tunnel Surveying, Forest Inventory, Open Cast Mine Surveying

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Understand the components of laser and various platforms of laser scanning

CO2 Summarize the components of Airborne Laser Scanner and concept of ranging principles

CO3 Analyse the flight planning parameters and pre-processing of acquired data

CO4 Post process the data to derive DSM and DEM and its applications

CO5 Understand the components of TLS and its applications

TEXTBOOKS:

1. Jie Shan, Charles K. Toth, “Topographic Laser Ranging and Scanning – Principles and Processing”, 2nd Edition, CRC Press Publication, March 2018. ISBN: 9781498772273.

REFERENCES:

1. George Vosselman and Hans-Gerd Maas, Airborne and Terrestrial Laser Scanning, WhittlesPublishing, 2010

2. Matti Maltamo, Erik Næsset, JariVauhkonen, Forestry Applications of Airborne Laser Scanning-Concepts and Case Studies, Springer, Dordrecht , 2016,Reprint Edition. ISBN 978-94- 017-8662-1

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis			3	3		3
PO3	Design/development of solutions			3	2	2	3
PO4	Investigation			3	3		3
PO5	ModernTool Usage				3	3	3
PO6	Engineerand Society					3	3
PO7	Environment and Sustainability						
PO8	Ethics						
PO9	Individual and Team work						
PO10	Communication						
PO11	ProjectManagement and Finance					3	3
PO12	Life Long Learning			3		3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation			3	3		3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues			3		3	3

21155E65H HYDROGRAPHIC SURVEYING L T P C
3 0 0 3

COURSE OBJECTIVES

To provide the necessary knowledge and practical instrument operational and data processing skills needed for them to confidently accomplish a bathymetric survey in the real world

To develop students' critical and creative thinking, as well as cooperative attitudes & behaviour of working with others.

UNIT I INTRODUCTION, TIDES AND DATUMS 9

Overview of hydrographic surveying concepts- bathymetric and nautical charts- Basic tidal theorytidal observations and predictions - common types of recording tide gauges - different vertical datums - Indian tides.

UNIT II SOUNDINGS 9

Overview of depth data types- Working principle of echo sounders - characteristics and nature of underwater acoustic signals – transducers - error sources and calibrations- Advanced instrumentation.

UNIT III NAVIGATION AND POSITION FIXING 9

Horizontal positioning methods and requirements - concept of line and surface of position - positioning and navigation using satellite positioning systems - differential GPS and Real-time kinematic (RTK)

UNIT IV PLANNING AND DATA PROCESSING 9

General considerations for planning of an inshore hydrographic survey - ground and track control - practical soundings in inshore and coastal surveys - data processing and chart compilation - hydrographic software packages for data collection - processing and plotting.

UNIT V MARINE ENVIRONMENTAL MEASUREMENTS 9

Methods of measuring and recording of currents - composition of the sea bed - and solids in suspension - Case Studies (The role of the hydrographic surveyor on different marine projects)

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course, the student is expected to be able to

CO1 Learn the fundamentals of hydrographic surveying

CO2 Identify the appropriate techniques for different types of survey

CO3 Understand the various options available during the Navigation

CO4 Analyze the data collected from a survey and assess its quality against the project requirements

CO5 Discuss the different roles for a hydrographic surveyor on marine projects

TEXTBOOK:

1. U.S. Army Corps of Engineers, (2002), Hydrographic Surveying, Document No. EM 1110-2-1003.

REFERENCES

1. de Jong, C. D., Lachapelle, G., Skone, S. & Elema, I. A. (2002), Hydrography, Delft University Press, The Netherlands.

2. Ingham, A. E. (1992), Hydrography for the Surveyor and Engineer, 3rd Edition revised by Abbott V. J., Blackwell Science.

3. International Hydrographic Organisation (1998), IHO Standards for Hydrographic Surveying (S44), IHB Monaco.

4. Loweth, R. P. (1997), Manual of Offshore Surveying for Geoscientists and Engineers Chapman & Hall.

5. Pugh, D. (2004), Changing Sea Levels – Effects of Tides, Weather and Climate, Cambridge University Press. 6. Sonnenberg, G. J. (1988), Radar and Electronic Navigation, Butterworths.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis			2	3	2	2
PO3	Design/development of solutions			3	3	3	3
PO4	Investigation			3	3	3	3
PO5	ModernTool Usage			3	3	3	3
PO6	Engineerand Society				3	3	3
PO7	Environment and Sustainability			3	3	3	3
PO8	Ethics		3	3	3	3	3
PO9	Individual and Team work					3	3
PO10	Communication				3	3	3
PO11	ProjectManagement and Finance				3	3	3
PO12	Life Long Learning			3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	3	3	3	3	3

21155E65I PARTICIPATORY WATER RESOURCES MANAGEMENT L T P C
3 0 0 3

OBJECTIVE

To gain an insight on local and global perceptions and approaches on participatory water resource management

UNIT I FUNDAMENTALS: SOCIOLOGY AND PARTICIPATORY APPROACH 6

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

UNIT II UNDERSTANDING FARMERS PARTICIPATION 10

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

UNIT III ISSUES IN WATER MANAGEMENT 9

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

UNIT IV PARTICIPATORY WATER CONSERVATION 10

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

UNIT V PARTICIPATORY WATERSHED DEVELOPMENT 10

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

TOTAL: 45 PERIODS

OUTCOMES

- The students will be able to Gain knowledge on various processes involved in participatory water resource management.
- Understand famers participation in water resources management. ware of the issues related to water conservation and watershed Development a Get knowledge in participatory water conservation
- Understand concept, principle , approach of watershed management.

TEXTBOOKS

1. Sivasubramaniyan, K. Water Management, SIMRES Publication, Chennai, 2011

2. Uphoff.N., Improving International Irrigation management with Farmer Participation – Getting the process Right – Studies in water Policy and management, No.11, Westview press, Boulder,CO, 1986.

3. Tideman, E.M., "Watershed Management", Omega Scientific Publishers, New Delhi, 1996.

REFERENCE:

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

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	2	2	2	2
PO2	Problem analysis	3	3	2	2	2	2
PO3	Design/development of solutions	3	3	3	2	2	3
PO4	Investigation	-	-	-	-	3	3
PO5	ModernTool Usage	1	2	3	3	3	3
PO6	Engineerand Society	3	3	2	3	3	3
PO7	Environment and Sustainability	-	-	3	3	3	3
PO8	Ethics	-	-	-	-	3	3
PO9	Individual and Team work	1	2	2	3	3	3
PO10	Communication	2	2	2	2	2	2
PO11	ProjectManagement and Finance	1	2	3	2	2	2
PO12	Life Long Learning	2	2	2	3	3	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	2	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	2	2	3	3	3	3

21155E65J DESIGN OF PLATE AND SHELL STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

To learn the design of plate and shell and spatial structures

UNIT I THIN PLATES WITH SMALL DEFLECTION 10

Laterally loaded thin plates - Governing differential equation, various boundary conditions.

UNIT II RECTANGULAR PLATES 10

Simply supported rectangular plates - Navier solution and Levy's method – Loading.

UNIT III ANALYSIS OF THIN SHELLS 5

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.

UNIT IV DESIGN OF SHELLS 10

Spherical dome, conical shell and Cylindrical shell.

UNIT V SPACE FRAMES 10

Space Frames – Configuration – Node connector- Types – General principles of design philosophy – Behaviour

. **TOTAL: 45 PERIODS**

OUTCOMES:

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.

TEXTBOOKS:

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

REFERENCES:

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.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	2	2	3	3	3
PO2	Problem analysis	3	2	2	3	1	3
PO3	Design/development of solutions	3	3	3	3	2	3
PO4	Investigation	3	3	3	1	2	3
PO5	ModernTool Usage	2	3	3	3	3	3
PO6	Engineerand Society	3	2	2	3	2	3
PO7	Environment and Sustainability	3	1	1	1	2	2
PO8	Ethics	3	1	1	1	3	2
PO9	Individual and Team work	3	2	2	1	1	2
PO10	Communication	3	1	2	2		2
PO11	ProjectManagement and Finance	3	3	3	3	3	3
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	2	3	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	2	2	3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	2	2	3	3	3

ELECTIVE V

21155E66A PILE FOUNDATION L T P C

3 0 0 3

COURSE OBJECTIVES:

- The student will be exposed to the design of piles, pile groups and caissons with respect to vertical and lateral loads for various field conditions**.**

UNIT I PILE CLASSIFICATIONS AND LOAD TRANSFER PRINCIPLE 9

Necessity of pile foundation – classification of piles – Factors governing choice of type of pile – Load transfer mechanism – piling equipments and methods – effect of pile installation on soil condition – pile raft system – basic interactive analysis - criteria for pile socketing.

UNIT II AXIAL LOAD CAPACITY OF PILES AND PILE GROUPS 9

Allowable load of piles and pile groups – Static and dynamic methods – for cohesive and cohesionless soil – negative skin friction – group efficiency – pile driving formulae - limitation – Wave equation application – evaluation of axial load capacity from field test results - Settlement of piles and pile group.

UNIT III LATERAL AND UPLIFT LOAD CAPACITIES OF PILES 9

Piles under Lateral loads – Broms method, elastic, p-y curve analyses – Batter piles – response to moment – piles under uplift loads – under reamed piles – Drilled shaft – Lateral and pull out capacity from load test

UNIT IV STRUCTURAL DESIGN OF PILE AND PILE GROUPS 9

Structural design of pile – structural capacity – pile and pile cap connection – pile cap design – shape, depth, assessment and amount of steel – truss and bending theory- Reinforcement details of pile and pile caps — pile subjected to vibration.

UNIT V CAISSONS 9

Necessity of caisson – type and shape - Stability of caissons – principles of analysis and design – tilting of caisson – construction - seismic influences.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Explain the importance of pile foundation and various functions and responsibilities of geotechnical engineer and contractor, in addition to the piling equipments.

CO2 Determine the vertical load carrying capacity of pile and pile group- keeping the settlement of pile as an important criteria based on field practices and codal provisions.

CO3 Apart from vertically loaded piles, the structures are exposed to the peculiar pile subjected to lateral and uplift load with reference to codal provision and case studies.

CO4 Understand the design of pile and pile caps, considering the wind and seismic loads.

CO5 Explain the importance of caisson foundation and checking the stability of caissons based on codal provisions.

REFERENCES:

1. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.

2. Poulos, H.G., Davis, E.H., Pile foundation analysis and design, John Wiley and Sons, New York, 1980.

3. Tomlinson, M.J. Foundation engineering, ELBS, Longman Group, U.K. Ltd., England 1995.

4. Michael Tomlinson and John Woodward, Pile design and construction practice, Taylor & Francis Group, London & New York, 2008.

5. Cernica, J.N. Geotechnical Engineering Foundation Design, John Wiley and Sons, Inc. 1995.

6. Bowles, J.E., Foundation Analysis and Design, Fifth Edition, McGraw Hill, New York, 1996.

7. Donald, P., Coduto, Foundation Design Principles and Practices, Prentice Hall, Inc. Englewood Cliffs, New Jersey, 1996.

8. Varghese P.C.," Foundation Engineering", PHI Learning Private Limited, New Delhi, 2005.

9. Reese,L.C., Isenhower,W.M. and Wang,S.T. Analysis and Design of Shallow and Deep

Foundations, John Wiley and Sons, New York, 2005.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	1	2	2	1	2	2
PO2	Problem analysis	1	3	3	3	3	3
PO3	Design/development of solutions	1	3	3	3	2	3
PO4	Investigation	3	1	2	2	2	2
PO5	ModernTool Usage	2	1	2	2	2	2
PO6	Engineerand Society	1		1		1	1
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	2	1	1	1	1	2
PO10	Communication	2	1	1	1	1	2
PO11	ProjectManagement and Finance	1	1		1	1	1
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	2	3	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	2	2	3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	2	2	3	3	3

21155E66B URBAN PLANNING AND DEVELOPMENT L T P C
3 0 0 3

COURSE OBJECTIVE:

- 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 INTRODUCTION 7

Definition of Human settlement, Urban area, Town, City, Metropolitan City, Megalopolis, rbanisation, Urbanism, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Urban Agglomeration, Census definition of urban settlements, Classification of urban areas – Positive and negative impacts of urbanisation, - Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

UNIT II PLANNING PROCESS AND THEORIES 10

Principles of Planning –Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Draft Plans, Evaluation, Final Plan. Planning Theories - Garden City Concept, Geddesian Triad by Patrick Geddes, Modernism Concept by Le-Corbusier, Radbun Concept, Neighbourhoods, Theories of Ekistics, Bid-rent Theory by William Alonso, Green Belt Concept

UNIT III DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION 10

Types of plans – Regional Plan, Master Plan, Structure Plan, Detailed Development Plan, New Town/ Satellite town- Development Plan, urban nodes, Smart City Plan -Scope and Content of Regional Plan (RP), Master Plan (MP), and the Detailed Development Plan (DDP), Methodologies for the preparation of the RP, MP, and the DDP – Case Studies.

UNIT IV PLAN IMPLEMENTATION 10

Planning Standards, Project Formulation and evaluation; Project Report preparation and presentation; Legal, Financial and Institutional constraints – Problems due to multiple laws, rulesand institutions; Financing of Urban Development Projects; Urban planning agencies and their functions in the plan formulation and implementation. –

UNIT V URBAN AND REGIONAL PLANNING LEGISLATIONS, REGULATIONS AND DESIGNS 8

Town and Country Planning, Local Bodies and Land Acquisition Acts, Development and Building Rules, Site analyses, Layouts and Buildings Design.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Understand the basic issues and meaning of terminologies in urban planning
CO2 Understand the different types of theories of urban planning and city development.
CO3 Understand the different types of plan, their strategies and their preparation process.
CO4 Comprehend the planning standards, evaluate the constraints and the financial mechanism
CO5 Knowledge on various town and country planning acts and their functions.

TEXTBOOKS:

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

REFERENCES

1. Tamil Nadu Town and Country Planning Act 1971, and Rules made thereunder, Government of Tamil Nadu, Chennai
2. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005
3. Chennai City Municipal Corporation Act, 1919 and Tamil Nadu District Municipalities Act, 1920
4. The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013
5. The Tamil Nadu Combined Development and Building Rules, 2019

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	2	3		3	3
PO2	Problem analysis	2				2	2
PO3	Design/development of solutions		3	3	2	1	2
PO4	Investigation		2		2	2	2
PO5	ModernTool Usage				2		2
PO6	Engineerand Society	3	3	2		3	3
PO7	Environment and Sustainability	3	2	3	2	2	2
PO8	Ethics		2		2	2	2
PO9	Individual and Team work	3	2	2	3	2	2
PO10	Communication			2		2	2
PO11	ProjectManagement and Finance	3	3	2	3	3	3
PO12	Life Long Learning		2	1	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	2	2	1	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	2	1	1	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	2	3	2	2	2

21155E66C CONSTRUCTION EQUIPMENT AND MACHINERY L T P C
3 0 0 3

COURSE OBJECTIVE

- To train the students in field of construction equipment and machineries so as to have a first hand knowledge of practical problems in carrying out engineering tasks. To develop skills in facing and solving the field problems using construction equipment like bull dozer, concrete mixer, cranes and scraper etc.,

STRATEGY:

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

COURSE OUTCOMES:

At the end of the course the student will be able to understand the output of construction equipment and machineries:

CO1 To implement the textbook knowledge into practice.
CO2 To analyse the concepts of developments and implementation of new construction equipment
CO3 To analyse the concepts of developments and implementation of new construction equipment
CO4 To develope a user friendly construction equipment and machinery model.
CO5 To analyse the cost effectiveness of using construction equipment and machinery

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	2	3		3	3
PO2	Problem analysis	2				2	2
PO3	Design/development of solutions		3	3	2	1	2
PO4	Investigation		2		2	2	2
PO5	ModernTool Usage				2		2
PO6	Engineerand Society	3	3	2		3	3
PO7	Environment and Sustainability	3	2	3	2	2	2
PO8	Ethics		2		2	2	2
PO9	Individual and Team work	3	2	2	3	2	2
PO10	Communication			2		2	2
PO11	ProjectManagement and Finance	3	3	2	3	3	3
PO12	Life Long Learning		2	1	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	2	2	1	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	2	1	1	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	2	3	2	2	2

21155E66D **SMART CITIES** **L T P C**
3 0 0 3

COURSE OBJECTIVE

To help the leaners to understand the concepts of smart city and to introduce the students about application of technologies in smart cities

UNIT I INTRODUCTION **6**

Urbanisation, need of focused development, role of Authorities, Smart city, Opportunity and Challenges- Smart infrastructures for city- Smart Cities Mission

UNIT II SMART PHYSICAL INFRASTRUCTURE **12**

Infrastructure development in Smart Cities - Physical Infrastructure, Land Use - Compact/mixed-use development, Transit oriented development (TOD); Smart City Management-Transportation Unified governance structure (UMTA). Smart public transportation, Smart parking, Intelligent traffic management, Detour management; Low emission vehicles, Electric Mobility - Environmental projects etc

UNIT III SUSTAINABILITY AND SMART PLANNING **10**

Relationship Between Sustainability and Smart planning - Place making project guidelinesSurveillance, Smart Street Lighting, Intelligent Emergency Services, Intelligent Disaster Forecasting and Management, GIS-based Spatial Decision Support Systems, Smart Communication Services;

UNIT IV APPLICATION OF TECHNOLOGIES IN SMART CITIES **8**

Role of Technologies in Smart Cities - Integrated Command and Control Center (ICCC), Data Analytics, Data driven strategies implementation in smart cities

UNIT V SMART CITIES PROJECT MANAGEMENT **9**

Need for project management, Philosophy and concepts; Project phasing and stages; Project organizational structuring: Planning and Scheduling: Project cost analysis; Procurement and Contracting: PPP: Project Monitoring and Evaluation: Risk Management; Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Understand the basics of Urbanisation and the role of smart cities.

CO2 Gain knowledge on implementation of smart physical infrastructure.

CO3 Understand the role of smart planning for sustainable development.

CO4 Comprehend the knowledge of Technologies in Smart City planning

CO5 Reviewing the case studies of smart city projects.

REFERENCES

1. P Sharma , “Sustainable Smart cities in India, Challenges and Future Perspectives”, Springer Link, 2017

2. Sameer Sharma,“Smart Cities Unbounded- Ideas and Practice of Smart Cities in India”, Bloomsbury India, 2018.

3. Binti Singh, ManojParmar, “Smart City in India Urban Laboratory, Paradigm or Trajectory? Routledge India,2019

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	2	3
PO2	Problem analysis	1	3	1	2	2	2
PO3	Design/development of solutions	2	3	3	2	3	3
PO4	Investigation	1	2	2	2	3	2
PO5	ModernTool Usage	3	1	1	3	2	2
PO6	Engineerand Society	2	3	1	2	2	2
PO7	Environment and Sustainability	3	3	3	3	2	3
PO8	Ethics	1	2	3	2	2	2
PO9	Individual and Team work	1	3	2	3	3	2
PO10	Communication	2	1	2	1	3	2
PO11	ProjectManagement and Finance	2	3	3	3	2	3
PO12	Life Long Learning	1	1	2	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	2	2	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	2	3	3	2	3	3

21155E66E INTELLIGENT TRANSPORTATION SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVE

To learn the fundamentals of ITS

.• To study the ITS functional areas

• To have an overview of ITS implementation in developing countries

UNIT I INTRODUCTION TO ITS 7

Fundamentals of ITS: Definition of ITS, Challenges in ITS Development-Purpose of ITS DeploymentBenefits of ITS- Overview of application of ITS in Transportation Planning

UNIT II DATA COLLECTION THROUGH ITS 9

Sensors & its application in traffic data collection - Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques – vehicle Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, RFID, video data collection, Internet of Things (IOT)

UNIT III ITS IN TRAFFIC MANAGEMENT 10

ITS User Needs and Services and Functional areas –Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS)- Autonomous Vehicles- Autonomous Intersections

UNIT IV ITS IN TRANSPORTATION PLANNING 10

ITS and safety, ITS and security- Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportation network operations – public transportation applications- Weight –in Motion

UNIT V ITS APPLICATION IN LOGISTICS 9

Commercial vehicle operations and intermodal freight-Fleet Management- IT application in freight logistics-E commerce

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Understand the fundamentals of ITS and its benefits.

CO2 Gain knowledge on data collection using sensors and its applications.

CO3 Acquainted with the knowledge of ITS in Traffic Management

CO4 Application of ITS in Transportation Planning

CO5 Able to gain knowledge on application of ITS in Logistics

TEXT BOOKS:

1. R. Srinivasa Kumar,"Intelligent Transportation Systems", Universities Press P Ltd, Telangana, 2022.

REFERENCES:

1. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US,2001.

2. Henry F.Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill,1992.

3. TurbanE.,"Decision Support and Export Systems Management Support Systems", Maxwell Macmillan,1998.

4. Sitausu S. Mittra, "Decision Support Systems–Tools and Techniques", John Wiley, New York,1986.

5. Cycle W.Halsapple and Andrew B.Winston, "Decision Support Systems–Theory and Application", Springer Verlog, New York, 1987

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

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	2	2	2	3	2
PO2	Problem analysis	1	2	1	2	2	2
PO3	Design/development of solutions		1	2	1	1	2
PO4	Investigation	2	3	2	3	3	3
PO5	ModernTool Usage	3	3	3	3	3	3
PO6	Engineerand Society	2	2	2	2	2	2
PO7	Environment and Sustainability	2	2	1	1	1	2
PO8	Ethics	1	2	1	1	2	2
PO9	Individual and Team work	3	3	3	3	3	3
PO10	Communication	1	2	2	1	2	2
PO11	ProjectManagement and Finance	2	3	1	3	3	3
PO12	Life Long Learning	2	2	1	2	2	2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	2	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	3	2	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	2	2	3	2	3	3

21155E66F TRANSPORTATION PLANNING PROCESS L T P C
3 0 0 3

COURSE OBJECTIVE

To impart knowledge in the rudiments and stages in Transportation Planning Process

UNIT I TRANSPORTATION PLANNING PROCESS 8

Importance of transportation planning, Integration of Land Use and Transport; Systems Approach to Transport Planning; Four Steps in the Transport Planning Process; Travel Demand Modelling Approach; Traffic Analyses Zones – internal and external; Various Transportation Surveys for the collection of data – methodology, analyses of data and presentation of results.

UNIT II TRIP GENERATION STAGE 9

Definition and importance; Trip Production and Attraction, Types of trips; Factors governing trip generation: population related data, land and building use, socio-economic, Trip generation models: Types, Assumptions made, Multiple Linear Regression, category analysis- merits and de-merits of the model, verification, calibration and validation of the model.

UNIT III TRIP DISTRIBUTION STAGE 10

Definition and objective; Data collection, analyses and presentation of trip matrix table, Desire Line Diagram, Development of Gravity, growth factor methods for Trip Distribution, Calibration of gravity model and its validation.

UNIT IV MODAL SPLIT STAGE 9

Factors influencing mode choice - Household characteristics; Zonal Characteristics; Network characteristics - Modal split: pre distribution or post distribution - Mode wise trip matrix and modal split analyses- Overview of Probit and Logit model

UNIT V TRAFFIC ASSIGNMENT STAGE 9

Meaning and objective; General principles; Assignment Techniques- all-or-nothing assignments, multiple route assignment, capacity restraint, diversion curves, Trip assignment route selection; Mode-wise trip matrices; element of transportation network, nodes and links, speed flow curves, minimum path trees

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Understand the principles of the transportation planning process and methods of data collection.

CO2 Acquainted with the trip production, trip attraction models and calibration.

CO3 Acquainted with the trip production, trip attraction models and calibration.

CO4 Able to understand trip distribution models and its application.

CO5 Gain knowledge on the mode choice behaviour and mode split models.

TEXTBOOKS

1. Kadiyali. L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2019.

2. C.S. Papacostas and P.D. Prevedouros, Transportation Engineering and Planning, Prentice Hall of India Pvt. Ltd., 2009.

3. Michael J.Bruton, Introduction to Transportation Planning, Hutchinson, London, 199

. REFERENCES

1. J D Ortuzar and L G Willumnsen. Modeling Transport. John Wiley and Sons, New York, 2011.

2. John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1990.

3. C. JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998

4. Juan de Dios Ort zar and Luis G. Willumsen, Modelling Transport, John Wiley & Sons 2001

5. Chennai Comprehensive Traffic Study, Chennai Metropolitan Development Authority, 2007.

6. James H.Banks, Introduction to Transportation Engineering, Tata McGraw Hill Education Pvt Ltd, 2010

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	1	2	2	2		2
PO2	Problem analysis	2	3	3	2		2
PO3	Design/development of solutions	2	3	3	3	2	3
PO4	Investigation	3	3	3	2		3
PO5	ModernTool Usage	2	2	2	2	2	2
PO6	Engineerand Society	2	1	1	2	3	2
PO7	Environment and Sustainability	3	2	2	2	2	2
PO8	Ethics	2	1	2	2	2	2
PO9	Individual and Team work	3	1	2	2		2
PO10	Communication	1	1	1	2		1
PO11	ProjectManagement and Finance	3	2	3	3	2	3
PO12	Life Long Learning	1	1	1	1	1	1
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2		1		2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	1	1		2	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	1	2		2	2

21155E66G COASTAL HAZARDS AND MITIGATION L T P C
3 0 0 3

COURSE OBJECTIVES

To provide students understanding of the materials and processes associated with the major natural hazards: floods, earthquakes, tsunamis, landslides and other coastal hazards To be able to mitigate these hazards based on case studies and respond in the event of a disaster by appropriate strategies.

UNIT I INTRODUCTION 8

Introduction to Environmental and Human induced hazards - Natural vs. Man-made hazard - Hazard and disaster, vulnerability, resilience - coping mechanisms

UNIT II COASTAL HAZARDS 9

Coastal hazards- Tsunami, Cyclones, Earthquakes, Storm surges, Coastal erosion, Floods, Sea Level Rise–Technological Hazards – causes – impacts – responses – mitigation strategies - early warning systems

UNIT III LAW AND POLICY 9

Disaster management law and policy in India – changing pattern of disaster management in India – response and recovery framework - enabling institutions– institutional coordination

UNIT IV ADAPTATION AND MITIGATION 10

Coastal Hazards Adaptation Strategy - Adaptation indigenous knowledge - Sectoral adaptations - Disaster risk response frameworks - Mapping and planning for disaster -Community based disaster Mitigation Measures – Indigenous knowledge for disaster Mitigation - NDMA guidelines

UNIT V CASE STUDIES 9

Case studies of tsunami (2004 Indian Ocean tsunami), Earthquake (Latur), cyclones (Gaja,2018 Tamlnadu), other cyclones, coastal erosion, oil spills, chemical disasters, nuclear disasters – vulnerability of coastal megacities - lessons from building back better.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course, the student is expected to be able to

CO1 Highlight the concepts of hazards and their related physical process

CO2 Remember the concepts of natural and manmade hazards.

CO3 Summarize the adaptation strategy and mitigation measure to coastal hazards

CO4 Explain the various laws and policies involved in - institutional coordination of India.

CO5 Manage the hazards based on case studies and respond in the event of a disaster by appropriate strategies.

REFERENCES

1. Bryant, E., “Natural Hazards”, Cambridge University Press, New York, 2006.

2. Rajib Shaw and RR Krishnamurthy, “Disaster Management: Global Challenges Local Solutions” University Press, 2009

3. National Disaster Management Division, Ministry of Home Affairs, GoI. http://www.ndmindia.nic.in/ Regularly issued guidelines and training materials especially for disaster management policy, reconstruction of buildings etc

4. United Nations office for Disaster Risk Reduction www.unisdr.org various publications and guidelines that are constantly updated

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences					2	2
PO2	Problem analysis			3	2	3	3
PO3	Design/development of solutions		2	3		3	3
PO4	Investigation		2	3	2	3	2
PO5	ModernTool Usage			3		2	3
PO6	Engineerand Society			2	2	2	3
PO7	Environment and Sustainability				2	2	2
PO8	Ethics		2	2		3	2
PO9	Individual and Team work			2	2		2
PO10	Communication		3	3	3	3	3
PO11	ProjectManagement and Finance			2	2	2	2
PO12	Life Long Learning	2		2	2		2
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline			3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation		3	2	2	3	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues		3	2	2		2

21155E66H SOLID AND HAZARDOUS WASTE MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVE

To impart knowledge and skills relevant to minimization, storage, collection, transport, recycling, processing and disposal of solid and hazardous wastes including the related regulations, engineering principles, design criteria, methods and equipment

UNIT I WASTE CLASSIFICATION AND REGULATORY REQUIREMENTS 9

Sources and types of solid and hazardous wastes - need for solid and hazardous waste management – salient features of latest Indian legislations on management and handling of solid wastes, hazardous wastes, biomedical wastes, electronic wastes, construction and demolition wastes, plastics and discarded lead acid batteries – elements of integrated waste management and roles of stakeholders - seven elements and seven step approach to integrated solid waste management planning.

UNIT II WASTE CHARACTERIZATION SOURCE REDUCTION AND RECYCLING 9

Waste sampling and characterization plan - waste generation rates and variation – physical composition, chemical and biological properties – hazardous characteristics – ignitability, corrosivity and TCLP tests –source reduction, segregation and onsite storage of wastes – waste exchange - extended producer responsibility - recycling of plastics, C&D wastes and E wastes.

UNIT III WASTE COLLECTION TRANSPORT AND MATERIAL RECOVERY 9

Door to door collection of segregated solid wastes - analysis of hauled container and stationery container collection systems - compatibility, storage, labeling and handling of hazardous wastes – principles and design of transfer and transport facilities - hazardous waste transport and manifests - mechanical processing and material separation technologies – Size reduction – size separation - density separation - magenetic separation – compaction – principles and design of material recovery facilities – physico chemical treatment of hazardous wastes - solidification and stabilization – case studies on waste collection and material recovery

UNIT IV BIOLOGICAL AND THERMAL PROCESSING OF WASTES 9

Biological and thermos-chemical conversion technologies – composting – biomethanation – incineration – pyrolysis- plasma arc gasification –principles and design of biological and thermal treatment facilities - MSW processes to energy with high-value products and specialty By-products - operation of facilities and environmental controls - treatment of biomedical wastes – case studies and emerging waste processing technologies.

UNIT V WASTE DISPOSAL 9

Sanitary and secure landfills - components and configuration– site selection - liner and cover systems - geo synthetic clay liners and geo membranes - design of sanitary landfills and secure landfills- leachate collection, treatment and landfill gas management – landfill construction and operational controls - landfill closure and environmental monitoring – landfill bioreactors – rehabilitation of open dumps and biomining of dumpsites-remediation of contaminated sites- Case studies

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Explain the various functional elements of solid and hazardous waste management including the associated legal, health, safety, and cultural issues as well as responsibilities of different stakeholders

CO2 Apply the knowledge of science and engineering fundamentals to characterize different types of solid and hazardous wastes, assess the factors affecting variation and assess performance of waste treatment and disposal systems

CO3 Design of systems and processes to meet specified needs of waste minimization, storage, collection, transport, recycling, processing and disposal.

CO4 Select appropriate methods for processing and disposal of solid and hazardous wastes, taking into account the impact of the solutions in a sustainability context

CO5 Conduct research pertinent to solid and hazardous waste management and communicate effectively to different stakeholders as well as engage in independent lifelong learning

REFERENCES:

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 erspective, 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 Conversion Processes: Economic, Technical, and Renewable Comparisons, Wiley, 2010
7. Cherry P M, Solid and Hazardous Waste Management, CBS publishers and distributors Pvt Ltd, 2018.
8. Rao M.N, Razia Sultana, Sri Harsha Kota, solid and hazardous waste management – Science and Engineering , Butterworth-Heinemann, 2016

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences		3				3
PO2	Problem analysis	3	2		2	2	2
PO3	Design/development of solutions			3			3
PO4	Investigation		2			2	2
PO5	ModernTool Usage		2		2		2
PO6	Engineerand Society	2			2		2
PO7	Environment and Sustainability	2			2		2
PO8	Ethics				2		2
PO9	Individual and Team work		2	2			2
PO10	Communication					1	1
PO11	ProjectManagement and Finance				2		2
PO12	Life Long Learning					1	1
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	3	3		3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	2	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues		3	3			3

21155E66I GREEN BUILDING DESIGN AND MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

To expose students to various green building concepts

.• To impart knowledge about utilisation and management of water in buildings.

• To enlighten students with knowledge about various energy requirements in buildings and management principles. To impart knowledge about thermal design in buildings and its influences

.• To expose students to concept of solid waste management and green composites.

UNIT I GREEN CONCEPTS IN BUILDINGS 9

Green Building concepts and definition – Heat Transfer – Measuring Conduction Convection and Radiation – Thermal Storage – Measuring latent and sensible heat – Psychrometry Chart – Types of Shading Devices –Design responses to energy conservation strategies. - Building materials, embodied energy, maintenance and environmental implications.

UNIT II WATER MANAGEMENT IN BULDINGS 9

Water utilisation in buildings – Environmental implications of buildings on water, energy, waste disposal and carbon emissions – Management of sullage and sewage – Methods of waste water treatment and recycling – Low energy approaches to water management.

UNIT III ENERGY MANAGEMENT IN BUILDINGS 9

Energy requirements of building – Optimising the energy utility – Low energy concepts in lighting, ventilation and transportation of men and materials in buildings - Zoning – General Principles of Passive Solar Heating – Direct Gain Thermal Storage of Wall and Roof - Roof Radiation Trap - Solarium - Isolated Gain Key Design Elements – Sunspace –Case Studies – General Principles of Passive Cooling – Principles – Case Studies – Courtyards – Roof Ponds – Methods of utilisation solar and wind energy - Predicting Ventilation in buildings – Room Organization Strategies for Cross and Stack Ventilation – Radiation – Evaporation and dehumidification – Wind Catchers – Induced Ventilation - Earth Sheltering - Wind Tower - Earth Air Tunnels

UNIT IV THERMAL MANAGEMENT OF BUILDINGS 9

Thermal comfort in Buildings – Heat Insulation – Heat transfer characteristic of Building materials and building techniques – Thermal Design of buildings – Influence of Design Parameters – Mechanical Controls – Implications of geographical locations and seasonal variations – Orientation of buildings – Incidence of solar heat on buildings – Case studies on thermal management.

UNIT V MANAGEMENT OF SOLID WASTE AND BIOMASS 9

Low energy approaches in collection, storage, transport, recycling and disposal of solid wastes – Biomass resources for buildings – Green cover and built environment – Concepts of green composites.

TOTAL : 45 PERIODS

OUTCOMES

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

CO1 : apply suitable schemes towards design of green building.

CO2 : apply suitable schemes towards management and treatment of waste water in buildings.

CO3 : Know the different techniques of energy management.

CO4 : apply suitable techniques towards management and control of thermal energy (heat) in buildings

CO5 : apply suitable schemes towards recycling of solid wastes and green composites.

REFERENCES

1. Jagadish K.S., Venkatramreddy B.U. and Nanjundarao K.S., Alternative Building materials and technologies, New age International, 2007.

2. Low energy Cooling for sustainable buildings, Johy Wiley & Sons, 2009

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	1	2	2	2		2
PO2	Problem analysis	2	3	3	2		2
PO3	Design/development of solutions	2	3	3	3	2	3
PO4	Investigation	3	3	3	2		3
PO5	ModernTool Usage	2	2	2	2	2	2
PO6	Engineerand Society	2	1	1	2	3	2
PO7	Environment and Sustainability	3	2	2	2	2	2
PO8	Ethics	2	1	2	2	2	2
PO9	Individual and Team work	3	1	2	2		2
PO10	Communication	1	1	1	2		1
PO11	ProjectManagement and Finance	3	2	3	3	2	3
PO12	Life Long Learning	1	1	1	1	1	1
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2		1		2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	1	1		2	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	1	2		2	2

21155E66J **POWER PLANT STRUCTURES** **L T P C**
3 0 0 3

OBJECTIVE:

To study the layout, functional aspects and principles involved in the selection of different types of Power Plant Structures.

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.

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 hydro electric plant – Penstocks and surge Tanks in Power Station.

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.

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.

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.

TOTAL: 45 PERIODS

TEXTBOOKS :

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, 2006.

REFERENCES :

1. Lewis.E.E., Nuclear Power Reactor Safety, Willey Inter Science, 1977.
2. Srinivasasulu.P and Vaidyanathan.C.V., Hand book on Machine Foundations, Tata McGraw Hill Publishing Co. Ltd., 2007.
3. Gilbert Gedeon.P.E., Planning and Design of Hydro Electric Power Plants, CECW-ED Engineer Manual, 1110-2-3001 Manual No.1110-2-3001, 1995.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	3	2	2	3	2
PO2	Problem analysis	2	3	3	2	2	2
PO3	Design/development of solutions	3	2	2	3	3	3
PO4	Investigation	2	2	2	3	2	2
PO5	ModernTool Usage	3	3	3	3	3	3
PO6	Engineerand Society	3	2	3	3	2	3
PO7	Environment and Sustainability	2	2	2	3	3	3
PO8	Ethics	2	2	2	2	3	2
PO9	Individual and Team work	3	2	3	3	3	3
PO10	Communication	2	2	2	2	2	2
PO11	ProjectManagement and Finance	2	3	2	3	3	3
PO12	Life Long Learning	2	3	2	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	2	3	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	3	2	2	2
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	3	2	3	3	3

ELECTIVE VI

21155E67A ADVANCED CONSTRUCTION TECHNIQUES L T P C

3 0 0 3

COURSE OBJECTIVE:

- To study and understand the latest construction techniques applied to engineering construction for sub structure, super structure, special structures, rehabilitation and strengthening techniques and demolition techniques.

UNIT I SUB STRUCTURE CONSTRUCTION 9

Construction Methodology - Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - Piling techniques - Driving well and caisson - sinking cofferdam - cable anchoring and grouting - Driving diaphragm walls, Sheet piles - Laying operations for built up offshore system - Shoring for deep cutting - Large reservoir construction - well points - Dewatering for underground open excavation.

UNIT II SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS 9

Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks in-situ prestressing in high rise structures, Post tensioning of slab- aerial transporting – Handlingand erecting lightweight components on tall structures.

UNIT III CONSTRUCTION OF SPECIAL STRUCTURES 9

Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, sky scrapers - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks.

UNIT IV REHABILITATION AND STRENGTHENING TECHNIQUES 9

Seismic retrofitting - Strengthening of beams - Strengthening of columns - Strengthening of slab - Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation – Micro piling and underpinning for strengthening floor and shallow profile - Sub grade water proofing, Soil Stabilization techniques.

UNIT V DEMOLITION 9

Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to be able to

CO1 Understand the modern construction techniques used in the sub structure construction.

CO2 Demonstrate knowledge and understanding of the principles and concepts relevant to super structure construction for buildings

CO3 Understand the concepts used in the construction of special structures

CO4 Knowledge on Various strengthening and repair methods for different cases.

CO5 Identify the suitable demolition technique for demolishing a building.

REFERENCES:

1. Jerry Irvine, Advanced Construction Techniques, CA Rocket, 1984

2. Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 1992.

3. Peter H.Emmons, “Concrete repair and maintenance illustrated”, Galgotia Publications Pvt. Ltd., 2001.Press, 2008.

4. Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 1995.

5. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University, New Delhi, 2008.

COs-PO's&PSO'sMAPPING

PO/PSO		CourseOutcome					Overall Correlationof COs to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM O UTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2	1	2	2	1	2
PO2	Problem analysis	2	-	3	3	3	3
PO3	Design/development of solutions	1	-	3	3	3	3
PO4	Investigation	3	2	2	3	3	3
PO5	ModernTool Usage	3	2	3	2	2	2
PO6	Engineerand Society	2	2	3	1	2	2
PO7	Environment and Sustainability	2	3	2	2	1	2
PO8	Ethics	-	-	1	1	1	1
PO9	Individual and Team work	1	1	2	1	2	1
PO10	Communication	1	1	2	1	2	1
PO11	ProjectManagement and Finance	2	2	3	2	3	2
PO12	Life Long Learning	1	1	2	1	2	1
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	3	3	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	3	3
PSO3	Concept ualization and evaluation of engineering solutions to Civil EngineeringIssues	3	2	3	3	2	3

21155E67B TRAFFIC ENGINEERING AND MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVE

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

UNIT I TRAFFIC SURVEYS AND ANALYSES 8

Traffic characteristics: Human, vehicular, and Pavement Characteristics, Problems- presentation of traffic volume data, Annual Average Daily Traffic, Average Daily Traffic, Design hourly traffic volume; Speed- spot speed, presentation of spot speed data, speed and delay studies, methods of conducting spot-speed studies and Speed and Delay studies; Problems Origin and Destination – methods of conducting the survey and presentation of data; parking surveys, presentation of data and analyses, determination of parking demand; Accident studies and analyses; Different problems.

UNIT II TRAFFIC FLOW AND ROADWAY CAPACITY 8

Traffic Flow Characteristics – Basic traffic manoeuvres, Traffic stream flow characteristics, Speed-Flow- Density Relations; Passenger Car Units – Mixed traffic flow and related issues – Concept of PCU value- Factors affecting PCU values- Recommended PCU values for different conditions; Capacity and Level of Service – Factors affecting practical capacity – Design Service Volumes

UNIT III COST – EFFECTIVE TRAFFIC MANAGEMENT TECHNIQUES 10

Traffic System Management: Regulatory Techniques- one way street, Reversible Street, Reversible lane, Turning moment restrictions, closing streets; Traffic Control Devices – Traffic Signs – Road Markings, Traffic Signals, Miscellaneous traffic control devices; Traffic Segregation – Vehicle segregation, Pedestrian segregation, Traffic signals design; Bus Priority Techniques – Priority manoeuvres – With-flow bus lane and contra-flow bus lane; Self- Enforcing Techniques- Demand Management Techniques (TDM) Road pricing, parking control, Tolls, Staggering of office/educational institution hours.

UNIT IV DESIGN OF ROAD INTERSECTIONS 10

Importance and Classification; Intersections at-grade – uncontrolled, channelised; Rotary intersections (problems)- Signalised intersections (problems)- Grade Separated Intersections – merits and demerits, types, pattern of intersections with different types of interchanges- Capacity, Concept diagrams.

UNIT V DESIGN OF PARKING AND PEDESTRIAN FACILITIES AND CYCLE TRACKS 9

Parking: Need for parking studies and its ill effects- Parking Standards for different land uses, different types of parking - Conceptual plans for different types of parking; **Pedestrians:** Importance, Barriers, Behaviour, Pedestrian facilities – Principles of planning, Level of Service (LoS), Design standards.; **Cycle Tracks:** Principles of design, Design criteria, Design standards for Rural Expressways.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Apply the knowledge of science and engineering fundamentals in conducting traffic surveys, analyze the problems and relating it with standards

CO2 Understand the principles of traffic flow characteristics and their relationships

CO3 Understand various traffic management measures in addressing the demand Pricing and ITS applications.

CO4 Designing various types of control and regulatory measures to meet an efficient traffic network.

CO5 Understand various type of facilities and plan for Non Motorised Transport

TEXT BOOKS:

1. Kadiyali. L.R. Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2019.
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.
5. Papacosta.P.S and Prevedouros.P.D, " Transportation Engineering and Planning, third edition, 2015

REFERENCES

1. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
2. Khanna S. K, and others, Highway Engineering, Nam Chand & Bros, Roorkee, 2014, Pages 177 – 308.
3. C. JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
4. Taylor MAP and Young W, Traffic Analysis – New Technology and New Solutions, Hargreen Publishing Company , 1998.
5. Salter. R.I and Hounsell N.B, Highway Traffic Analysis and design, Macmillan Press Ltd.1996.
6. Roger P.Roess, William R.Mcshane and Elena S.Prassas, Traffic Engineering-Second Edition, Prentice Hall Publishers,, Upper Saddle River, New Jersey 1998

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	2	2	3
PO2	Problem analysis	2	3	2	3	2	2
PO3	Design / development of solutions	2	3	3	3	1	2
PO4	Investigation	2	3	2	3	1	2
PO5	Modern Tool Usage	1	3	1	3	1	2
PO6	Engineer and Society	1	2	1	2	2	2
PO7	Environment and Sustainability	1	1	1	2	3	1
PO8	Ethics	1	2	2	2	3	2
PO9	Individual and Team work	2	3	2	2	1	2
PO10	Communication	2		3	3	1	2
PO11	Project Management and Finance	3	3	2	3	2	3
PO12	Life Long Learning	1	1	1	1	1	1
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems andinnovation	3	2	2	3	2	2
PSO3	Conceptualization and evaluation of engineering solutions to CivilEngineering Issues	3	3	2	3	2	3

21155E67C DYNAMICS AND EARTHQUAKE RESISTANT STRUCTURES **L T P C**
3 0 0 3

COURSE OBJECTIVE

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

UNIT I INTRODUCTION TO DYNAMICS **9**

Dynamics - Degree of freedom – Free and forced vibration - Idealization of structure as Single Degree of Freedom (SDOF) and Multi degree of freedom (MDOF) system – D'Alemberts Principles Formulation of equation of motion for SDOF system and MDOF system –- Evaluation of natural frequencies and modes - Effect of damping.

UNIT II SEISMOLOGY **9**

Elements of Engineering Seismology – Seismic hazard - Earthquake phenomenon – Seismotectonics Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters – Soil Structure Interaction – Liquefaction of soil - Seismic zone map – Response spectra.

UNIT III EARTHQUAKE EFFECTS ON STRUCTURES **9**

Inertia force on structures – load transfer path – Effect of architectural features on behavior of structures – Hysteretic Behaviour of RCC, steel and prestressed concrete - Pinching Effect – Bouchinger Effects - Energy dissipation - P-delta effect - storey drift - Behavior of brick masonry, stone masonry and reinforced concrete structures under past earthquakes – typical failures - Causes of damage –- Lessons learnt from past earthquakes.

UNIT IV EARTHQUAKE LOAD ANALYSIS **9**

Design spectra – Codal provision – Different methods of earthquake analysis –- Analysis of structure by Equivalent static method – Analysis of structure by Response spectrum method – Introduction to time-history method of analysis

UNIT V EARTHQUAKE RESISTANT DESIGN **9**

Philosophy of earthquake resistant design - Planning considerations and Architectural concepts - Design and detailing as per codal provisions - Design and detailing of typical flexural member and column member, Ductile detailing of beam-column joints and footing – Concept and principle of shear wall - Introduction to performance based seismic design - Seismic isolation principles and methods.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Develop the equations of motion for SDOF and MDOF system and to evaluate the natural frequencies and mode shapes.

CO2 Explain the elements of engineering seismology, characteristics of earthquake and seismic instrumentation.

CO3 Explain the behavior of various types of structures under earthquake

CO4 Determine the forces in a structure due to earthquake

CO5 Design earthquake resistant building structures

TEXTBOOKS:

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.

REFERENCES:

1. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.

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.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	2	3	3	3	3
PO3	Design / development of solutions	3	2	3	3	3	3
PO4	Investigation	2	2	3	2	3	2
PO5	Modern Tool Usage	1	1	1	2	2	2
PO6	Engineer and Society	1	1	3	2	3	2
PO7	Environment and Sustainability	1	1	2	3	3	2
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	1	1	1	1	1	1
PO10	Communication	1	1	1	1	1	1
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	2	2	3	3	2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems andinnovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluation of engineering solutions to CivilEngineering Issues	3	2	3	3	3	3

21155E67D CLIMATE CHANGE ADAPTATION AND MITIGATION L T P C
3 0 0 3

COURSE OBJECTIVE:

To impart knowledge on the global warming, the impact of climate change on society and the adaptation and mitigation measures to the students

UNIT I INTRODUCTION 9

Atmosphere – weather and Climate - climate parameters – Temperature, Rainfall, Humidity, Wind – Global ocean circulation – El Nino and its effect - Carbon cycle

UNIT II ELEMENTS RELATED TO CLIMATE CHANGE 7

Greenhouse gases - Total carbon dioxide emissions by energy sector – industrial, commercial, transportation, residential – Impacts – air quality, hydrology, green space - Causes of global and regional climate change – Changes in patterns of temperature, precipitation and sea level rise – Greenhouse effect

UNIT III IMPACTS OF CLIMATE CHANGE 10

Effects of Climate Changes on living things – health effects, malnutrition, human migration, socioeconomic impacts- tourism, industry and business, vulnerability assessment- infrastructure, population and sector – Agriculture, forestry, human health, coastal areas

UNIT IV MITIGATING CLIMATE CHANGE 9

IPCC Technical Guidelines for Assessing Climate Change Impact and Adaptation -Identifying adaption options – designing and implementing adaption measures – surface albedo environmentreflective roofing and reflective paving – enhancement of evapotranspiration - tree planting programme – green roofing strategies – energy conservation in buildings – energy efficiencies – carbon sequestration.

UNIT V ALTERNATE FUELS AND RENEWABLE ENERGY 10

Energy source – coal, natural gas – wind energy, hydropower, solar energy, nuclear energy, geothermal energy – biofuels – Energy policies for a cool future - Energy Audit.

TOTAL: 45 PERIODS

COURSE OUTCOMES

The students completing the course will have

CO1 an insight into carbon cycle, physical basis of the natural greenhouse effect, including the meaning of the term radiative forcing, climate change, global warming and measures to adapt and to mitigate the impacts of climate change

CO2 understanding on the growing scientific consensus established through the IPCC as well as the complexities and uncertainties

CO3 ability to plan climate change mitigation and adaptation projects including the use of alternate fuels and renewable energy

CO4 Gain in-depth knowledge on climate models

CO5 Post process the modeloutputs for climate impact assessment, know about adaptation strategies

TEXTBOOKS:

1. Ruddiman W.F, freeman W.H. and Company, “Earth‟s Climate Past and Future”, 2001
2. Velma. I. Grover “Global Warming and Climate” Change. Vol I an II. Science Publishers, 2005.
3. Dash Sushil Kumar, “Climate Change – An Indian Perspective”, Cambridge University Press India Pvt. Ltd, 2007

REFERENCES:

1. IPCC Fourth Assessment Report, Cambridge University Press, Cambridge, UK, 2007
2. Thomas E, Lovejoy and Lee Hannah “Climate Change and Biodiversity”, TERI Publishers, 2005
3. Jan C. van Dam, Impacts of “Climate Change and Climate Variability on Hydrological Regimes”, Cambridge University Press, 2003.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences			2	2		2
PO2	Problem analysis	3		3		3	3
PO3	Design / development of solutions				2		2
PO4	Investigation			2	2		2
PO5	Modern Tool Usage			3	3	3	3
PO6	Engineer and Society		2			2	2
PO7	Environment and Sustainability		3				3
PO8	Ethics						
PO9	Individual and Team work				3	3	3
PO10	Communication	1				2	1
PO11	Project Management and Finance					3	3
PO12	Life Long Learning	2		3		2	2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline		2				2
PSO2	Critical analysis of Civil Engineering problems andinnovation					2	2
PSO3	Conceptualization and evaluation of engineering solutions to CivilEngineering Issues		3				3

21155E67E ENVIRONMENTAL HEALTH AND SAFETY L T P C
3 0 0 3

COURSE OBJECTIVE:

To educate overview of EHS in industries and related Indian regulations, types of Health hazards, effect, assessment and control methods and EHS Management System

UNIT I INTRODUCTION 9

Need for developing Environment, Health and Safety systems in work places- International initiatives, National Policy and Legislations on EHS in India - Regulations and Codes of Practice - Role of trade union safety representatives - Ergonomics.

UNIT II OCCUPATIONAL HEALTH AND HYGIENE 10

Definition of occupational health and hygiene - Categories of health hazards – Exposure pathways and human responses–Exposure Assessment-occupational exposure limits - Hierarchy of control measures - Role of personal protective equipment and the selection criteria

UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS 11

Features of Satisfactory and Safe design of work premises – good housekeeping - lighting and color, Ventilation and Heat Control, Noise, Chemical and Radiation Safety – Electrical Safety – Fire Safety – Safety at Construction sites, ETP – Machine guarding – Process Safety, Working at different levels

UNIT IV HAZARDS AND RISK MANAGEMENT 8

Safety appraisal – Job Safety Analysis-Control techniques – plant safety inspection – Accident investigation - Analysis and Reporting – Hazard and Risk Management Techniques –Onsite and Offsite emergency Plans. Employee Participation- Education and Training- Case Studies

UNIT V ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT 7

Concept of Environmental Health and Safety Management – Elements of Environmental Health and Safety Management Policy and implementation and review – ISO 45001-Strucure and Clauses-Case Studies

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of this course, the students are expected to be able to understand:

CO1 Need for EHS in industries and related Indian regulations

CO2 Various types of Health hazards, effect, assessment and control methods

CO3 Various safety systems in working environments

CO4 The methodology for preparation of Emergency Plans and Accident investigation

CO5 EHS Management System and its elements

REFERENCES

1. Industrial Health and Safety Acts and Amendments, by Ministry of Labour and Employment, Government of India

2. Fundamentals of Industrial Safety and Health by Dr.K.U.Mistry, Siddharth Prakashan, 2012

3. The Facility Manager's Guide to Environmental Health and Safety by Brian Gallant, Government Inst Publ., 2007.

4. Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services, 2005.

5. Environmental and Health and Safety Management by Nicholas P.Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1		3		3		3		3	2		1	2		2	
2	2	2	2	3					2			3	2	2	
3			2		3	3	1	1	2		2	3			
4			3	2		1	2						2	2	2
5	1				2				1		1		1		
Avg.	2	3	2	3	3	3	1	2	2		1	2	2	2	2

1-Low,2-Medium,3-High,"-"-no correlation

21155E67F INDUSTRIAL WASTEWATER MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge on the concept and application of Industrial pollution prevention,cleaner technologies, industrial wastewater treatment and residue management. Understand principles of various processes applicable to industrial wastewater treatment
- Identify the best applicable technologies for wastewater treatment from the perspective of yield production.

UNIT I INTRODUCTION 8

Industrial scenario in India– Industrial activity and Environment - Uses of Water by industry – Sources and types of industrial wastewater – Nature and Origin of Pollutants - Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater – Industrial waste survey – Industrial wastewater monitoring and sampling – generation rates, characterization and variables –Toxicity of industrial effluents and Bioassay tests – Major issues on water quality management.

UNIT II INDUSTRIAL POLLUTION PREVENTION &WASTE MINIMISATION 8

Prevention vis a vis Control of Industrial Pollution – Benefits and Barriers – Waste management Hierarchy - Source reduction techniques – Periodic Waste Minimisation Assessments – Evaluation of Pollution Prevention Options – Cost benefit analysis – Pay-back period – Implementing & Promoting Pollution Prevention Programs in Industries.

UNIT III INDUSTRIAL WASTEWATER TREATMENT 10

Flow and Load Equalisation – Solids Separation – Removal of Fats, Oil & Grease-NeutralisationRemoval of Inorganic Constituents – Precipitation, Heavy metal removal, Nitrogen & Phosphorousremoval, Ion exchange, Adsorption, Membrane Filtration, Electro dialysis & Evaporation –Removal of Organic Constituents – Biological treatment Processes, Chemical OxidationProcesses, Advanced Oxidation processes – Treatability Studies.

UNIT IV WASTEWATER REUSE AND RESIDUAL MANAGEMENT 9

Individual and Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse Industrial reuse , Present status and issues - Disposal on water and land – Residuals of industrialwastewater treatment – Quantification and characteristics of Sludge – Thickening, digestion,conditioning, dewatering and disposal of sludge – Management of ROrejects.

UNIT V CASE STUDIES 10

Industrial manufacturing process description, wastewater characteristics, source reduction optionsand waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Sugar and Distilleries

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of this course, the students is expected to be able to,

CO1 Explain the source and types of industrial wastewater and their environmental impacts and choose the regulatory laws pertaining to environmental protection

CO2 Identify industrial wastewater pollution and implement pollution prevention, waste minimization in industries

CO3 Apply knowledge and skills to design industrial wastewater treatment schemes

CO4 Audit and analyze environmental performance of industries to internal, external client, regulatory bodies and design water reuse management techniques

CO5 Conduct research to develop effective management systems for industrial wastewater that are technically sound, economically feasible and socially acceptable

REFERENCES:

1. "Industrial wastewater management, T reatment & disposal, Water Environment" Federation Alexandria Virginia, Third Edition, 2008.

2. Lawrance K. Wang, Yung Tse Hung, Howard H.Lo and Constantine Yapijakis "handlook of Industrial and Hazardous waste Treatment", Second Edition, 2004.
3. Metcalf & Eddy, Inc., George Tchobanoglous, Franklin L. Burton and H. David Stensel, Wastewater engineering, treatment and reuse, Fourth Edition, McGraw-Hill, 2017
4. Nelson Leonard Nemerow, " industrial waste Treatment", Elsevier, 2007.
5. Wesley Eckenfelder W., " Industrial Water Pollution Control", Second Edition, Mc Graw Hill, 2000.
6. Paul L. Bishop, Pollution Prevention: - Fundamentals and Practice", Mc-Graw Hill International, Boston, 2000.
7. Waste water Treatment for pollution control and reuse by Soli. J. Arceivala, Shyam. R. Asolekar, Tata McGraw Hill, 2007

CO's-PO's & PSO's MAPPING

CO's	**PO's**												**PSO's**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3										3	1	2		3
2		3	2	2				3	3	2				2	
3	2	3	3						3	2	2	3		2	3
4	2		3		2		2	3	3						
5	2	3	2	3		1	2			2	3		3		3
Avg.	2	3	3	2	2	1	2	3	3	2	3	2	2	2	3

1-Low,2-Medium,3-High,"-"-no correlation

21155E67G COASTAL ZONE MANAGEMENT AND REMOTE SENSING L T P C
3 0 0 3

COURSE OBJECTIVES

To be able to "see" the features and components of the coastal zone.

- To assess the various living and non-living resources
- To understand the need for coastal zone management and to develop an ICM plan.
- To provide the coastal and oceanographic applications of satellite remote sensing.

UNIT I COASTAL ZONE **9**

Coastal Zone – Beach Profile – Surf Zone – Off Shore – Coastal Waters – Coastal sediments - Estuaries– Wetlands and Lagoons – Coastal dunes – Coastal Geomorphology.

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.

UNIT III COASTAL ECOSYSTEM **9**

Marine ecosystem: Mangroves – Seagrass – Seaweeds - Coral reef – Large marine ecosystem - Climate effects on living marine resources- Biological monitoring of marine ecosystem- Human impacts on marine ecosystem.

UNIT IV COASTAL REGULATIONS **9**

Introduction- What is ICM- Developing an ICM framework- Principles-Goals-defining boundaries – Coastal Regulation Zones (CRZ) for main land and Islands –Environmental Law and policy.

UNIT V REMOTE SENSING IN COASTAL ZONE MANAGEMENT **9**

Sensors and Platforms used for coastal application –Mapping of Coral Reefs, Macroalgae, Mangrove and Wetlands – Coastal Landuse / Land Cover Mapping – Coastal Regulation Zone Mapping – Case studies.

TOTAL:45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Understand the science and basic of Coastal zone.

CO2 Assess the living marine resources and non-living marine resources.

CO3 Learn about importance of different ecosystem available in coastal and marine environment.

CO4 Understand the coastal regulations for mainland and islands.

CO5 Acquire knowledge about various satellites and sensors used for marine and coastal environment.

TEXTBOOKS:

1. RichardSylvester,"Coastal Engineering, Volume I And II", Elseiner Scientific Publishing Co., 1999

2. NCSCM straigies and guide line for National implementation of Integrated Coastal zone management, 2013

3. Ramesh R and Purvaja R , E-learning module on ICZM for UNESCO-HE,TheNetheralands,2006

4. Dwivedi,S.N., Natarajan,R And Ramachandran,S., "Coastal Zone Management In Tamilnadu", Madras, 1991

5. David R. Green, Stephen D. King; Coastal and Marine Geo-Information Systems: Applying the Technology to the Environment, Springer, 2003

6. Ramamohana Rao P, Suneetha P, "Coastal Zone Management Using Remote Sensing and GIS", Paperback – Import, 2014.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlationof CO s to POs
		CO1	**CO2**	**CO3**	**CO4**	**CO5**	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	2	3	2		3	2
PO2	Problem analysis			3	3	3	3
PO3	Design / development of solutions		2	3		3	3
PO4	Investigation	1	2	2	2	3	2
PO5	Modern Tool Usage			3		3	3
PO6	Engineer and Society		3		2		3
PO7	Environment and Sustainability				2		2
PO8	Ethics		2	2	2	3	2
PO9	Individual and Team work				3		3
PO10	Communication	2	3	3	3	3	3
PO11	Project Management and Finance		1			3	3
PO12	Life Long Learning			2			2
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	2	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems andinnovation		3		3	3	3
PSO3	Conceptualization and evaluation of engineering solutions to CivilEngineering Issues		3	3	3		3

21155E67H COMPUTATIONAL FLUID DYNAMICS L T P C
3 0 0 3

COURSE OBJECTIVES:

- The main learning objective of this course is to prepare the students for Applying the fundamentals of CFD, and developing case specific governing equations,
- Performing finite difference and finite volume based analysis for steady and transient diffusion
- problems, Implementing various mathematical schemes under finite volume method for convention diffusion.
- Solving complex problems in the field of fluid flow and heat transfer with the support of high speed
- computers. Applying the various discretization methods, solution procedure and the concept of turbulence modelling.

UNIT I GOVERNING EQUATIONS ANDBOUNDARY CONDITIONS 9

Basics of computational fluid dynamics – Governing equations– Continuity, Momentum and Energy equations – Chemical species transport –Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behavior of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

UNIT II FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION 9

Derivation of finite difference equations– General Methods for first and second order accuracy – Finite volume formulation for steady and transient diffusion problems –Example problems– Use of Finite Difference and Finite Volume methods

UNIT III FINITE VOLUME METHOD FORCONVECTIONDIFFUSION 9

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes, properties of discretization schemes, Hybrid, Power-law, QUICK Schemes, Conservativeness, Boundedness, Transportiveness.

UNIT IV FLOWFIELD ANALYSIS 9

Stream function and vorticity, Representation of the pressure gradient term, Staggered grid – Momentum equations, Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

UNIT V TURBULENCE MODELS ANDMESHGENERATION 9

Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models, Mesh Generation and refinement Techniques-software tools.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1 Apply the fundamentals of CFD and develop case specific governingequations

CO2 Perform finite difference and finite volume based analysis for steady and transient diffusion problems

CO3 Implement various mathematical schemes under finite volume method for convention diffusion

CO4 Solve complex problems in the field of fluid flow and heat transfer with the support of high speedcomputers

CO5 Apply the various discretization methods, solution procedure and the concept of turbulence modelling

TEXT BOOKS:

1. Versteeg, H.K. and Malalasekera, W. “An Introduction to Computational Fluid Dynamics: The finite volume Method”, Pearson Education,2014

2. Ghoshdastidar, P.S., “Computer Simulation of flow and heat transfer”, Tata McGraw Hill, 1998.

REFERENCES:

1. John. F. Wendt, “Computational Fluid Dynamics – An Introduction”, Springer,2013.

2. K.Muralidhar&T.Sundararajan, Computational Fluid Flow and Heat Transfer, Narora Publishing House,1994.

3. Suhas V, Patankar, “Numerical Heat transfer and Fluid flow”, Taylor & Francis,2009.

4. Uriel Frisch, Turbulence, Cambridge University Press,1999

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	2	2	2	3	3	2
PO3	Design / development of solutions	1	2	3	3	3	3
PO4	Investigation	1	1	2	3	3	2
PO5	Modern Tool Usage	2	2	2	2	2	2
PO6	Engineer and Society	2	2	2	2	2	2
PO7	Environment and Sustainability	1	1	1	1	1	1
PO8	Ethics	1	1	1	1	1	1
PO9	Individual and Team work	1	1	2	2	2	2
PO10	Communication	1	1	2	2	2	2
PO11	Project Management and Finance	1	1	2	2	2	2
PO12	Life Long Learning	1	1	1	2	2	1
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems andinnovation	1	1	2	3	3	2
PSO3	Conceptualization and evaluation of engineering solutions to CivilEngineering Issues	2	2	3	3	3	3

21155E67I **EARTH AND ROCK FILL DAMS** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

Students are expected to learn reasons for failure and damages of embankments and slopes, various methods of analysis of slopes and remedial techniques to protect the slopes.

UNIT I DESIGN CONSIDERATION **9**

Design consideration, Factors influencing design, Types of earth and rock fill dams, Design details, Provisions to control pore pressure.

UNIT II SLOPE STABILITY AND SEEPAGE ANALYSIS **8**

Stability of infinite and finite slopes, Method of Slices, Bishop's method, Flow nets, Stability conditions during construction, Full reservoir and drawdown - cut off walls – Trenches – Importance of drainage and filters.

UNIT III HYDRAULIC FRACTURING **9**

Introduction, Conditions and mechanisms for hydraulic fracturing, Failure criterion for hydraulic fracturing – cubic specimen with a crack – core with a transverse crack – core with a vertical crack, strike–dip of easiest crack spreading; factors affecting hydraulic fracturing, self-healing of a core crack.

UNIT IV FAILURE AND DAMAGES **9**

Failure and damages, Nature and importance of failures in embankment and foundation - Piping, Differential settlement, Foundation slides, Earthquake damage, creep and anisotropic effects, Reservoir wave action, Dispersive piping.

UNIT V SLOPE PROTECTION MEASURES **10**

Special design problems, Slope protection, Filter design, Foundation treatment, Earth dams on pervious soil foundation, Application of Geosynthetic materials in filtration. Treatment of rock foundation, Construction Techniques, Quality control and performance measurement

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of thecourse, thestudent isexpected tobeableto

CO1 Assess the causes of failure and damage of embankments and slopes.

CO2 Apply the knowledge of engineering and analyse the stability of slopes for various seepage conditions and apply the concept in the design of earth and rock fill dams.

CO3 Apply the knowledge of engineering and assess the stability of dam against hydraulic fracturing and suggest suitable remedial measure.

CO4 Understand the nature of failures and damages in earth and rock fill dams and apply the concept in field to avoid distress.

CO5 Recommend suitable remedial measures to protect the slopes and implement quality control and monitor its performance

REFERENCES:

1. Rowe, R.K., Geotechnical and Geoenvironmental Engineering Handbook, Kulwer Academic Publishers, 2001.

2. Anderson, M.G., and Richards, K.S., Slope Stability, John Wiley, 1987.

3. Sherard, J.L., Woodward, R.J., Gizienski, R.J. and Clevenger, W.A., Earth and Earth rock dam, John Wiley, 1963.

4. Chowdhury, D.F., Slope analysis, Prentice Hall, 1988.

5. McCarthy, D.F., Essentials of Soil Mechanics and Foundations: Basic Geotechnics, Sixth Edition, Prentice Hall, 2002.

6. Bramhead, E.N., The Stability of Slopes, Blacky Academic and Professionals Publications, Glasgow, 1986. 7. Chandhar, R.J., Engineering Developments and Applications, Thomas Telford, 1991

8. Koerner, R.M. Designing with Geosynthetics, Third Edition, Prentice Hall, 1997.

9. Jun-Jie Wang, Hydraulic Fracturing in Earth-rock Fill Dams, John Wiley & Sons, 2014.

COs- PO's & PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	2	3	3	3	2	3
PO2	Problem analysis	2	3	3	3	2	3
PO3	Design / development of solutions	2	3	3	3	3	3
PO4	Investigation	3	2	3	2	1	2
PO5	Modern Tool Usage	1	3	2	3	3	3
PO6	Engineer and Society	2	2	3	3	3	3
PO7	Environment and Sustainability	1	2	2	3	3	3
PO8	Ethics	3	1	1	1	3	2
PO9	Individual and Team work	2	2	2	3	3	2
PO10	Communication	1	1	2	2	1	1
PO11	Project Management and Finance	2	2	3	3	3	3
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems andinnovation	2	2	2	3	3	2
PSO3	Conceptualization and evaluation of engineering solutions to CivilEngineering Issues	2	2	3	3	3	3

21155E67J **FINANCE FOR ENGINEERS** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

To study the concepts of Finance such as fundamentals of management of accounting,Time value of money, comparing alternatives proposals, evaluating alternative investments and management of funds.

UNIT I FUNDAMENTALS OF MANAGEMENT ACCOUNTING 9

Basics of accounting - Management accounting, Financial accounting principles- basic concepts, Financial statements – accounting ratios - funds flow statement – cash flow statement.

UNIT II TIME VALUE OF MONEY 9

Time Value of Money – Present Value – Future Value – Single amount - Annuity – Cost of Capital – Cost of Debt, Preference, Equity – Proportions- Cost of Capital Calculation – Financial Institutions Considerations.

UNIT III COMPARING ALTERNATIVES PROPOSALS 9

Comparing alternatives- NPV – BCR – IRR – ARR – Urgency – Pay Back Period and Break Even Analysis – Assessment of Various Methods – Indian Practice of Investment Appraisal – International Practice of Appraisal

UNIT IV EVALUATING ALTERNATIVE INVESTMENTS 9

Real Estate - Investment Property, Equipment Replace Analysis, Depreciation – Tax before and after depreciation – GST– Input Tax Credit (ITC) – Assessment and Administration of GST – Inflation - Practical knowledge of risk and tax management.

UNIT V FUNDS MANAGEMENT 9

Project Finance – Sources of finance - Long-term and short -term finance, Working Capital Management, Inventory valuation, Mortgage Financing - International financial management-foreign currency management - Applications of valuation concepts to real-world cases & examples.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Describe the basic principles of accounting

CO2 Assess the value of money

CO3 Evaluate alternate proposals

CO4 Evaluate alternative investments

CO5 Select best source of finance for a project

REFERENCES:

1. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation Review, McGraw Hill Publishing Company Ltd., New Delhi. 2006.

2. Blank, L.T., and Tarquin,a.J Engineering Economy,4th Edn. Mc-Graw Hill Book Co., 1988

3. Collier C and GlaGola C Engineering Economics & Cost Analysis, 3nd Edn. Addison Wesley Education Publishers.,1998.

4. Patel, B M Project management- strategic Financial Planning, Evaluation and Control, Vikas Publishing House Pvt. Ltd. New Delhi, 2000 5. Steinand noer, H.M. Engineering Economic principles, 2nd Edn. McGraw Hill Book, 1996

COs- PO's &PSO's MAPPING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES(PO)							
PO1	Knowledge of Engineering Sciences	2	3	3	3	2	3
PO2	Problem analysis	2	3	3	3	2	3
PO3	Design / development of solutions	2	3	3	3	3	3
PO4	Investigation	3	2	3	2	1	2
PO5	Modern Tool Usage	1	3	2	3	3	3
PO6	Engineer and Society	2	2	3	3	3	3
PO7	Environment and Sustainability	1	2	2	3	3	3
PO8	Ethics	3	1	1	1	3	2
PO9	Individual and Team work	2	2	2	3	3	2
PO10	Communication	1	1	2	2	1	1
PO11	Project Management and Finance	2	2	3	3	3	3
PO12	Life Long Learning	3	3	3	3	3	3
PROGRAM SPECIFIC OUTCOMES(PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems andinnovation	2	2	2	3	3	2
PSO3	Conceptualization and evaluation of engineering solutions to CivilEngineering Issues	2	2	3	3	3	3

SEMESTER VI

OPEN ELECTIVE-I

21150OE61A IOT CONCEPTS AND APPLICATIONS L T P C

2 0 2 3

COURSE OBJECTIVES:

- To apprise students with basic knowledge of IoT that paves a platform to understand physical and logical design of IOT
- To teach a student how to analyse requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms.
- To introduce the technologies behind Internet of Things(IoT).
- To explain the students how to code for an IoT application using Arduino/Raspberry Pi open platform.
- To apply the concept of Internet of Things in real world scenario.

UNIT I INTRODUCTION TO INTERNET OF THINGS 5

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT

UNIT II COMPONENTS IN INTERNET OF THINGS 5

Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee,Wifi, GPS, GSM Modules)

UNIT III PROTOCOLS AND TECHNOLOGIES BEHIND IOT 6

IOT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, BigData Analytics, Cloud Computing, Embedded Systems.

UNIT IV OPEN PLATFORMS AND PROGRAMMING 7

IOT deployment for Raspberry Pi /Arduino platform-Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V IOT APPLICATIONS 7

Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture

30 PERIODS

PRACTICAL EXERCISES:

1. Introduction to Arduino platform and programming
2. Interfacing Arduino to Zigbee module
3. Interfacing Arduino to GSM module
4. Interfacing Arduino to Bluetooth Module
5. Introduction to Raspberry PI platform and python programming
6. Interfacing sensors to Raspberry PI
7. Communicate between Arduino and Raspberry PI using any wireless medium
8. Setup a cloud platform to log the data
9. Log Data using Raspberry PI and upload to the cloud platform10.Design an IOT based system

TOTAL PERIODS:60

COURSE OUTCOMES:

CO1: Explain the concept of IoT.

CO2: Understand the communication models and various protocols for IoT.

CO3: Design portable IoT using Arduino/Raspberry Pi /open platform

CO4: Apply data analytics and use cloud offerings related to IoT.

CO5: Analyze applications of IoT in real time scenario.

TEXTBOOKS

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017

2. Samuel Greengard, The Internet of Things, The MIT Press, 2015

REFERENCES

1. Perry Lea, "Internet of things for architects", Packt, 2018
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012
3. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
5. ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
6. https://www.arduino.cc/
https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3										3	1	2		3
2		3	2	2				3	3	2				2	
3	2	3	3						3	2	2	3		2	3
4	2		3		2		2	3	3						
5	2	3	2	3		1	2			2	3		3		3
Avg.	2	3	3	2	2	1	2	3	3	2	3	2	2	2	3

1-Low,2-Medium,3-High,"-"-no correlation

21150OE61B AUGMENTED REALITY/VIRTUAL REALITY L T P C
2 0 2 3

COURSE OBJECTIVES:

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT I INTRODUCTION 7

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays –Human Auditory System.

UNIT II VR MODELING 6

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

UNIT III VR PROGRAMMING 6

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT IV APPLICATIONS 6

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT V AUGMENTED REALITY 5

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation-Navigation-Wearable devices

30 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection types by handling camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model three dimensional objects using various modelling techniques and apply textures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
8. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
9. Develop AR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization and surgery simulation.

10. Develop simple MR enabled gaming applications.

TOTAL:60 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the basic concepts of AR and VR

CO2: Understand the tools and technologies related to AR/VR

CO3: Know the working principle of AR/VR related Sensor devices

CO4: Design of various models using modeling techniques

CO5: Develop AR/VR applications in different domains

TEXTBOOKS:

1. Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018

2. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", Addison Wesley, 2016

3. John Vince, "Introduction to Virtual Reality", Springer-Verlag, 2004.

4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design", Morgan Kaufmann, 2003'

CO's – PO's & PSO's MAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	-	3	-	-	-	2	2	1	2	2	1	2
2	3	2	2	1	3	-	-	-	3	2	2	3	3	1	2
3	3	3	2	2	3	-	-	-	3	2	1	2	3	2	2
4	3	3	3	2	3	-	-	-	3	2	2	3	3	2	2
5	3	3	3	3	3	-	-	-	3	3	3	3	3	3	3
Avg.	3	2.6	2.4	**2**	3	**-**	**-**	**-**	2.8	2.2	1.8	2.8	2.8	1.8	2.2

SEMESTER VII

OPEN ELECTIVE-II

21150OE72A DATA SCIENCE FUNDAMENTALS L T P C

2 0 2 3

COURSE OBJECTIVES:

- Familiarize students with the data science process.
- Understand the data manipulation functions in Numpy and Pandas.
- Explore different types of machine learning approaches.
- Understand and practice visualization techniques using tools.
- Learn to handle large volumes of data with case studies.

UNIT I INTRODUCTION 6

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – data preparation - Exploratory Data analysis – build the model – presenting findings and building applications - Data Mining - Data Warehousing – Basic statistical descriptions of Data

UNIT II DATA MANIPULATION 9

Python Shell - Jupyter Notebook - IPython Magic Commands - NumPy Arrays-Universal Functions – Aggregations – Computation on Arrays – Fancy Indexing – Sorting arrays – Structured data – Data manipulation with Pandas – Data Indexing and Selection – Handling missing data – Hierarchical indexing – Combining datasets – Aggregation and Grouping – String operations – Working with time series – High performance

UNIT III MACHINE LEARNING 5

The modeling process - Types of machine learning - Supervised learning - Unsupervised learning - Semi-supervised learning- Classification, regression - Clustering – Outliers and Outlier Analysis

UNIT IV DATA VISUALIZATION 5

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn

UNIT V HANDLING LARGE DATA 5

Problems - techniques for handling large volumes of data - programming tips for dealing with large data sets- Case studies: Predicting malicious URLs, Building a recommender system - Tools and techniques needed - Research question - Data preparation - Model building – Presentation and automation.

30 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

LAB EXERCISES

1. Download, install and explore the features of Python for data analytics.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Basic plots using Matplotlib
5. Statistical and Probability measures

a) Frequency distributions
b) Mean, Mode, Standard Deviation
c) Variability
d) Normal curves
e) Correlation and scatter plots
f) Correlation coefficient
g) Regression

6. Use the standard benchmark data set for performing the following:

a) Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
b) Bivariate Analysis: Linear and logistic regression modelling.

7. Apply supervised learning algorithms and unsupervised learning algorithms on any data set.
8. Apply and explore various plotting functions on any data set.

Note: Example data sets like: UCI, Iris, Pima Indians Diabetes etc.

COURSE OUTCOMES:

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

CO1: Gain knowledge on data science process.
CO2: Perform data manipulation functions using Numpy and Pandas.
CO3 Understand different types of machine learning approaches.
CO4: Perform data visualization using tools.
CO5: Handle large volumes of data in practical scenarios.

TOTAL:60 PERIODS

TEXT BOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
2. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.

REFERENCES

1. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
2. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3										3	1	2		3
2		3	2	2				3	3	2				2	
3	2	3	3						3	2	2	3		2	3
4	2		3		2		2	3	3						
5	2	3	2	3		1	2			2	3		3		3
Avg.	2	3	3	2	2	1	2	3	3	2	3	2	2	2	3

1-Low,2-Medium,3-High,"-"-no correlation

21150OE72B ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FUNDAMENTALS **L T P C 2 0 2 3**

COURSE OBJECTIVES:

The main objectives of this course are to:

- Understand the importance, principles, and search methods of AI
- Provide knowledge on predicate logic and Prolog.
- Introduce machine learning fundamentals
- Study of supervised learning algorithms.
- Study about unsupervised learning algorithms.

UNIT I INTELLIGENT AGENT AND UNINFORMED SEARCH 6

Introduction - Foundations of AI - History of AI - The state of the art - Risks and Benefits of AI - **Intelligent Agents** - Nature of Environment - Structure of Agent - Problem Solving Agents - Formulating Problems - **Uninformed Search** - Breadth First Search - Dijkstra's algorithm or uniform-cost search - Depth First Search - Depth Limited Search

UNIT II PROBLEM SOLVING WITH SEARCH TECHNIQUES 6

Informed Search - Greedy Best First - A* algorithm - Adversarial Game and Search - **Game theory** - Optimal decisions in game - Min Max Search algorithm - Alpha-beta pruning - **Constraint Satisfaction Problems (CSP)** - Examples - Map Coloring - Job Scheduling - Backtracking Search for CSP

UNIT III LEARNING 6

Machine Learning: Definitions – Classification - Regression - approaches of machine learning models - Types of learning - Probability - Basics - Linear Algebra – Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation, Concept of over fitting, under fitting, Bias and Variance - **Regression**: Linear Regression - Logistic Regression

UNIT IV SUPERVISED LEARNING 6

Neural Network: Introduction, Perceptron Networks – Adaline - Back propagation networks - **Decision Tree:** Entropy – Information gain - Gini Impurity - classification algorithm - Rule based Classification - **Naïve Bayesian classification** - **Support Vector Machines** (SVM)

UNIT V UNSUPERVISED LEARNING 6

Unsupervised Learning – Principle Component Analysis - **Neural Network**: Fixed Weight Competitive Nets - Kohonen Self-Organizing Feature Maps – **Clustering**: Definition - Types of Clustering – Hierarchical clustering algorithms – k-means algorithm

TOTAL : 30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

Programs for Problem solving with Search

1. Implement breadth first search
2. Implement depth first search
3. Analysis of breadth first and depth first search in terms of time and space
4. Implement and compare Greedy and A* algorithms.

Supervised learning

5. Implement the non-parametric locally weighted regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs
6. Write a program to demonstrate the working of the decision tree based algorithm.
7. Build an artificial neural network by implementing the back propagation algorithm and test the same using appropriate data sets.
8. Write a program to implement the naïve Bayesian classifier.

Unsupervised learning

9. Implementing neural network using self-organizing maps
10. Implementing k-Means algorithm to cluster a set of data.
11. Implementing hierarchical clustering algorithm.

Note:

- Installation of gnu-prolog, Study of Prolog (gnu-prolog).
- The programs can be implemented in using C++/JAVA/ Python or appropriate tools can be used by designing good user interface
- Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

COURSE OUTCOMES:

CO1: Understand the foundations of AI and the structure of Intelligent Agents
CO2: Use appropriate search algorithms for any AI problem
CO3: Study of learning methods
CO4: Solving problem using Supervised learning
CO5: Solving problem using Unsupervised learning

TOTAL : 60 PERIODS

TEXT BOOK

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Fourth Edition, 2021

2. S.N.Sivanandam and S.N.Deepa, Principles of soft computing-Wiley India.3 rd ed,

REFERENCES

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
2. I. Bratko, "Prolog: Programming for Artificial Intelligence‖ Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

3. C. Muller & Sarah Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3										3	1	2		3
2		3	2	2				3	3	2				2	
3	2	3	3						3	2	2	3		2	3
4	2		3		2		2	3	3						
5	2	3	2	3		1	2			2	3		3		3
Avg.	2	3	3	2	2	1	2	3	3	2	3	2	2	2	3

1-Low,2-Medium,3-High,"-"-no correlation

OPEN ELECTIVE-III

21147OE73A	**ENGLISH FOR COMPETITIVE EXAMINATIONS**	**L T P C**
		3 0 0 3

COURSE DESCRIPTION:

Students aspiring to take up competitive exams of which the English language is a vital component will find this course useful. Designed for students in the higher semesters, the course will help students to familiarise themselves with those aspects of English that are tested in these examinations.

COURSE OBJECTIVES:

- To train the students in the language components essential to face competitive examinations both at the national (UPSC, Banking, Railway, Defence) and the international level (GRE, TOEFL, IELTS).
- To enhance an awareness of the specific patterns in language testing and the respective skills to tackle verbal reasoning and verbal ability tests.
- To inculcate effective practices in language-learning in order to improve accuracy in usage of grammar and coherence in writing.
- To improve students' confidence to express their ideas and opinions in formal contexts
- To create awareness of accuracy and precision in communication

UNIT I **9**

Orientation on different formats of competitive exams - Vocabulary – Verbal ability – Verbal reasoning - Exploring the world of words – Essential words – Meaning and their usage – Synonyms-antonyms – Word substitution – Word analogy – Idioms and phrases – Commonly confused words – Spellings – Word expansion – New words in use.

UNIT II **9**

Grammar – Sentence improvement –Sentence completion – Rearranging phrases into sentences – Error identification –Tenses – Prepositions – Adjectives – Adverbs – Subject-verb agreement – Voice – Reported speech – Articles – Clauses – Speech patterns.

UNIT III **9**

Reading - Specific information and detail – Identifying main and supporting ideas – Speed reading techniques – Improving global reading skills – Linking ideas – Summarising – Understanding argument – Identifying opinion/attitude and making inferences - Critical reading.

UNIT IV **9**

Writing – Pre-writing techniques – Mindmap - Describing pictures and facts - Paragraph structure – organising points – Rhetoric writing – Improving an answer – Drafting, writing and developing an argument – Focus on cohesion – Using cohesive devices –Analytic writing – Structure and types of essay – Mind maps – Structure of drafts, letters, memos, emails – Statements of Purpose – Structure, Content and Style.

UNIT V **9**

Listening and Speaking – Contextual listening – Listening to instructions – Listening for specific information – Identifying detail, main ideas – Following signpost words – Stress, rhythm and intonation - Speaking to respond and elicit ideas – Guided speaking – Opening phrases – Interactive communication – Dysfluency -Sentence stress – Speaking on a topic – Giving opinions – Giving an oral presentation – Telling a story or a personal anecdote – Talking about oneself - Utterance – Speech acts- Brainstorming ideas – Group discussion.

TOTAL: 45 PERIODS

Learning Outcomes:

At the end of the course, learners will be able

CO1 expand their vocabulary and gain practical techniques to read and comprehend a wide range of texts with the emphasis required

CO2 identify errors with precision and write with clarity and coherence

CO3 understand the importance of task fulfilment and the usage of task-appropriate vocabulary

CO4 communicate effectively in group discussions, presentations and interviews

CO5 write topic based essays with precision and accuracy

Teaching Methods:

Instructional methods will involve discussions, taking mock tests on various question papers – Objective, multiple-choice and descriptive. Peer evaluation, self-check on improvement and peer feedback - Practice sessions on speaking assessments, interview and discussion – Using multimedia.

Evaluative Pattern:

Internal Tests – 50%

End Semester Exam - 50%

TEXTBOOKS:

1. R.P.Bhatnagar - General English for Competitive Examinations. Macmillan India Limited, 2009.

REFERENCES:

1. Educational Testing Service - The Official Guide to the GRE Revised General Test, Tata McGraw Hill, 2010.

2. The Official Guide to the TOEFL Test, Tata McGraw Hill, 2010.

3. R Rajagopalan- General English for Competitive Examinations, McGraw Hill Education

COs- PO's & PSO's MAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	1	3	3	1	3	3	3	3	1	3	1	3	-	-	-
2	2	3	3	2	3	3	3	3	1	3	3	3	-	-	-
3	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
4	2	2	2	2	2	2	2	2	3	3	3	3	-	-	-
5	2	2	2	2	2	2	2	2	2	3	2	3	-	-	-
Avg.	**2**	**2.6**	**2.6**	**2**	**2.6**	**2.6**	**2.6**	**2.6**	**2**	**3**	**2.4**	**3**	**-**	**-**	**-**

1-low, 2-medium, 3-high, '-"- no correlation

Note: The average value of this course to be used for program articulation matrix.

21153OE73A RENEWABLE ENERGY TECHNOLOGIES L T P C
3 0 0 3

COURSE OBJECTIVES

- To know the Indian and global energy scenario
- To learn the various solar energy technologies and its applications.
- To educate the various wind energy technologies.
- To explore the various bio-energy technologies.
- To study the ocean and geothermal technologies.

UNIT I ENERGY SCENARIO 9

Indian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status- Potential of various renewable energy sources-Global energy status-Per capita energy consumption - Future energy plans

UNIT II SOLAR ENERGY 9

Solar radiation – Measurements of solar radiation and sunshine – Solar spectrum - Solar thermal collectors – Flat plate and concentrating collectors – Solar thermal applications – Solar thermal energy storage – Fundamentals of solar photo voltaic conversion – Solar cells – Solar PV Systems – Solar PV applications.

UNIT III WIND ENERGY 9

Wind data and energy estimation – Betz limit - Site selection for windfarms – characteristics - Wind resource assessment - Horizontal axis wind turbine – components - Vertical axis wind turbine – Wind turbine generators and its performance – Hybrid systems – Environmental issues - Applications.

UNIT IV BIO-ENERGY 9

Bio resources – Biomass direct combustion – thermochemical conversion - biochemical conversion- mechanical conversion - Biomass gasifier - Types of biomass gasifiers - Cogeneration –- Carbonisation – Pyrolysis - Biogas plants – Digesters –Biodiesel production – Ethanol production - Applications.

UNIT V OCEAN AND GEOTHERMAL ENERGY 9

Small hydro - Tidal energy – Wave energy – Open and closed OTEC Cycles – Limitations – Geothermal energy – Geothermal energy sources - Types of geothermal power plants – Applications Environmental impact.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 Discuss the Indian and global energy scenario.

CO2 Describe the various solar energy technologies and its applications.

CO3 Explain the various wind energy technologies.

CO4 Explore the various bio-energy technologies.

CO5 Discuss the ocean and geothermal technologies.

TEXT BOOKS:

1. Fundamentals and Applications of Renewable Energy | Indian Edition, by Mehmet Kanoglu, Yunus A. Cengel, John M. Cimbala, cGraw Hill; First edition (10 December 2020), ISBN-10 : 9390385636

2. Renewable Energy Sources and Emerging Technologies, by Kothari, Prentice Hall India Learning Private Limited; 2nd edition (1 January 2011), ISBN-10 : 8120344707

REFERENCES:

1. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 2012.

2. Rai.G.D., "Non-Conventional Energy Sources", Khanna Publishers, New Delhi, 2014.

3. Sukhatme.S.P., "Solar Energy: Principles of Thermal Collection and Storage", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.

4. Tiwari G.N., "Solar Energy – Fundamentals Design, Modelling and applications", Alpha Science Intl Ltd, 2015.

5. Twidell, J.W. & Weir A., "Renewable Energy Resources", EFNSpon Ltd., UK, 2015.

COs- PO's & PSO's MAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	1	1	1	1	1	2	3	2	2	1	1	3	2	1	2
2	3	2	2	1	1	1	3	1	1	1	2	3	2	1	2
3	3	2	3	1	2	1	3	1	1	1	1	3	1	1	2
4	2	2	2	1	2	1	3	1	1	1	2	3	2	2	2
5	2	1	2	1	2	1	3	1	1	1	1	3	2	1	2
Low(1) ;Medium(2) ; High(3);															

21153OE73B ELECTRIC AND HYBRID VEHICLES L T P C

3 0 0 3

COURSE OBJECTIVES:

- The objective of this course is to prepare the students to know about the general aspects of Electric and Hybrid Vehicles (EHV), including architectures, modelling, sizing, and sub system design and hybrid vehicle control.

UNIT I DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES 9

Need for Electric vehicle- Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles. - Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refuelling Systems.

UNIT II ENERGY SOURCES 9

Battery Parameters- - Different types of batteries – Lead Acid- Nickel Metal Hydride - Lithium ion- Sodium based- Metal Air. Battery Modelling - Equivalent circuits, Battery charging- Quick Charging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell. Ultra capacitors. Battery Management System.

UNIT III MOTORS AND DRIVES 9

Types of Motors- DC motors- AC motors, PMSM motors, BLDC motors, Switched reluctance motors working principle, construction and characteristics.

UNIT IV POWER CONVERTERS AND CONTROLLERS 9

Solid state Switching elements and characteristics – BJT, MOSFET, IGBT, SCR and TRIAC - Power Converters – rectifiers, inverters and converters - Motor Drives - DC, AC motor, PMSM motors, BLDC motors, Switched reluctance motors – four quadrant operations –operating modes

UNIT V HYBRID AND ELECTRIC VEHICLES 9

Main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Power Split devices for Hybrid Vehicles - Operation modes - ControlStrategies for Hybrid Vehicle - Economy of hybrid Vehicles - Case study on specification of electric and hybrid vehicles.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Understand the operation and architecture of electric and hybrid vehicles

CO2 Identify various energy source options like battery and fuel cell

CO3 Select suitable electric motor for applications in hybrid and electric vehicles.

CO4 Explain the role of power electronics in hybrid and electric vehicles

CO5 Analyze the energy and design requirement for hybrid and electric vehicles.

TEXT BOOKS:

1. Iqbal Husain, " Electric and Hybrid Vehicles-Design Fundamentals", CRC Press,2003

2. Mehrdad Ehsani, " Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRCPress,2005.

REFERENCES:

1. James Larminie and John Lowry, "Electric Vehicle Technology Explained " John Wiley & Sons,2003

2. Lino Guzzella, " Vehicle Propulsion System" Springer Publications,2005

3. Ron HodKinson, "Light Weight Electric/ Hybrid Vehicle Design", Butterworth Heinemann Publication,2005.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	1	1	1	1	1	2	3	2	2	1	1	3	2	1	2
2	3	2	2	1	1	1	3	1	1	1	2	3	2	1	2
3	3	2	3	1	2	1	3	1	1	1	1	3	1	1	2
4	2	2	2	1	2	1	3	1	1	1	2	3	2	2	2
5	2	1	2	1	2	1	3	1	1	1	1	3	2	1	2
Low(1) ;Medium(2) ; High(3);															

21154OE73A INTRODUCTION TO NON-DESTRUCTIVE TESTING L T P C

3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the basic importance of NDT in quality assurance.
- Imbibing the basic principles of various NDT techniques, its applications, limitations, codes and standards.
- Equipping themselves to locate a flaw in various materials, products.
- Applying apply the testing methods for inspecting materials in accordance with industry specifications and standards.
- Acquiring the knowledge on the selection of the suitable NDT technique for a given application

UNIT I INTRODUCTION TO NDT & VISUAL TESTING 9

Concepts of Non-destructive testing-relative merits and limitations-NDT Versus mechanical testing, Fundamentals of Visual Testing – vision, lighting, material attributes, environmental factors, visual perception, direct and indirect methods – mirrors, magnifiers, boroscopes and fibroscopes – light sources and special lighting.

UNIT II LIQUID PENETRANT & MAGNETIC PARTICLE TESTING 9

Liquid Penetrant Inspection: principle, applications, advantages and limitations, dyes, developersand cleaners, Methods & Interpretation. Magnetic Particle Inspection: Principles, applications, magnetization methods, magnetic particles, Testing Procedure, demagnetization, advantages and limitations, – Interpretation and evaluation oftest indications.

UNIT III EDDY CURRENT TESTING & THERMOGRAPHY 9

Eddy Current Testing: Generation of eddy currents– properties– eddy current sensing elements, probes, Instrumentation, Types of arrangement, applications, advantages, limitations – Factors affecting sensing elements and coil impedance, calibration, Interpretation/Evaluation. Thermography- Principle, Contact & Non-Contact inspection methods, Active & Passive methods, Liquid Crystal – Concept, example, advantages & limitations. Electromagnetic spectrum, infrared thermography- approaches, IR detectors, Instrumentation and methods, applications.

UNIT IV ULTRASONIC TESTING & AET 9

Ultrasonic Testing: Types of ultrasonic waves, characteristics, attenuation, couplants, probes, EMAT. Inspection methods-pulse echo, transmission and phased array techniques, types of scanning and displays, angle beam inspection of welds, time of flight diffraction (TOFD) technique, Thickness determination by ultrasonic method, Study of A, B and C scan presentations, calibration. Acoustic Emission Technique – Introduction, Types of AE signal, AE wave propagation, Source location, Kaiser effect, AE transducers, Principle, AE parameters, AE instrumentation, Advantages & Limitations, Interpretation of Results, Applications.

UNIT V RADIOGRAPHY TESTING 9

Sources-X-rays and Gamma rays and their characteristics-absorption, scattering. Filters and screens, Imaging modalities-film radiography and digital radiography (Computed, Direct, Real Time, CT scan). Problems in shadow formation, exposure factors, inverse square law, exposure charts, Penetrameters, safety in radiography.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Realize the importance of NDT in various engineering fields.

CO2 Have a basic knowledge of surface NDE techniques which enables to carry out various inspection in accordance with the established procedures.
CO3 Calibrate the instrument and inspect for in-service damage in the components by means of Eddy current testing as well as Thermography testing.
CO4 Differentiate various techniques of UT and AET and select appropriate NDT methods for better evaluation.
CO5 Interpret the results of Radiography testing and also have the ability to analyse the influence of various parameters on the testing.

TEXT BOOKS:

1. Baldev Raj, T. Jayakumar and M. Thavasimuthu, Practical Non Destructive Testing, Alpha Science International Limited, 3rd edition, 2002.
2. J. Prasad and C. G. K. Nair, Non-Destructive Test and Evaluation of Materials, Tata McGraw-Hill Education, 2nd edition, 2011.
3. Ravi Prakash, "Non-Destructive Testing Techniques", 1st revised edition, New Age International Publishers, 2010.

REFERENCES:

1. ASM Metals Handbook, V-17, "Nondestructive Evaluation and Quality Control", American Society of Metals, USA, 2001.
2. Barry Hull and Vernon John,"Nondestructive Testing", Macmillan, 1989.
3. Chuck Hellier, "Handbook of Nondestructive Evaluation", Mc Graw Hill, 2012.
4. Louis Cartz, "Nondestructive Testing", ASM International, USA, 1995.

COs- PO's & PSO's MAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1			3	3	3	3	2	3	3	3	2	1	
2		3	2	3	3	3	3	3	2	3	3	3			2
3	2	3	2	3	3	3	3	3	2	3	3	3	1	2	3
4	2	2	3	3	2	3	3	3	2	3	3	3		3	3
5	2	2			-	-	-	-	3	3	3	3	2		
AVg.	2	2.2	2.3	3	**2.75**	**3**	**3**	**3**	**2.2**	**3**	**3**	**3**	1.8	2	2.6

21154OE73B INDUSTRIAL MANAGEMENT L T P C

3 0 0 3

COURSE OBJECTIVES:

- To introduce fundamental concepts of industrial management
- To understand the approaches to the study of Management
- To learn about Decision Making, Organizing and leadership
- To analyze the Managerial Role and functions
- To know about the Supply Chain Management'

UNIT I INTRODUCTION 9

Technology Management - Definition - Functions - Evolution of Modern Management - Scientific Management Development of Management Thought. Approaches to the study of Management, Forms of Organization -Individual Ownership - Partnership - Joint Stock Companies - Co-operative Enterprises - Public Sector Undertakings, Corporate Frame Work- Share Holders - Board of Directors - Committees - Chief Executive Line and Functional Managers,-Financial-Legal-Trade Union

UNIT II FUNCTIONS OF MANAGEMENT 9

Planning - Nature and Purpose - Objectives - Strategies – Policies and Planning Premises - Decision Making - Organizing - Nature and Process - Premises - Departmentalization - Line and staff - Decentralization -Organizational culture, Staffing - selection and training .Placement - Performance appraisal - Career Strategy – Organizational Development. Leading - Managing human factor - Leadership .Communication, Controlling - Process of Controlling - Controlling techniques, productivity and operations management - Preventive control, Industrial Safety.

UNIT III ORGANIZATIONAL BEHAVIOUR 9

Definition - Organization - Managerial Role and functions -Organizational approaches, Individual behaviour - causes - Environmental Effect - Behaviour and Performance, Perception - Organizational Implications. Personality - Contributing factors - Dimension – Need Theories - Process Theories - Job Satisfaction, Learning and Behaviour-Learning Curves, Work Design and approaches.

UNIT IV GROUP DYNAMICS 9

Group Behaviour - Groups - Contributing factors - Group Norms, Communication - Process - Barriers to communication - Effective communication, leadership - formal and informal characteristics – Managerial Grid - Leadership styles - Group Decision Making - Leadership Role in Group Decision, Group Conflicts - Types -Causes - Conflict Resolution -Inter group relations and conflict, Organization centralization and decentralization - Formal and informal - Organizational Structures Organizational Change and Development -Change Process – Resistance to Change - Culture and Ethics.

UNIT V MODERN CONCEPTS 9

Management by Objectives (MBO) - Management by Exception (MBE),Strategic Management - Planning for Future direction - SWOT Analysis -Evolving development strategies, information technology in management Decisions support system-Management Games Business Process Re-engineering(BPR) –Enterprises Resource Planning (ERP) - Supply Chain Management (SCM) - Activity Based Management (AM) - Global Perspective - Principles and Steps Advantages and disadvantage

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Understand the basic concepts of industrial management

CO2: Identify the group conflicts and its causes.

CO3: Perform swot analysis

CO4 : Analyze the learning curves

CO5 : Understand the placement and performance appraisal

REFERENCES:

Maynard H.B, "Industrial Engineering Hand book", McGraw-Hill, sixth 2008

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1											2	1	
2		3	2	3											2
3	2	3	2	3									1	2	3
4	2	2	3	3										3	3
5	2	2											2		
AVg.	2	2.2	2.3	3									1.8	2	2.6

21152OE73A BIOMEDICALINSTRUMENTATION L T P C

3 0 0 3

UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING 9

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues -Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors.

UNIT II NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES 9

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSR measurements.

UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 9

Electrodes – Limb electrodes –floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipment.

UNIT IV IMAGING MODALITIES AND ANALYSIS 9

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems.

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES 9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU

COs- PO's & PSO's MAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1			3	3	3	3	2	3	3	3	2	1	
2		3	2	3	3	3	3	3	2	3	3	3			2
3	2	3	2	3	3	3	3	3	2	3	3	3	1	2	3
4	2	2	3	3	2	3	3	3	2	3	3	3		3	3
5	2	2			-	-	-	-	3	3	3	3	2		
AVg.	2	2.2	2.3	3	**2.75**	**3**	**3**	**3**	**2.2**	**3**	**3**	**3**	1.8	2	2.6

21152OE73B FUNDAMENTALS OF ELECTRONIC DEVICES L T P C

3 0 0 3

COURSE OBJECTIVES:

- To give a comprehensive exposure to all types of devices and circuits constructed with discrete components. This helps to develop a strong basis for building linear and digital integrated circuits
- To analyze the frequency response of small signal amplifiers
- To design and analyze single stage and multistage amplifier circuits
- To study about feedback amplifiers and oscillators principles
- To understand the analysis and design of multi vibrators

UNIT I SEMICONDUCTOR DEVICES 9

PN junction diode, Zener diode, BJT, MOSFET, UJT –structure, operation and V-I characteristics, Rectifiers – Half Wave and Full Wave Rectifier, Zener as regulator

UNIT II AMPLIFIERS 9

Load line, operating point, biasing methods for BJT and MOSFET**,** BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –Analysis of CS and Sourcefollower – Gain and frequency response- High frequency analysis.

UNIT III MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9

Cascode amplifier, Differential amplifier – Common mode and Difference mode analysis – Tuned amplifiers – Gain and frequency response – Neutralization methods.

UNIT IV FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback – Analysis of Voltage / Current, Series , Shunt feedback Amplifiers – positive feedback–Condition for oscillations, phase shift – Wien bridge, Hartley,Colpitts and Crystal oscillators.

UNIT V POWER AMPLIFIERS AND DC/DC CONVERTERS 9

Power amplifiers- class A-Class B-Class AB-Class C-Temperature Effect- Class AB Power amplifier using MOSFET –DC/DC convertors – Buck, Boost, Buck-Boost analysis and design.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

CO1: Explain the structure and working operation of basic electronic devices.

CO2: Design and analyze amplifiers.

CO3: Analyze frequency response of BJT and MOSFET amplifiers

CO4: Design and analyze feedback amplifiers and oscillator principles.

CO5: Design and analyze power amplifiers and supply circuits

TEXT BOOKS :

1. David A. Bell, "Electronic Devices and Circuits", Oxford Higher Education press, 5 th Edition, 2010.

2. Robert L. Boylestad and Louis Nasheresky, “Electronic Devices and Circuit Theory”, 10th Edition, Pearson Education / PHI, 2008.

3. Adel .S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", Oxford University Press, 7 th Edition, 2014.

REFERENCES :

1. Donald.A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill, 3 rd Edition, 2010.

2. D.Schilling and C.Belove, "Electronic Circuits", McGraw Hill, 3 rd Edition, 1989
3. Muhammad H.Rashid, "Power Electronics", Pearson Education / PHI , 2004.

COs- PO's & PSO's MAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	2	1	-	-	-	-	-	1	2	1	1
2	3	2	2	3	2	2	-	-	-	-	-	1	2	1	1
3	3	3	3	2	1	2	-	-	-	-	-	1	2	1	1
4	3	3	2	3	2	2	-	-	-	-	-	1	2	1	1
5	3	2	3	2	2	1	-	-	-	-	-	1	2	1	1
AVg.	3	3	3	3	2	2	-	-	-	-	-	1	2	1	1

OPEN ELECTIVE-IV

21154OE74A ADDITIVE MANUFACTURING L T P C

3 0 0 3

COURSE OBJECTIVES:

- To introduce the development, capabilities, applications, of Additive Manufacturing (AM), and its business opportunities.
- To be acquainted with vat polymerization and material extrusion processes
- To be familiar with powder bed fusion and binder jetting processes.
- To gain knowledge on applications of direct energy deposition, and material jetting processes.
- To impart knowledge on sheet lamination and direct write technologies.

UNIT I INTRODUCTION 9

Overview - Need - Development of Additive Manufacturing (AM) Technology: Rapid Prototyping- Rapid Tooling - Rapid Manufacturing - Additive Manufacturing. AM Process Chain - ASTM/ISO 52900 Classification - Benefits - AM Unique Capabilities - AM File formats: STL, AMF Applications: Building Printing, Bio Printing, Food Printing, Electronics Printing, Automobile, Aerospace, Healthcare. Business Opportunities in AM.

UNIT II VAT POLYMERIZATION AND MATERIAL EXTRUSION 9

Photo polymerization: Stereolithography Apparatus (SLA)- Materials -Process - top down and bottom up approach - Advantages - Limitations - Applications. Digital Light Processing (DLP) - Process - Advantages - Applications. Material Extrusion: Fused Deposition Modeling (FDM) - Process-Materials -Applications andLimitations.

UNIT III POWDER BED FUSION AND BINDER JETTING 9

Powder Bed Fusion: Selective Laser Sintering (SLS): Process - Powder Fusion Mechanism -Materials and Application. Selective Laser Melting (SLM), Electron Beam Melting (EBM): Materials - Process - Advantages and Applications. Binder Jetting: Three-Dimensional Printing - Materials - Process - Benefits - Limitations -Applications.

UNIT IV MATERIAL JETTING AND DIRECTED ENERGY DEPOSITION 9

Material Jetting: Multijet Modeling- Materials - Process - Benefits - Applications. Directed Energy Deposition: Laser Engineered Net Shaping (LENS) - Process - Material Delivery -Materials -Benefits -Applications.

UNIT V SHEET LAMINATION AND DIRECT WRITE TECHNOLOGY 9

Sheet Lamination: Laminated Object Manufacturing (LOM)- Basic Principle- Mechanism: Gluing or Adhesive Bonding - Thermal Bonding - Materials - Application and Limitation. Ink-Based Direct Writing (DW): Nozzle Dispensing Processes, Inkjet Printing Processes, AerosolDW - Applications of DW.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course students shall be able to:

CO1: Recognize the development of AM technology and how AM technology propagated into various businesses and developing opportunities.

CO2: Acquire knowledge on process vat polymerization and material extrusion processes and its applications.

CO3: Elaborate the process and applications of powder bed fusion and binder jetting.

CO4: Evaluate the advantages, limitations, applications of material jetting and directed energy deposition processes.

CO5: Acquire knowledge on sheet lamination and direct write technology.

TEXT BOOKS:

1. Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani "Additive manufacturing technologies". 3rd edition Springer Cham, Switzerland. (2021). ISBN: 978-3-030-56126-0

2. Andreas Gebhardt and Jan-Steffen Hötter "Additive Manufacturing: 3D Printing for Prototyping and Manufacturing", Hanser publications, United States, 2015, ISBN: 978-1- 56990-582-1.

REFERENCES:

1. Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing", Hanser Gardner Publication, Cincinnati., Ohio, 2011, ISBN :9783446425521.

2. Milan Brandt, "Laser Additive Manufacturing: Materials, Design, Technologies, and Applications", Woodhead Publishing., United Kingdom, 2016, ISBN: 9780081004333.

3. Amit Bandyopadhyay and Susmita Bose, "Additive Manufacturing", 1st Edition, CRC Press., United States, 2015, ISBN-13: 978-1482223590.

4. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer., United States ,2006, ISBN: 978-1-4614-9842-1.

5. Liou, L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press., United States, 2011, ISBN: 9780849334092.

COs- PO's & PSO's MAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	2	1	-	-	-	-	-	1	2	1	1
2	3	2	2	3	2	2	-	-	-	-	-	1	2	1	1
3	3	3	3	2	1	2	-	-	-	-	-	1	2	1	1
4	3	3	2	3	2	2	-	-	-	-	-	1	2	1	1
5	3	2	3	2	2	1	-	-	-	-	-	1	2	1	1
AVg.	3	3	3	3	2	2	-	-	-	-	-	1	2	1	1

21154OE74B **INDUSTRIAL SAFETY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To educate about the health hazards and the safety measures to be followed in the industrialenvironment.
- Describe industrial legislations (Factories Acts, Workmen's Compensation and other laws)enacted for the protection of employees health at work settings
- Describe methods of prevention and control of Occupational Health diseases, accidents /emergencies and other hazards

UNIT I INTRODUCTION **9**

Need for developing Environment, Health and Safety systems in work places - Accident Case Studies - Status and relationship of Acts - Regulations and Codes of Practice - Role of trade unionsafety representatives. International initiatives - Ergonomics and work place.

UNIT II OCCUPATIONAL HEALTH AND HYGIENE **9**

Definition of the term occupational health and hygiene - Categories of health hazards - Exposure pathways and human responses to hazardous and toxic substances - Advantages and limitations of environmental monitoring and occupational exposure limits - Hierarchy of control measures for occupational health risks - Role of personal protective equipment and the selection criteria - Effects on humans - control methods and reduction strategies for noise, radiation and excessive stress.

UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS **9**

Features of Satisfactory and Safe design of work premises – good housekeeping - lighting and colour, Ventilation and Heat Control – Electrical Safety – Fire Safety – Safe Systems of work for manual handling operations – Machine guarding – Working at different levels – Process and SystemSafety.

UNIT IV HAZARDS AND RISK MANAGEMENT **9**

Safety appraisal - analysis and control techniques – plant safety inspection – Accident investigation - Analysis and Reporting – Hazard and Risk Management Techniques – major accident hazard control
– Onsite and Offsite emergency Plans.

UNIT V ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT **9**

Concept of Environmental Health and Safety Management – Elements of Environmental Health and Safety Management Policy and methods of its effective implementation and review – Elements of Management Principles – Education and Training – Employee Participation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of this course, the student is expected to be able to:

CO1 Describe, with example, the common work-related diseases and accidents in occupationalsetting

CO2 Name essential members of the Occupational Health team

CO3 What roles can a community health practitioners play in an Occupational setting to ensure theprotection, promotion and maintenance of the health of the employee.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1			3	3	3	3	2	3	3	3	2	1	
2		3	2	3	3	3	3	3	2	3	3	3			2
3	2	3	2	3	3	3	3	3	2	3	3	3	1	2	3
4	2	2	3	3	2	3	3	3	2	3	3	3		3	3
5	2	2			-	-	-	-	3	3	3	3	2		
AVg.	2	2.2	2.3	3	**2.75**	**3**	**3**	**3**	**2.2**	**3**	**3**	**3**	1.8	2	2.6

21153OE74A **SENSORS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To learn the various types of sensors, transducers, sensor output signal types, calibration techniques, formulation of system equation and its characteristics.
- To understand basic working principle, construction, Application and characteristics of displacement, speed and ranging sensors.
- To understand and analyze the working principle, construction, application and characteristics of force, magnetic and heading sensors.
- To learn and analyze the working principle, construction, application and characteristics ofoptical, pressure, temperature and other sensors.
- To familiarize students with different signal conditioning circuits design and data acquisitionsystem.

UNIT I SENSOR CLASSIFICATION, CHARACTERISTICS AND SIGNAL TYPES 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 Outputs - Signal Types - Analog and Digital Signals, PWMand PPM.

UNIT II DISPLACEMENT, PROXIMITY AND RANGING SENSORS 9

Displacement Sensors – Brush Encoders - Potentiometers, Resolver, Encoders – Optical, Magnetic,Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer – Range Sensors - Ultrasonic Ranging - Reflective Beacons - Laser Range Sensor (LIDAR) – GPS - RF Beacons.

UNIT III FORCE, MAGNETIC AND HEADING SENSORS 9

Strain Gage – Types, Working, Advantage, Limitation, and Applications: Load Measurement – Force and Torque Measurement - Magnetic Sensors – Types, Principle, Advantage, Limitation, and Applications - Magneto Resistive – Hall Effect, Eddy Current Sensor - Heading Sensors – Compass,Gyroscope and Inclinometers.

UNIT IV OPTICAL, PRESSURE, TEMPERATURE AND OTHER SENSORS 9

Photo Conductive Cell, Photo Voltaic, Photo Resistive, LDR – Fiber Optic Sensors – Pressure – Diaphragm – Bellows - Piezoelectric - Piezo-resistive - Acoustic, Temperature – IC, Thermistor, RTD, Thermocouple – Non Contact Sensor - Chemical Sensors - MEMS Sensors - Smart Sensors.

UNIT V SIGNAL CONDITIONING 9

Need for Signal Conditioning – Resistive, Inductive and Capacitive Bridges for Measurement - DC and AC Signal Conditioning - Voltage, Current, Power and Instrumentation Amplifiers – Filter andIsolation Circuits – Fundamentals of Data Acquisition System

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Understand various sensor effects, sensor characteristics, signal types, calibration methods andobtain transfer function and empirical relation of sensors. They can also analyze the densor response.

CO2: Analyze and select suitable sensor for displacement, proximity and range measurement.

CO3: Analyze and select suitable sensor for force, magnetic field, speed, position and direction measurement.

CO4: Analyze and Select suitable sensor for light detection, pressure and temperature measurementand also familiar with other miniaturized smart sensors.

CO5: Select and design suitable signal conditioning circuit with proper compensation and linearizing element based on sensor output signal.

TEXT BOOKS

1. Bolton W., "Mechatronics", Pearson Education, 6th Edition, 2015.
2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming, and Applications with the8085", Penram International Publishing Private Limited, 6th Edition, 2013.

REFERENCES

1. Bradley D.A., Dawson D., Buru N.C. and Loader A.J., "Mechatronics", Chapman and Hall, 1993.
2. Davis G. Alciatore and Michael B. Histand, "Introduction to Mechatronics and Measurementsystems", McGraw Hill Education, 2011.
3. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", Cengage Learning, 2010.
4. Nitaigour Premchand Mahalik, "Mechatronics Principles, Concepts and Applications", McGrawHill Education, 2015.
5. Smaili. A and Mrad. F, "Mechatronics Integrated Technologies for Intelligent Machines", OxfordUniversity Press, 2007.

COs- PO's & PSO's MAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1			3	3	3	3	2	3	3	3	2	1	
2		3	2	3	3	3	3	3	2	3	3	3			2
3	2	3	2	3	3	3	3	3	2	3	3	3	1	2	3
4	2	2	3	3	2	3	3	3	2	3	3	3		3	3
5	2	2			-	-	-	-	3	3	3	3	2		
AVg.	2	2.2	2.3	3	**2.75**	**3**	**3**	**3**	**2.2**	**3**	**3**	**3**	1.8	2	2.6

21153OE74B ELECTRICAL, ELECTRONIC AND MAGNETIC MATERIALS **L T P C 3 0 0 3**

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understanding the importance of various materials used in electrical, electronics and
- magnetic applications
- Acquiring knowledge on the properties of electrical, electronics and magnetic materials.
- Gaining knowledge on the selection of suitable materials for the given application
- Knowing the fundamental concepts in Semiconducting materials
- Getting equipped with the materials used in optical and optoelectronic applications.

UNIT I DIELECTRIC MATERIALS **9**

Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

UNIT II MAGNETIC MATERIALS **9**

Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing ofmagnets. Factors effecting permeability and Hysteresis

UNIT III SEMICONDUCTOR MATERIALS **9**

Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale Integration techniques. Concept of superconductivity; theories and examples for high temperature superconductivity; discussion on specific superconducting materials; comments on fabrication andengineering applications.

UNIT IV MATERIALS FOR ELECTRICAL APPLICATIONS **9**

Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

UNIT V OPTICAL AND OPTOELECTRONIC MATERIALS **9**

Principles of photoconductivity - effect of impurities - principles of luminescence-laser principles - He-Ne, injection lasers, LED materials - binary, ternary photoelectronic materials - LCD materials - photo detectors - applications of optoelectronic materials - optical fibres and materials - electro opticmodulators - Kerr effect - Pockels effect.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Understand various types of dielectric materials, their properties in various conditions.
CO2 Evaluate magnetic materials and their behavior.
CO3 Evaluate semiconductor materials and technologies.
CO4 Select suitable materials for electrical engineering applications.
CO5 Identify right material for optical and optoelectronic applications

TEXT BOOKS:

1. Pradeep Fulay, "Electronic, Magnetic and Optical materials", CRC Press, taylor and Francis, and illustrated edition, 2017.
2. "R K Rajput", "A course in Electrical Engineering Materials", Laxmi Publications, 2009.

REFERENCES:

1. T K Basak, "A course in Electrical Engineering Materials", New Age Science Publications,

2009
2. TTTI Madras, “Electrical Engineering Materials”, McGraw Hill Education, 2004.
3. Adrianus J. Dekker, “Electrical Engineering Materials”, PHI Publication, 2006.
4. S. P. Seth, P. V. Gupta “A course in Electrical Engineering Materials”, Dhanpat Rai & Sons,2011.
5. C. Kittel, “Introduction to Solid State Physics”, 7th Edition, John Wiley & Sons,Singapore,(2006).

COs- PO’s & PSO’s MAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1			3	3	3	3	2	3	3	3	2	1	
2		3	2	3	3	3	3	3	2	3	3	3			2
3	2	3	2	3	3	3	3	3	2	3	3	3	1	2	3
4	2	2	3	3	2	3	3	3	2	3	3	3		3	3
5	2	2			-	-	-	-	3	3	3	3	2		
AVg.	2	2.2	2.3	3	**2.75**	**3**	**3**	**3**	**2.2**	**3**	**3**	**3**	1.8	2	2.6

21152OE75A **WEARABLE DEVICES** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

The student should be made to:

- To know the hardware requirement of wearable systems
- To understand the communication and security aspects in the wearable devices
- To know the applications of wearable devices in the field of medicine

UNIT I INTRODUCTION TO WEARABLE SYSTEMS AND SENSORS 9

Wearable Systems- Introduction, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Types of Wearable Systems, Components of wearable Systems. Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Impedance plethysmography, Wearable ground reaction force sensor.

UNIT II SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICES 9

Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.

UNIT III WIRELESS HEALTH SYSTEMS 9

Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication Techniques.

UNIT IV SMART TEXTILE 9

Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques-Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, Conductive Inks.Case study-smart fabric for monitoring biological parameters - ECG, respiration.

UNIT V APPLICATIONS OF WEARABLE SYSTEMS 9

Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderlypatients, neural recording, Gait analysis, Sports Medicine.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

CO1: Describe the concepts of wearable system.
CO2: Explain the energy harvestings in wearable device.
CO3: Use the concepts of BAN in health care.
CO4: Illustrate the concept of smart textile
CO5: Compare the various wearable devices in healthcare system

TEXT BOOKS

1. Annalisa Bonfiglo and Danilo De Rossi, Wearable Monitoring Systems, Springer, 2011
2. Zhang and Yuan-Ting, Wearable Medical Sensors and Systems,Springer, 2013
3. Edward Sazonov and Micheal R Neuman, Wearable Sensors: Fundamentals, Implementation andApplications, Elsevier, 2014
4. Mehmet R. Yuce and JamilY.Khan, Wireless Body Area Networks Technology, Implementationapplications,Pan Stanford Publishing Pte.Ltd, Singapore, 2012

REFERENCES

1. Sandeep K.S, Gupta, Tridib Mukherjee and Krishna Kumar Venkatasubramanian, Body AreaNetworks Safety, Security, and Sustainability, Cambridge University Press, 2013.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	-	1	1	-	-	-	-	-	-	-	-	-
2	3	2	2	-	1	1	-	-	-	-	-	-	-	-	-
3	3	2	2	-	1	1	-	-	-	-	-	-	-	-	-
4	3	-	2	2	2	1	-	-	-	-	-	-	-	-	-
5	3	1	-	-	1	3	-	-	-	-	-	-	-	-	-
AVG	3	1.75	2	2	1.2	1.4									

21152OE77B MEDICAL INFORMATICS L T P C

3 0 0 3

COURSE OBJECTIVES:

1. To study the applications of information technology in health care management.
2. This course provides knowledge on resources, devices, and methods required to optimize theacquisition, storage, retrieval, and use of information in health and biomedicine.

UNIT I INTRODUCTION TO MEDICAL INFORMATICS 9

Introduction - Structure of Medical Informatics –Internet and Medicine -Security issues , Computer based medical information retrieval, Hospital management and information system, Functional capabilities of a computerized HIS, Health Informatics – Medical Informatics, Bioinformatics

UNIT II COMPUTERS IN CLINICAL LABORATORY AND MEDICAL IMAGING 9

Automated clinical laboratories-Automated methods in hematology, cytology and histology, Intelligent Laboratory Information System - Computer assisted medical imaging- nuclear medicine, ultrasound imaging, computed X-ray tomography, Radiation therapy and planning, Nuclear Magnetic Resonance.

UNIT III COMPUTERISED PATIENT RECORD 9

Introduction - conventional patient record, Components and functionality of CPR, Development tools, Intranet, CPR in Radiology- Application server provider, Clinical information system, Computerized prescriptions for patients.

UNIT IV COMPUTER ASSISTED MEDICAL DECISION-MAKING 9

Neuro computers and Artificial Neural Networks application, Expert system-General model of CMD, Computer–assisted decision support system-production rule system cognitive model, semantic networks, decisions analysis inclinical medicine-computers in the care of critically ill patients, Computer aids for the handicapped.

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS 9

Virtual reality applications in medicine, Virtual endoscopy, Computer assisted surgery, Surgical simulation, Telemedicine - Tele surgery, Computer assisted patient education and health-Medicaleducation and healthcare information, computer assisted instruction in medicine.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Explain the structure and functional capabilities of Hospital Information System.

CO2 Describe the need of computers in medical imaging and automated clinical laboratory.

CO3 Articulate the functioning of information storage and retrieval in computerized patient recordsystem.

CO4 Apply the suitable decision support system for automated clinical diagnosis.

CO5 Discuss the application of virtual reality and telehealth technology in medical industry.

TEXT BOOKS:

1. Mohan Bansal, “Medical informatics”, Tata McGraw Hill Publishing Ltd, 2003.
2. R.D.Lele, “Computers in medicine progress in medical informatics”, Tata Mcgraw Hill, 2005

REFERENCE:

1. Kathryn J. Hannah, Marion J Ball, “Health Informatics”, 3rd Edition, Springer, 2006.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	-	1	1	-	-	-	-	-	-	-	-	-
2	3	2	2	-	1	1	-	-	-	-	-	-	-	-	-
3	3	2	2	-	1	1	-	-	-	-	-	-	-	-	-
4	3	-	2	2	2	1	-	-	-	-	-	-	-	-	-
5	3	1	-	-	1	3	-	-	-	-	-	-	-	-	-
AVG	3	1.75	2	2	1.2	1.4									