VELAMMAL

COLLEGE OF ENGINEERING & TECHNOLOGY, MADURAI – 625 009

(Autonomous)

(Accredited by NAAC with 'A' Grade and by NBA for 5 UG Programmes)

(Approved by AICTE and affiliated to Anna University, Chennai)

DEPARTMENT OF CIVIL ENGINEERING

B.E. CIVIL ENGINEERING

CURRICULUM and SYLLABUS

(I to VIII Semesters)

VELAMMAL COLLEGE OF ENGINEERING & TECHNOLOGY, MADURAI - 625009

(Autonomous)

REGULATIONS – 2021

B. E. CIVIL ENGINEERING (CBCS)

CURRICULUM FOR SEMESTERS I TO VIII

SEMESTER-I

S.No.	Course Code	Course Title	Category	L	T	P	C
1.	21IP101	Induction Programme *(Common to all B.E./B.Tech. Programmes)*	-	0	0	0	0
		THEORY					
2.	21EN101	Professional English – I *(Common to all B.E./B.Tech. Programmes)*	HS	3	2	0	4
3.	21MA101	Matrices and Calculus *(Common to all B.E./B.Tech. Programmes)*	BS	3	2	0	4
4.	21PH101	Engineering Physics *(Common to all B.E./B.Tech. Programmes)*	BS	3	0	0	3
5.	21CH101	Engineering Chemistry *(Common to all B.E./B.Tech. Programmes)*	BS	3	0	0	3
6.	21CS101	Problem Solving and Python Programming *(Common to all B.E./B.Tech. Programmes)*	ES	3	0	0	3
7.		Cambridge Course*	EE	1	0	0	1
		PRACTICAL COURSES					
8.	21CS102	Problem Solving and Python Programming Laboratory *(Common to all B.E./B.Tech. Programmes)*	ES	0	0	4	2
9.	21PC101	Physics and Chemistry Laboratory *(Common to all B.E./B.Tech. Programmes)*	BS	0	0	4	2
		Total Credits					**22**

***Naan Mudhalvan Scheme Course**

J.P. Anie

BoS Chairman

SEMESTER-II

S.No.	Course Code	Course Title	Category	L	T	P	C
		THEORY					
1.	21EN102	English – II *(Common to all B.E./B.Tech. Programmes)*	HS	3	0	0	3
2.	21MA102	Vector Calculus and Complex Variables *(Common to B.E. Civil Engg., EEE & Mechanical Engg.)*	BS	3	2	0	4
3.	21PH102	Physics for Civil Engineering	BS	3	0	0	3
4.	21ME101	Engineering Graphics *(Common to all B.E./B.Tech. Programmes)*	ES	2	0	2	3
5.	21CE101	Construction Materials and Techniques	PC	3	0	0	3
		THEORY WITH PRACTICAL COURSE					
6.	21EE103	Basic Electrical and Electronics Engineering *(Common to B.E. Civil Engg. & Mechanical Engg.)*	ES	3	0	2	4
		PRACTICAL COURSES					
7.	21EM101	Engineering Practices laboratory *(Common to all B.E./B.Tech. Programmes)*	ES	0	0	4	2
8.	21CE102	Computer Aided Building Drawing laboratory	ES	0	0	4	2
		Total Credits					**24**

SEMESTER-III

S.No.	Course Code	Course Title	Category	L	T	P	C
		THEORY					
1.	21MA201	Transforms and Partial Differential Equations *(Common to B.E. Civil Engg., ECE & Mechanical Engg.)*	BS	3	2	0	4
2.	21CE201	Engineering Geology	ES	3	0	0	3
3.	21CE202	Mechanics of Solids	ES	3	0	0	3
4.	21CE203	Water Supply Engineering	PC	3	0	0	3
5.		Microsoft Office Fundamentals*	EE	2	0	0	1
		THEORY WITH PRACTICAL COURSES					
6.	21CE204	Fluid Mechanics	PC	3	0	2	4
7.	21CE205	Surveying and Geomatics	PC	3	0	2	4
		PRACTICAL COURSES					
8.	21CE206	Strength of Materials laboratory	ES	0	0	4	2
9.	21CE207	Internship (1 week) + Seminar #	EE	0	0	0	0
		Total Credits					**24**

 # Will be done during summer vacation

J.P. Devi

BoS Chairman

SEMESTER-IV

S.No.	Course Code	Course Title	Category	L	T	P	C
THEORY							
1.	21MA204	Probability, Statistics and Numerical Methods *(Common to B.E. Civil Engg. & Mechanical Engg.)*	BS	3	2	0	4
2.	21CH103	Environmental Science *(Common to all B.E./B.Tech. Programmes)*	BS	2	0	0	2
3.	21CE208	Strength of Materials	ES	3	0	0	3
4.	21CE209	Wastewater Engineering	PC	3	0	0	3
THEORY WITH PRACTICAL COURSES							
5.	21CE210	Hydraulics and Hydraulic Machinery	PC	3	0	2	4
6.	21CE211	Concrete Technology & Construction Equipments	PC	3	0	2	4
7.	21CE212	Soil Mechanics	PC	3	0	2	4
PRACTICAL COURSES							
8.	21CE213	Survey Camp (2 weeks) &	EE	0	0	2	1
9.	21CE214	Water and Wastewater Analysis Laboratory	PC	0	0	4	2
Total Credits							**27**

***Naan Mudhalvan Scheme Course**

&Will be done during winter vacation

J. P.

BoS Chairman

SEMESTER-V

S.No.	Course Code	Course Title	Category	L	T	P	C
		THEORY					
1.	21CE301	Structural Analysis - I	PC	2	2	0	3
2.	21CE302	Design of Reinforced Cement Concrete Elements	PC	2	2	0	3
3.	21CE303	Foundation Engineering	PC	3	0	0	3
4.	21PCEXX	Professional Elective - I	PE	3	0	0	3
5.	21PCEXX	Professional Elective - II	PE	3	0	0	3
6.		Naan Mudhalvan Scheme Course*	EE	2	0	0	2
7.	21MCC01	Constitution of India	MC	1	0	0	0
		THEORY WITH PRACTICAL COURSE					
8.	21CE304	Highway and Railway Engineering	PC	3	0	2	4
		PRACTICAL COURSES					
9.	21EN301	Professional Communication Laboratory *(Common to all B.E./B.Tech. Programmes)*	HS	0	0	2	1
10.	21CE305	Internship (2 weeks) + Seminar#	EE	0	0	0	1
		Total Credits					**21**

SEMESTER-VI

S.No.	Course Code	Course Title	Category	L	T	P	C
		THEORY					
1.	21CE306	Structural Analysis – II	PC	2	2	0	3
2.	21CE307	Design of Steel Structural Elements	PC	2	2	0	3
3.	21CE308	Estimation, Costing and Valuation Engineering	PC	3	0	0	3
4.	21CE309	Irrigation Engineering	PC	3	0	0	3
5.	21PCEXX	Professional Elective - III	PE	3	0	0	3
6.	21XXXXX	Open Elective – I	OE	3	0	0	3
7.		Naan Mudhalvan Scheme Course*	EE	2	0	0	2
8.	21MCC02	Essence of Indian Traditional Knowledge	MC	1	0	0	0
		PRACTICAL COURSE					
9.	21CE310	Computer Aided Structural Design and Drawing laboratory	PC	0	0	4	2
		Total Credits					**20**

***Building Information Modeling/Design and Construction of Steel Buildings/High Rise Building Design/Transportation Infrastructure-Airports, Metros & Seaports**

 # Will be done during summer vacation

J.P

SEMESTER-VII

S.No.	Course Code	Course Title	Category	L	T	P	C
		THEORY					
1.	21XXXXX	Open Elective – II	OE	3	0	0	3
2.	21XXXXX	Open Elective – III	OE	3	0	0	3
3.	21XXXXX	Open Elective – IV	OE	3	0	0	3
4.		Naan Mudhalvan Scheme Course*	EE	2	0	0	2
		PRACTICAL COURSES					
5.	21CE401	Project Work – I	EE	0	0	4	2
6.	21CE402	Comprehension	PC	0	0	2	1
7.	21OCCEXX	One Credit Course	EE	0	0	2	1
8.	21CE403	Internship (4 weeks) + Seminar #	EE	0	0	0	2
		Total Credits					**15**

SEMESTER-VIII

S.No.	Course Code	Course Title	Category	L	T	P	C
		THEORY					
1.	21PCEXX	Professional Elective – IV	PE	3	0	0	3
2.	21PCEXX	Professional Elective - V	PE	3	0	0	3
		PRACTICAL COURSE					
3.	21CE404	Project Work – II	EE	0	0	20	10
		Total Credits					**16**
							169

****Building Information Modeling/Design and Construction of Steel Buildings/High Rise Building Design/Transportation Infrastructure-Airports, Metros & Seaports**

 # Will be done during summer vacation

J.P. [illegible]

BoS Chairman

SEMESTERWISE CREDIT DISTRIBUTION

	I	II	III	IV	V	VI	VII	VIII	Total Credits
HS	4	3	-	-	1	-	-	-	8
BS	12	7	4	6	-	-	-	-	29
ES	5	11	8	3	-	-	-	-	27
PC	-	3	11	17	13	14	1	-	59
PE	-	-	-	-	6	3	-	6	15
OE	-	-	-	-	-	3	9	-	12
EE	1	-	1	1	1+2*	2*	5+2*	10	19
MC (Non Credit)	-	-	-	-	1	1	-	-	-
TOTAL	**22**	**24**	**24**	**27**	**21**	**20**	**15**	**16**	**169**

*** Naan Mudhalvan Scheme Courses-*Subject to guidelines be provided by Government of Tamil Nadu***

S.No.	Topic
1	Humanities and Social Science including Management(HS)
2	Basic Sciences (BS)
3	Engineering Sciences including Workshop, Drawing, Basics of Civil/Electrical/Mechanical/Computer etc., (ES)
4	Professional Core Courses (PC)
5	Professional Electives: Courses relevant to chosen specialization/branch (PE)
6	Open Electives : Electives from other technical and/or emerging Courses (OE)
7	Project Work , Seminar and Internship in Industry – Employability Enhancement Courses (EE)
8	Mandatory Courses (MC)

J.P. Amil

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL-I: CONSTRUCTION MANAGEMENT AND GEO INFORMATICS

S.No.	Course Code	Course Title	Category	L	T	P	C
1.	21PCE01	Advanced Surveying	PE	3	0	0	3
2.	21PCE02	Remote Sensing and Geographic Information System	PE	3	0	0	3
3.	21PCE03	Engineering Materials for Sustainability	PE	3	0	0	3
4.	21PCE04	Construction Planning and Scheduling	PE	3	0	0	3
5.	21PCE05	Housing Planning and Management	PE	3	0	0	3
6.	21PCE06	Infrastructure Planning and Management	PE	3	0	0	3
7.	21PCE07	Green Building Concepts	PE	3	0	0	3

VERTICAL-II: GEOTECHNICAL

S.No.	Course Code	Course Title	Category	L	T	P	C
1.	21PCE08	Geo Synthetics in Civil Engineering	PE	3	0	0	3
2.	21PCE09	Ground Improvement Techniques	PE	3	0	0	3
3.	21PCE10	Soil Dynamics and Machine Foundation	PE	3	0	0	3
4.	21PCE11	Reinforced Earth Structures	PE	3	0	0	3
5.	21PCE12	Rock Engineering	PE	3	0	0	3
6.	21PCE13	Tunneling Engineering	PE	3	0	0	3
7.	21PCE14	Pile Foundation	PE	3	0	0	3

VERTICAL-III: ENVIRONMENT

S.No.	Course Code	Course Title	Category	L	T	P	C
1.	21PCE15	Industrial Wastewater Management	PE	3	0	0	3
2.	21PCE16	Air and Noise Pollution Control Engineering	PE	3	0	0	3
3.	21PCE17	Solid and Hazardous Waste Management	PE	3	0	0	3
4.	21PCE18	Environmental Impact Assessment	PE	3	0	0	3
5.	21PCE19	Environment, Health and Safety	PE	3	0	0	3
6.	21PCE20	Disaster Management	PE	3	0	0	3
7.	21OCH01	Climate Change and its Impact	PE	3	0	0	3

VERTICAL-IV: STRUCTURES

S.No.	Course Code	Course Title	Category	L	T	P	C
1.	21PCE21	Prestressed Concrete Structures	PE	3	0	0	3
2.	21PCE22	Repair and Rehabilitation of Structures	PE	3	0	0	3
3.	21PCE23	Prefabricated Structures	PE	3	0	0	3
4.	21PCE24	Introduction to Finite Element Method	PE	3	0	0	3
5.	21PCE25	Steel Concrete Composite Structures	PE	3	0	0	3
6.	21PCE26	Bridge Engineering	PE	3	0	0	3
7.	21PCE27	Structural Dynamics and Aseismic Design	PE	3	0	0	3

VERTICAL-V: WATER RESOURCES

S.No.	Course Code	Course Title	Category	L	T	P	C
1.	21PCE28	Ground Water Engineering	PE	3	0	0	3
2.	21PCE29	Hydrology and Water Resources Engineering	PE	3	0	0	3
3.	21PCE30	Participatory Water Resources Management	PE	3	0	0	3
4.	21PCE31	Integrated Water Resources Management	PE	3	0	0	3
5.	21PCE32	River Engineering	PE	3	0	0	3
6.	21PCE33	Coastal Engineering	PE	3	0	0	3
7.	21PCE34	Watershed Conservation and Management	PE	3	0	0	3

VERTICAL-VI: TRANSPORTATION

S.No.	Course Code	Course Title	Category	L	T	P	C
1.	21PCE35	Airports, Docks and Harbor Engineering	PE	3	0	0	3
2.	21PCE36	Pavement Engineering	PE	3	0	0	3
3.	21PCE37	Transportation Planning	PE	3	0	0	3
4.	21PCE38	Urban Planning and Development	PE	3	0	0	3
5.	21PCE39	Intelligent Transport System	PE	3	0	0	3
6.	21PCE40	Planning of Smart Cities	PE	3	0	0	3
7.	21PCE41	Traffic Engineering and Management	PE	3	0	0	3

ONE CREDIT COURSES

S.No.	Course Code	Course Title	Category	L	T	P	C
1.	21OCCE01	STAADPRO – C Cube CADD Academy, Madurai	EE	0	0	2	1
2.	21OCCE02	REVIT ARCHITECTURE – C Cube CADD Academy, Madurai	EE	0	0	2	1
3.	21OCCE03	PRIMAVERA – C Cube CADD Academy, Madurai	EE	0	0	2	1
4.	21OCCE04	GPS Surveying – NPTEL IIT, Roorkee	EE	1	0	0	1
5.	21OCCE05	Visual Communication Design for Digital Media - NPTEL IIT, Roorkee	EE	1	0	0	1
6.	21OCCE06	Design Thinking - A Primer - NPTEL IIT, Madras	EE	1	0	0	1
7.	21OCCE07	Innovation by Design - NPTEL IIT, Bombay	EE	1	0	0	1
8.	21OCCE08	TEKLA STRUCTURES – C Cube CADD Academy, Madurai	EE	0	0	2	1
9.	21OCCE09	ANSYS – C Cube CADD Academy, Madurai	EE	0	0	2	1

J.P. Anb

VELAMMAL COLLEGE OF ENGINEERING & TECHNOLOGY, MADURAI - 625009

(Autonomous)

REGULATIONS – 2021

B. E. CIVIL ENGINEERING

(CHOICE BASED CREDIT SYSTEM)

SYLLABUS FOR SEMESTERS I TO VIII

SEMESTER-I

		L	T	P	C
21IP101	**INDUCTION PROGRAMME** *(Common to all B.E./B.Tech. Programmes)*	**0**	**0**	**0**	**0**

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 fulfil his/her responsibility as an engineer, as a citizen and as a human being. Besides the above, several meta-skills and underlying values are 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".

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 every day 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.

J. P. Anil

BoS Chairman

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 the student 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. This would 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 building things (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 no tests / assessments** during this programme.

REFERENCE:

Guide to Induction Program from AICTE.

21EN101	PROFESSIONAL ENGLISH - I *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

- To develop learners skills in listening and responding effectively.
- To apply basic grammar for better communication.
- To employ reading passages for understanding vocabulary.
- To construct logical sentences and participate in pair presentation, extempore.

- To organize ideas for various compositions in writing.

UNIT I	INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION	15

Listening – 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** - Self Introduction; Introducing a friend; Conversation - Politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form; **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, continuous); Question types: Wh/ Yes or No/ and Tags **Vocabulary** - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II	NARRATION AND SUMMATION	15

Listening - Listening to podcast, anecdotes / stories / event narration; documentaries and interviews with celebrities; **Speaking** - Narrating personal experiences / events; Interviewing a celebrity; Reporting / and summarizing of documentaries / podcasts/ interviews; **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, continuous); Subject-Verb Agreement; and Prepositions; **Vocabulary** - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III	DESCRIPTION OF A PROCESS / PRODUCT	15

Listening - Listen to a product and process descriptions; a classroom lecture; and advertisements about a products; **Speaking** - Picture description; Giving instruction to use the product; Presenting a product; and Summarizing a lecture; **Reading** - Reading advertisements, gadget reviews; user manuals; **Writing** - Writing definitions; instructions; and Product /Process description; **Grammar** - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect, Present and past perfect continuous tenses; **Vocabulary** - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT IV	CLASSIFICATION AND RECOMMENDATIONS	15

Listening - Listening to TED Talks; Scientific lectures; and educational videos; **Speaking** – Small Talk; Mini presentations and making recommendations; **Reading** - Newspaper articles; Journal reports - 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	15

Listening - Listening to debates/ discussions; different viewpoints on an issue; and panel discussions; **Speaking** - Group discussions, Debates, and Expressing opinions through Simulations & Role-play; **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 : 75 PERIODS

COURSE OUTCOMES:

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

CO1: Listen and comprehend complex academic texts.

CO2: Read and infer the denotative and connotative meanings of technical texts.

CO3: Write definitions, descriptions, narrations and essays on various topics.

CO4: Speak fluently and accurately in formal and informal communicative contexts.

CO5: Express their opinions effectively in both oral and written medium of communication.

TEXT BOOKS:

1. Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University. English for Science & Technology. Cambridge University Press, 2021
2. Board of Editors, Department of English, Anna University. English for Engineers & Technologists. Orient Blackswan Private Ltd, 2020.
3. Board of Editors, Department of English, Anna University. Using English Orient Blackswan Private Ltd, 2017.

REFERENCES:

1. Meenakshi Raman & Sangeeta Sharma. Technical Communication – Principles And Practices Oxford University Press, New Delhi, 2016
2. Lakshminarayanan K.R. A Course Book On Technical English. SciTech Publications (India) Pvt. Ltd., 2012
3. Ayesha Viswamohan. English For Technical Communication (With CD). McGraw Hill Education, ISBN: 0070264244. 2008.
4. Kulbhusan Kumar, RS Salaria, Effective Communication Skill. Khanna Publishing House. First Edition, 2018.
5. Dr. V. Chellammal. Learning to Communicate. Allied Publishing House, New Delhi, 2003.

21MA101	MATRICES AND CALCULUS *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To explain the students about differential calculus.
- To demonstrate the functions of several variables technique to solve problems in many engineering branches.
- To demonstrate the various techniques of integration.
- To prepare the student to use mathematical tools in evaluating multiple integrals and their applications.

UNIT I	MATRICES	12
Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues 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**	**12**
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**	**12**
Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications : Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.		
UNIT IV	**INTEGRAL CALCULUS**	**12**
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centres of mass.		
UNIT V	**MULTIPLE INTEGRALS**	**12**
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications: Moments and centres of mass, moment of inertia.		
		TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

CO1: Use the matrix algebra methods for solving engineering problems.

CO2: Apply differential calculus tools in solving various application problems.

CO3: Make use of differential calculus ideas on several variable functions.

CO4: Identify suitable methods of integration in solving practical problems.

CO5: Solve practical problems of areas, volumes using multiple integrals.

TEXT BOOKS:

1. Kreyszig.E, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons, New Delhi, 2016.
2. Grewal.B.S. "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2018.
3. James Stewart, "Calculus: Early Transcendentals", 8th Edition, Cengage Learning, New Delhi, 2015.

REFERENCES:

1. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", 7th Edition,

A. P. Prabhakar

BoS Chairman

Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 2009.
2. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", 5th Edition, Narosa
3. Publications, New Delhi, 2016.
4. Ramana. B.V., "Higher Engineering Mathematics", 6th Edition, McGraw Hill Education Pvt. Ltd, New Delhi, 2010.
5. Thomas. G. B., Hass. J and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2018.

21PH101	ENGINEERING PHYSICS *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To illustrate the students effectively to achieve an understanding of mechanics.
- To infer the students to gain knowledge of electromagnetic waves and its applications.
- To explain the basics of oscillations, optics and lasers.
- To outline the importance of quantum physics.
- To relate 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 vacuum interface 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 – sound waves - 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

BoS Chairman

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 an infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the 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 for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.		
		TOTAL :45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the importance of mechanics.

CO2: Extend their knowledge in electromagnetic waves.

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

CO4: Interpret the importance of quantum physics.

CO5: Summarize quantum mechanical principles towards the formation of energy bands.

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow, "An Introduction to Mechanics", First Edition, McGraw Hill Education, 2017.
2. E.M.Purcell and D.J.Morin, "Electricity and Magnetism", Third Edition, Cambridge University Press, 2013.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, "Concepts of Modern Physics", Seventh Edition, McGraw-Hill, 2017.

REFERENCES:

1. R.Wolfson. "Essential University Physics", Volume 1 & 2. , 1st Edition (Indian Edition) Pearson Education, 2009.
2. Paul A. Tipler, "Physics" - Volume 1 & 2, 1st Edition (Indian Edition), CBS Publishers & Distributors, 2004.
3. K.Thyagarajan and A.Ghatak. "Lasers: Fundamentals and Applications", 2nd Edition, Laxmi Publications, (Indian Edition), 2019.
4. D.Halliday, R. Resnick and J. Walker, "Principles of Physics", 10th Edition (Indian Edition), Wiley, 2015.
5. N.Garcia, A.Damask and S.Schwarz, "Physics for Computer Science Students", 1st Edition, Springer Verlag, 2012.

21CH101	ENGINEERING CHEMISTRY *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To inculcate sound understanding of water quality parameters and water treatment techniques.
- 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 and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of 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, fluoride 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 demineralization 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. **CO_2 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:** H_2-O_2 fuel cell, microbial fuel cell; **Supercapacitors:** Storage principle, types and examples.

TOTAL :45 PERIODS

COURSE OUTCOMES:

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

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

CO2: Identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.

CO3: Apply the knowledge of phase rule and composites for material selection requirements.

CO4: Recommend suitable fuels for engineering processes and applications.

CO5: Recognize different forms of energy resources and apply them for suitable applications in energy 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", 1st Edition, Tata McGraw-Hill Publishing Company Ltd, NewDelhi, 2008.
3. S.S. Dara, "A text book of Engineering Chemistry", 12th Edition, S. Chand Publishing, 2018.

REFERENCES:

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

21CS101	PROBLEM SOLVING AND PYTHON PROGRAMMING *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To describe the basics of algorithmic problem solving.
- To solve problems using Python conditionals and loops.
- To illustrate Python functions and use function calls to solve problems.
- To make use of Python data structures - lists, tuples, and dictionaries to represent complex data.
- To explain 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, and 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, and list; 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-else-if-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 exceptions: 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:

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

CO1: Make use of design approaches to solve computational problems.

CO2: Develop and execute basic Python programs using expressions and input/output statements.
CO3: Utilize strings, functions and control statements to develop real world problems.
CO4: Construct programs using Python data types like lists, tuples and dictionaries.
CO5: Prepare a Python application by incorporating files and exceptions.

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.
3. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc- Graw Hill, 2018.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", 1st Edition, Pearson Education, 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", 3rd Edition, MIT Press, 2021.
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.

21CS102	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS

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 of an 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:

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

CO1: Develop algorithmic solutions to simple computational Problems.

CO2: Illustrate and execute basic Python programs using simple statements.

CO3: Build program for scientific problems using strings, functions and control statements.

CO4: Utilize compound data types lists, tuples and dictionaries for real-time applications.

CO5: Experiment the python packages, files and exceptions for developing software applications.

21PC101	PHYSICS AND CHEMISTRY LABORATORY *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		0	0	4	2

PHYSICS LABORATORY

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS (Any 7 Experiments)

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and 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:

At the end of the course, learners will be able to .

CO1:.Explain the functioning of various physics laboratory equipment.

CO2: Relate the graphical models to analyze laboratory data.

CO3: Interpret mathematical models as a medium for quantitative reasoning and describing physical reality.

CO4: Explain Access, process and analyze scientific information.

CO5: Translate students to solve problems individually and collaboratively.

REFERENCES :

1. Department of Physics, "Physics Laboratory Manual", Velammal College of Engineering & Technology, Madurai, 2021.
2. P. Mani, "Physics Laboratory", Dhanam Publications, 2021.

CHEMISTRY LABORATORY

COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters such as acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electro analytical 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.
- To analyze the quality of coal sample using proximate analysis.

LIST OF EXPERIMENTS (Any 7 Experiments)

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using

the primary standard

2. Determination of types and amount of alkalinity in water sample.
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 :

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

CO1: Analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.

CO2: Determine the amount of metal ions through volumetric and spectroscopic techniques.

CO3: Analyse and determine the composition of alloys.

CO4: Learn simple method of synthesis of nanoparticles.

CO5: Quantitatively analyse the impurities in solution by electro analytical techniques.

TEXT BOOK:

1. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, "Vogel's Textbook of Quantitative Chemical Analysis", 2009.

SEMESTER-II

21EN102	ENGLISH – II *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- To prepare and write convincing job applications and effective reports.
- To demonstrate their speaking skills to make technical presentations and participate in group discussions.
- To apply their Listening skill which will help them comprehend lectures and talks in their areas of specialization
- To choose appropriate soft skills to suit the situation.

UNIT I	INTRODUCTION TO TECHNICAL ENGLISH	9

Listening - Factual and Academic speeches; **Speaking** - Asking for and giving directions - **Reading** - Technical texts from - Newspapers /websites; **Writing** - Statements - Definitions - issue based writing instructions - Checklists - Recommendations; **Vocabulary Development**- technical vocabulary; **Grammar** - Error spotting - Compound words; **Soft skills** - Leadership Skills.

UNIT II	READING AND STUDY SKILLS	9

Listening - Listening to longer technical talks and completing exercises based on them; **Speaking** - Describing a general process; **Reading** - Reading longer technical texts - Identifying the various transitions in a text - Paragraphing; **Writing** - Interpreting charts, graphs; **Vocabulary Development** - Vocabulary used in formal letters/emails and reports **Grammar** - Impersonal passive voice, numerical adjectives - **Soft skills** – Teamwork.

UNIT III	TECHNICAL WRITING AND GRAMMAR	9

Listening - Listening to classroom lectures, talks on engineering /technology; **Speaking** - introduction to technical presentations; **Reading** - longer texts both general and technical, practice in speed reading; **Writing** - Describing a technical process; **Vocabulary Development** - Sequence words - Misspelled words; **Grammar** - Embedded sentences ; **Soft skills** - Decision making.

UNIT IV	JOB APPLICATIONS	9

Listening - Listening to documentaries and making notes. **Speaking** - Mechanics of presentations; **Reading** - Reading for detailed comprehension; **Writing** - Email etiquette - job application - Cover Letter - Resume preparation(via email and hard copy) - Analytical essay writing - **Vocabulary Development** - finding suitable synonyms - paraphrasing; **Grammar** - clauses - If conditionals - **Soft skills** - Time Management.

UNIT V	GROUP DISCUSSION AND REPORT WRITING	9

Listening - TED talks; **Speaking** - Participating in a group discussion - **Reading** - Reading and understanding technical articles; **Writing** - Writing reports - Survey report, accident report and minutes of a meeting - **Vocabulary Development** - Verbal analogies; **Grammar** - reported speech; **Soft skills** - Conflict Resolution.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Interpret by reading information in technical texts.

CO2: Choose appropriate language to write convincing job applications, resume and reports.

CO3: Formulate the technical ideas effectively in spoken and written forms.

CO4: Analyze and understand spoken language in lectures and talks.

CO5: Demonstrate basic soft skills in life.

TEXT BOOKS:

1. Board of Editors, "Fluency in English-A Course Book for Undergraduate Engineers and Technologist", 2nd Edition, Orient BlackSwan Pvt Ltd; Hyderabad, 2018.
2. Jawahar, Jewelcy & Rathna.P. Communicative English Workbook. VRB Publishers Pvt Ltd. Chennai. 2018.
3. Board of Editors, Department of English, Anna University, Chennai, "Mindscapes-English for Technologists and Engineers", 1st Edition, Orient BlackSwan Pvt Ltd; Chennai, 2012.

REFERENCES:

1. Verma, Shalini. Technical Communication for Engineers. Vikas Publishing House Pvt Ltd. New Delhi. 2015
2. Raman, Meenakshi & Sharma, Sangeeta. Technical Communication English Skills for Engineers. Oxford University Press. 2008.
3. Rizvi, Ashraf.M. Effective Technical Communication. MC Graw Hill Education Pvt Ltd. New Delhi. 2016.

		L	T	P	C
21MA102	**VECTOR CALCULUS AND COMPLEX VARIABLES** *(Common to B.E. Civil Engg., EEE & Mechanical Engg.)*	**3**	**2**	**0**	**4**

COURSE OBJECTIVES:

- To explain the students with the concepts of vector calculus needed for problem solving in all engineering disciplines.
- To choose the effective mathematical methods for finding the solutions of partial differential equations.
- To identify and develop the standard techniques of complex variables.
- To apply with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.
- To prepare the student to acquire sound knowledge of techniques in solving ordinary

differential equations that model engineering problems.

UNIT I	VECTOR CALCULUS	12

Gradient , Divergence and Curl – Directional derivation – Irrotational and solenoidal vector fields – Vector integration – Greens theorem in a plane , Gauss Divergence theorem and Stoke's theorem (excluding proof) – Simple applications involving cubes and rectangular parallelepiped.

UNIT II	PARTIAL DIFFERENTIAL EQUATIONS	12

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

UNIT III	ANALYTIC FUNCTIONS	12

Analytic functions – necessary and sufficient conditions for analyticity-properties – Harmonic conjugates- construction of analytic function – conformal mapping –Mapping by functions- Bilinear transformation $w = c + z, az, \frac{1}{z}, z^2$.

UNIT IV	COMPLEX INTEGRATION	12

Complex Integration – Cauchy's integral theorem and integral formula (excluding proof)-Taylor series and Laurent's series –Residues – Cauchy's residue Theorem (excluding proof) – Application of Residue theorem to evaluate real integrals around unit circle and semi- circle (excluding poles on the real axis).

UNIT V	ORDINARY DIFFERENTIAL EQUATIONS	12

Linear equations of second order with constant and variable coefficients-Homogeneous equations of Euler type – Equations reducible to homogeneous form –Variation of parameters-Simultaneous first order with constant coefficients.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the concept of vector calculus which naturally arises in many engineering Problems.

CO2: Solve the Partial Differential Equations by using various techniques.

CO3: Construct an analytic function using the properties of analytic function.

CO4: Apply suitable formula to evaluate the given integral.

CO5: Use a suitable method, solve the given differential equation of first & second order.

TEXT BOOKS:

1. Kreyszig Erwin, "Advanced Engineering Mathematics ", 10th Edition, John Wiley and Sons, New Delhi, 2016.
2. James Stewart, " Calculus: Early Transcendentals", 8th Edition, Cengage Learning New Delhi, 2015.
3. Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson Education, 2018.

REFERENCES:

A. P. Prabakar
BoS Chairman

1. B.S.Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, 2015.
2. P. Kandasamy, Thilagavathy and K.Gunavathy, "Engineering Mathematics Vol-II", 3rd Edition, S. Chand Limited, 2015.
3. P. Kandasamy, Thilagavathy and K.Gunavathy, "Engineering Mathematics Vol-III", 3rd Edition, S. Chand Limited, 2015.

21PH102	PHYSICS FOR CIVIL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To explain the basics of heat transfer through different materials, thermal performance of building and various thermal applications.
- To interpret knowledge on the ventilation and air conditioning of buildings.
- To illustrate the concepts of sound insulation and lighting designs.
- To summarize the processing and applications of new engineering materials.
- To translate 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

Acoustics: Introduction - Reverberation - Growth and decay of sound - Sabine's formula for reverberation time - Determination of sound absorption coefficient - Factors affecting acoustics of 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 - Electro chromic windows.

UNIT IV	NEW ENGINEERING MATERIALS	9

Composites - Definition and classification - Fiber reinforced plastics (FRP) and fiber reinforcedmetals (FRM) - Metallic glasses - Shape memory alloys - Ceramics - Classification - Crystalline -Non Crystalline materials - Properties - thermal, mechanical, electrical and chemical ceramic fibres - Ferroelectric and ferromagnetic ceramics - High Aluminum 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:

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

CO1: Demonstrate the heat transfer through different materials, thermal performance of building and thermal insulation.

CO2: Extend knowledge on the ventilation and air conditioning of buildings.

CO3: Illustrate the acoustic properties of buildings.

CO4: Summarize the processing and applications of composites, metallic glasses, shape memory alloys and ceramics.

CO5: Translate 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", 11th Edition, S Chand & Company, 2010.
3. Hugo Hens, "Building Physics: Heat, Air and Moisture", 1st Edition, Wiley, 2017.

REFERENCES:

1. W.R. Stevens, "Building Physics: Lighting", 1st Edition, Pergamon Press, 2013.
2. Hugo Hens, "Applied Building Physics", 2nd Edition, Wiley, 2016.
3. K.G. Budinski and M.K. Budinski, "Engineering Materials: Properties and Selection", 9th Edition, Pearson Education, 2016.
4. Peter A. Claisse, "Civil Engineering Materials", 1st Edition, Elsevier, 2016.
5. Patrick L. Abbott, "Natural Disasters", 11th Edition, McGraw-Hill, 2017.

21ME101	ENGINEERING GRAPHICS *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To sketch the projection of points, lines and planes.
- To sketch the projection of simple solids.
- To sketch the projection of sectioned solids and development of lateral surfaces.
- To sketch the projection isometric and perspective projections of simple solids.
- To sketch the orthographic projection of various objects using freehand.

UNIT I	PROJECTIONS OF POINTS, LINES AND PLANE SURFACE	12

Importance of graphics in engineering applications – Use of drafting instruments - Lettering and dimensioning.

Introduction to Orthographic projections - Principles -Principal planes-First angle projection. Projection of points located in all quadrants. Projection of straight lines inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method. Projection of planes (regular polygonal and circular surfaces) inclined to both the principal planes by rotating object method. (Not for Examination)		
UNIT II	**PROJECTION OF SOLIDS**	**12**
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.		
UNIT III	**PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**	**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.		
UNIT IV	**ISOMETRIC AND PERSPECTIVE PROJECTIONS**	**12**
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .		
UNIT V	**FREEHAND SKETCHING**	**12**
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. Introduction to drafting packages and demonstration. (Not for examination).		
		TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

CO1: Construct the orthographic projections of points, straight lines and plane surfaces.

CO2: Sketch the orthographic projections in simple solids.

CO3: Sketch the orthographic projections in sectional solids and lateral surfaces of the solids.

CO4: Construct the isometric projections and perspective projections of simple solids.

CO5: Construct the orthographic projection of objects using free hand.

TEXT BOOKS:

1. Natarajan K.V., "A text book of Engineering Graphics", 31st Edition, Dhanalakshmi Publishers, Chennai, 2018.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", 15th Edition, New Age International (P) Limited, 2018.
3. Bhatt N.D. and Panchal V.M., "Engineering Drawing", 53rd Edition, Charotar Publishing House, 2014.

REFERENCES:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", 2nd Edition, Tata McGraw Hill Publishing Company Limited, 2013.
2. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", 2nd Edition, Oxford University, Press, New Delhi, 2015.
3. Shah M.B. and Rana B.C., "Engineering Drawing", 2nd Edition, Pearson, 2009.

21CE101	CONSTRUCTION MATERIALS AND TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To show various materials used in construction.
- To explain the various practices in brick masonry and stone masonry construction, flooring and roofing.
- To compare the different kinds of structural systems and to know energy efficient buildings.
- To identify the various construction techniques and to plan the requirements for substructure construction.
- To plan the methods and techniques of superstructure construction.

UNIT I	STONE – BRICKS - TIMBER	9

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use –Refractory bricks – Concrete blocks – Lightweight concrete blocks - Timber – Market forms – Industrial timber– Plywood – Veneer.

UNIT II	CONSTRUCTION PRACTICES	9

Specifications, details and sequence of activities and construction co-ordination – Site Clearance – marking – Earthwork - masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – Building foundations – basements – centering and shuttering – slip forms – scaffoldings –weather and water proof – roof finishes – acoustics and fire protection.

UNIT III	CONSTRUCTION TECHNIQUES	9

Structural systems - Load Bearing Structure - Framed Structure - Load transfer mechanism –floor system - Development of construction techniques - High rise Building Technology – Seismic effect - Environmental impact of materials – responsible sourcing - Eco Building (Green Building) - Materials used - Construction methods - Natural Buildings - Passive buildings – Intelligent (Smart) buildings - Meaning - Building automation - Energy efficient buildings for various zones.

UNIT IV	SUBSTRUCTURE CONSTRUCTION	9

Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement -Tunnelling techniques – Piling techniques - well and caisson - sinking cofferdam – driving diaphragm walls, sheet piles - shoring for deep cutting – well points - Dewatering and stand by Plant equipment for underground open excavation.		
UNIT V	**SUPERSTRUCTURE CONSTRUCTION**	**9**
Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ prestressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space decks.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Compare the properties of most common and advanced building materials.

CO2: Outline the various practices in brick masonry and stone masonry construction, flooring and roofing.

CO3: Classify the different kinds of structural systems and to know energy efficient buildings.

CO4: Illustrate the various construction techniques and to plan the requirements for substructure construction.

CO5: Explain the methods and techniques of superstructure construction.

TEXT BOOKS:

1. Varghese.P.C, "Building Materials", 2nd Edition, PHI Learning Pvt. Ltd, New Delhi, 2015.
2. Schexnayder, Clifford J.; Shapira, Aviad; Schmitt, Robert; Peurifoy, Robert, "Construction Planning, Equipment and Methods", 9th Edition, McGraw Hill, Singapore, 2021.
3. Arora S.P. and Bindra S.P., "A Textbook of Building Construction", 2nd Edition, Dhanpat Rai and Sons, 2014.
4. Varghese, P.C. "Building construction", 2nd Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2016.

REFERENCES:

1. Jagadish.K.S, "Alternative Building Materials Technology", 2nd Edition, New Age International, 2017.
2. Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publishers, 2008.
3. Sharma S.C. "Construction Equipment and Management", 2nd Edition, Khanna Publishers New Delhi, 2019.

		L	T	P	C
21EE103	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING** (Theory with Practical Course) *(Common to B.E., Civil Engg. & Mechanical Engg.)*	**3**	**0**	**2**	**4**

COURSE OBJECTIVES:

- To outline the basics of electric circuits and analysis.
- To classify wires and domestic wiring.
- To summarize the working principles and application of electrical machines.
- To outline the characteristics of semiconductor devices.
- To explain the functional elements and working of 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.

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 - safety precautions and First Aid.

UNIT III	ELECTRICAL MACHINES	9

Construction and Working principle- DC Separately and Self excited Generators, Types and Applications. Working Principle of DC motors, Types and Applications. Construction, Working principle and Applications of Transformer, working of Three phase Alternator and Three Phase Induction Motor.

UNIT IV	ANALOG & DIGITAL ELECTRONICS	9

Resistor, Inductor and Capacitor in Electronic Circuits- Silicon &Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, Rectifier.

Review of number systems, binary codes, Combinational logic - representation of logic functions.

UNIT V	INSTRUMENTATION SYSTEM	9

Classification of instruments – Operating Principles of indicating Instruments and Digital Energy meter. Strain gauge, LVDT, differential pressure transducer, optical and digital transducers, Smart sensors, Thermal Imagers.

	TOTAL: 45 PERIODS

PRACTICAL COURSE	15

List of Experiments

1. Verification of Ohms Laws
2. Verification of Kirchhoff's Laws
3. Residential Wiring
4. Load test on DC Shunt Motor
5. Characteristics of PN Diode
6. Characteristics of Zener Diode
7. Ripple factor calculation for half wave rectifier
8. Measurement of displacement of LVDT

	TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1. Summarize the electric circuit parameters for simple problems.

CO2: Outline the safety precautions in electrical installation.

CO3. Explain the working principle and applications of electrical machines.

CO4. Show VI characteristics of semiconductor devices.

CO5. Demonstrate the types and operating principles of sensors and transducers.

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", 2nd Edition,McGraw Hill Education, 2020
2. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", 2nd Edition, Pearson Education, 2017.
3. Sedha R.S., "A textbook book of Applied Electronics", S. Chand & Co., 2008
4. James A .Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley, 2018.
5. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements &Instrumentation', Dhanpat Rai and Co, 2015.

REFERENCES:

1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", 4th Edition, McGraw HillEducation, 2019.
2. Thomas L. Floyd, "Digital Fundamentals", 11th Edition, Pearson Education, 2017.
3. Albert Malvino, David Bates, "Electronic Principles", 7th Edition, McGraw Hill Education, 2017.
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGrawHill, 2002.
5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

21EM101	ENGINEERING PRACTICES LABORATORY *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To draw 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.
- To demonstrate the basic switch board wiring, fluorescent lamp wiring and stair case wiring using various electrical components.
- To choose various joints in steel plates using arc welding work and machining various simple processes like turning, drilling, tapping in parts
- To build a tray out of metal sheet using sheet metal work.
- To develop electronic circuit and testing for soldering and desoldering using PCB board.

LIST OF EXPERIMENTS

GROUP – A (CIVIL & ELECTRICAL)

PART I

CIVIL ENGINEERING PRACTICES

PLUMBING WORK:

- Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
- Preparing plumbing line sketches.
- Laying pipe connection to the suction side of a pump.
- Laying pipe connection to the delivery side of a pump.
- Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

- Sawing.

Planning and Making joints like T-Joint, Cross lap and Dovetail joint.

PART II

ELECTRICAL ENGINEERING PRACTICES

- Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket.
- Staircase wiring.
- Fluorescent Lamp wiring with introduction to CFL and LED types.
- Energy meter wiring and related calculations/ calibration.
- Study of Iron Box wiring and assembly.
- Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac).
- Measurement of resistance to earth of electrical equipment.

GROUP – B (MECHANICAL & ELECTRONICS)

PART III

MECHANICAL ENGINEERING PRACTICES

WELDING WORK:

- Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
- Practicing gas welding.

BASIC MACHINING WORK:

- Usage of Spanners and screw drivers
- Facing and Turning.
- Taper Turning.

ASSEMBLY WORK:

- Assembling a centrifugal pump.
- Assembling a household mixer.
- Assembling an air conditioner.

SHEET METAL WORK:

- Making of a square tray.

FOUNDRY WORK:

- Demonstrating basic foundry operations.

PART IV

ELECTRONIC ENGINEERING PRACTICES

SOLDERING WORK:

- Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

- Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

- Study elements of smart phone.
- Assembly and dismantle of computer / laptop.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Build various plumbing joints.

CO2: Develop various carpentry joints.

CO3: Construct various wiring electrical joints in common household electrical wire work.

CO4: Construct various welded joints, sheet metal and basic machining operations.

CO5: Develop the electronic circuit for soldering and testing using PCB board.

21CE102	COMPUTER AIDED BUILDING DRAWING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To sketch the plan of the Load bearing Buildings.
- To construct the plan of Multi-storey Buildings.
- To develop the 3D view of Residential Buildings.
- To plan the elevation and cross section of doors windows and staircase.
- To prepare the elevation and sectional views of the Industrial Buildings.

LIST OF EXPERIMENTS

Drafting using AutoCAD software

1. Single storey residential building (load bearing wall structure and framed structure) - Plan, Elevation and Section.
2. Multi-storey residential building (load bearing wall structure and framed structure) - Plan, Elevation and Section.
3. 3D view of a residential building.
4. Fully panelled door / partly glazed and wooden panelled door – Elevation and cross section.
5. Fully panelled window / fully glazed window – Elevation and cross section.
6. Dog legged staircase – Plan and Elevation.

7. Elevation of different types of roof truss members (King post and Queen post).
8. Residential building- Plan, Elevation and Section.
9. Multi-storey building with roof truss member - Plan, Elevation and Section.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

CO1: construct the detailed building plan, elevation and sectional views of the Load bearing structure of buildings.

CO2: plan the detailed building plan, elevation and sectional views of the framed buildings.

CO3: develop the detailed elevation and sectional views of the Panelled Door and Window.

CO4: sketch the detailed elevation and sectional views of the Dog legged staircase.

CO5: outline the detailed building plan, elevation and sectional views of the industrial structures.

TEXT BOOKS:

1. Bhat N. D. and Panchal V. M., "Engineering Drawing Plane and Solid Geometry", 53rd Edition, Charotar Publishing House, 2019.
2. Ashit Bajaj and Mamta Kataria., "Building Drawing (Civil Engineering Drawing-I)", 1st Edition, North Publication, 2020.
3. Bhavikatti S.S and Chitawadagi M.V., "Building Planning and Drawing", 1st Edition, Dreamtech Press India Pvt. Ltd, 2019.

REFERENCES:

1. Rangwala., "Civil Engineering Drawing", 3rd Edition, Charotar Publishing House Pvt. Ltd.; 2019.
2. Jeyapoovan T., "Engineering Drawing & Graphics Using Autocad", 3rd Edition, Vikas Publishing House Pvt Ltd, 2019.
3. Sikka V.B., "A Course in Civil Engineering Drawing", 4th Edition, S.K.Kataria and Sons, 2015.

BoS Chairman

SEMESTER-III

21MA201	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS *(Common to B.E. Civil Engg., ECE & Mechanical Engg.)*	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

- To use various methods of Laplace transforms for efficiently solving the problems that occur in various branches of engineering disciplines.
- To identify Fourier series which is essential to many applications in engineering.
- To explain the mathematical tools for the solutions of partial differential equations that model several physical processes.
- To explain the student with Fourier transform techniques used in wide variety of situations.
- To develop Z transform techniques to solve difference equations for discrete time systems.

UNIT I	LAPLACE TRANSFORM	12

Laplace transform- conditions for existence –Transform of elementary functions –Basic properties – First shifting theorem –Transform of derivatives on $t\,f(t), f(t)/t$ and periodic functions-Transform of unit step function and impulse functions. Inverse Laplace transform by partial function method and convolution theorem (excluding proof)-Initial and finial value theorems-Solutions of linear ODE of second order with constant coefficients using Laplace transform techniques.

UNIT II	FOURIER SERIES	12

Dirichlet's conditions – General Fourier series odd and even functions – Half range sine series – half range cosine series – Parseval's identity – Harmonic Analysis.

UNIT III	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	12

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

UNIT IV	FOURIER TRANSFORMS	12

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

UNIT V	Z - TRANSFORMS AND DIFFERENCE EQUATIONS	12

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

TOTAL : 60 PERIODS

OUTCOMES:

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

CO1: Calculate Laplace transform and inverse Laplace transform of different functions.

CO2: Express the Fourier series expansion to represent the given function in the given interval.

CO3: Classify the second order PDE and to know about solving initial and final value problems.

CO4: Apply Fourier transform techniques to evaluate the given integral.

CO5: Solve the given difference equations using Z-transforms.

TEXT BOOKS:

1. Kreyszig Erwin, "Advanced Engineering Mathematics ", 10th Edition, John Wiley and Sons, New Delhi, 2016.
2. Peter V.O. Neil "Advanced Engineering Mathematics", 7th Edition, Cengage, New Delhi, 2012.
3. Glyn James, "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, 2016.

REFERENCES:

1. Grewal.B.S. "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2018.
2. Wylie C. R. and Barrett L. C "Advanced Engineering Mathematics", 6th Edition, Tata McGraw-Hill, New Delhi, 2012.
3. Datta K.B., "Mathematical Methods of Science and Engineering", 2nd Edition, Cengage Learning India Pvt Ltd, Delhi, 2013.

21CE201	ENGINEERING GEOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To use the importance of geological knowledge and the action of various geological agencies.
- To explain the properties of minerals.
- To classify the types of rocks, their distribution and uses.
- To illustrate the study of geophysical methods on geological structure.
- To identify the application of geological investigation in Civil Engineering projects.

UNIT I	PHYSICAL GEOLOGY	9

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

UNIT II	MINERALS OF THE EARTH'S CRUST	9

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

UNIT III	ROCKS OF THE EARTH'S CRUST	9

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

UNIT IV	STRUCTURAL GEOLOGY AND GEOPHYSICAL METHOD	9

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

UNIT V	GEOLOGY FOR ENGINEERING PROJECTS	9

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the importance of geological knowledge and the action of various geological agencies.

CO2: Interpret the properties of minerals.

CO3: Compare the types of rocks, their distribution and uses.

CO4: Outline the geological structure by using geophysical methods.

CO5: Make use of the application of geological investigation in projects such as dams, tunnels, bridges, roads, airport and harbour and the remote sensing applications in Civil Engineering.

TEXT BOOKS:

1. Varghese, P.C., "Engineering Geology for Civil Engineers", 1st Edition, Prentice Hall of India Learning Private Limited, New Delhi, 2012.
2. Venkat Reddy. D "Engineering Geology", 2nd Edition, Vikas Publishing House Pvt. Ltd, 2017.
3. Bangar K.M, "Principles of Engineering Geology", 1st edition, McGraw Hill Education, 2017.
4. Parbin Singh. A "Text book of Engineering and General Geology", 8th Edition, S.K. Kataria & Sons 2022.

REFERENCES:

1. Blyth F.G.H. and de Freitas M.H., "A Geology for Engineers", 7th Edition, Edward Arnold, London, 2010.
2. Bell .F.G. "Fundamentals of Engineering Geology", B.S. Publications, Hyderabad, 2011.
3. Chenna Kesavulu N. "Textbook of Engineering Geology", 2nd Edition, Macmillan India Ltd., 2009.

21CE202	MECHANICS OF SOLIDS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To calculate resultant, resolve several concurrent forces and also to apply equilibrium concepts.
- To solve the friction and the effects by the laws of friction and rigid body kinetics.
- To relate fundamental concepts of Stress, Strain and deformation of solids.
- To identify the mechanism of load transfer in beams, the induced stress resultants and deformations.
- To interpret complex two dimensional state of stress and plane trusses.

UNIT I	BASICS OF STATICS	9

Forces – Systems of forces - Concurrent forces in plane and space - Resultant - Problems involving

the equilibrium of a particle-free body diagram-equilibrium of particle in space - Varignon's theorem, external and internal forces, free body diagram, requirements of equilibrium of a rigid body.		
UNIT II	**FRICTION AND RIGID BODY KINETICS**	**9**
Laws of friction - coefficient of friction - problems involving dry friction - wedge & ladder friction – Newton's II law – D'Alembert's principle - Energy - potential energy - kinetic energy - conservation of energy - Work done by a force - work energy method.		
UNIT III	**SIMPLE STRESSES AND STRAINS**	**9**
Stress and strain due to axial force – Elastic limit – Hooke's law – Factor of safety – Stepped bars - uniformly varying sections – composite bar – stresses due to temperature - Stress-strain diagram for mild - steel - Lateral strain – Poisson's ratio – Volumetric strain – changes in dimensions and volume – shear stress – shear strain – Relationship between elastic constants – changes in dimensions and volume.		
UNIT IV	**DETERMINATE STRUCTURE**	**9**
Relationship between load, shear force and bending moment – shear force and bending moment diagrams for cantilever, simply supported and overhanging beams under concentrated loads, uniformly distributed loads, uniformly varying loads and moment - Maximum bending moment and point of contraflexure - Force in members of a truss by Method of Joints, Method of Sections - Tension coefficient method.		
UNIT V	**GEOMETRIC PROPERTIES, SHEAR AND BENDING IN BEAMS**	**9**
Centroid of areas, composite areas, determination of moment of inertia of plane figures, polar moment of inertia - radius of gyration – mass moment of inertia of simple solids - Bending stresses in various sections (Rectangular, circular, flanged, angle, and channel cross-sections) - Flitched beams - Shear stress in various sections (Rectangular, circular, flanged, angle, and channel cross-sections).		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Calculate resultant, resolve several concurrent forces and also to apply equilibrium concepts.

CO2: Solve the friction and the effects by the laws of friction and rigid body kinetics.

CO3: Calculate simple stresses and strains in bars and composite materials.

CO4: Construct shear force and bending moment diagrams in determinate structure.

CO5: Make use of geometric properties of sections and to determine the shear stress, bending stress and plot its variation across the section.

TEXT BOOKS:

1. Vela Murali, "Engineering Mechanics", 2nd Edition, Oxford University Press (2018).
2. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.
3. Rajput R.K. "Strength of Materials (Mechanics of Solids)", 7th Edition, S.Chand & company Ltd., New Delhi, 2018.

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4. Rattan.S.S., "Strength of Materials", 3rd Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2017.
5. Bansal. R.K. "Strength of Materials (Mechanics of Solids)", 6th Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2020.

REFERENCES:

1. Bhavikatti S.S, "Engineering Mechanics", 7th edition, New Age Publishers Pvt Ltd., 2019.
2. Khurmi R. S., "Engineering Mechanics", 22nd edition, S Chand & Co Ltd., 2019.
3. Gambhir.M.L, "Fundamentals of Solid Mechanics", 1st edition, PHI Learning Private Limited., New Delhi, 2009.
4. Hibbeler R.C, "Mechanics of Materials", 9th Edition, Pearson Education., 2018.
5. Mubeen Abdul, "Mechanics of Solids", 2nd Edition, Pearson Education India, 2011.
6. Vaishwanar R and Shashi Bhushan Jha, "Mechanics of Solids", 8th Edition, science technology, 2020.

21CE203	WATER SUPPLY ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To calculate the total water demand for a town/city.
- To identify suitable sources of water to meet the demand and to design the conduits for transportation of water.
- To use the characteristics of different sources of water and to design an appropriate treatment system for the water available at the source.
- To relate the recent advances in water treatment units.
- To construct a water distribution system for a community.

UNIT I	WATER DEMAND ESTIMATION	9

Importance and need for planned water supplies - water demand – types and factors affecting per capita demand - variation in demand – Design periods - population forecasting – different methods.

UNIT II	SOURCES OF WATER, INTAKES AND TRANSPORT OF WATER	9

Sources of water - Surface sources - ponds, lakes, streams, rivers - Ground water sources - occurrence, aquifers and their types – Wells - open wells, Tube wells - springs and their types - Infiltration galleries - Infiltration wells - Intakes and their types. Transport of water - hydraulic design of pressure pipe - Pipe materials - pipe joints - pipe appurtenances, testing of pipe line - Pumps for lifting water – types.

UNIT III	QUALITY ASSESSMENT AND WATER TREATMENT	9

Quality of water – Physical quality, chemical quality and biological quality – significance - water borne diseases -Water quality standards – Case Studies - Screening - Sedimentation – theory, types of settling, Stokes law - Coagulation - flocculation - Jar test – design of sedimentation tank - Filtration – removal mechanisms, filter media, types, slow sand, rapid sand and pressure filters, filter design. Disinfection – methods. Chlorination – action, factors influencing, free chlorination,

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BoS Chairman

combined chlorination – ozonation, UV radiation.		
UNIT IV	**ADVANCED WATER TREATMENT**	**9**
water softening – Desalination – Reverse Osmosis - demineralization – Adsorption - Ion exchange – Membrane Systems - RO Reject Management - Iron and Manganese removal - Defluoridation - Construction and Operation & Maintenance aspects – Recent advances - MBR process - water treatment practices in rural areas.		
UNIT V	**WATER DISTRIBUTION AND SUPPLY**	**9**
Distribution systems – requirements, layouts and methods - Distribution reservoirs – storage capacity, mass curve method - Leak detection - Analysis of distribution network - Hardy Cross method - Water supply system in buildings – house service connection, pipe fittings & fixtures, storage tanks, piping systems – Systems of plumbing.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Calculate the total water demand for a town/city.

CO2: Identify suitable sources of water to meet the demand and design the conduits for transportation of water from the source to treatment plant and to the city.

CO3: Make use of the physical, chemical and biological characteristics of different sources of water and design appropriate treatment systems.

CO4: Demonstrate the recent advances in water treatment units.

CO5: Plan a water distribution system for an individual building and for a community.

TEXT BOOKS:

1. Garg, S.K. "Environmental Engineering, Vol I", 35th Edition, Khanna Publishers, New Delhi, 2021.
2. Modi, P.N., "Water Supply Engineering, Vol.I", 6th Edition, Standard Book House, New Delhi, 2018.
3. Punmia, B.C., Ashok Jain and Arun Jain, "Water Supply Engineering", 2nd Edition, Laxmi Publications (P) Ltd., New Delhi, 2014.

REFERENCES:

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2. IS10500:2012, "Water Quality Standards", New Delhi 2012.
3. IS SP 35, "Handbook on water supply and drainage (with special emphasis on plumbing)", 1987
4. Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 3rd Edition, Pearson New International Edition, 2013.
5. Steel E.W., "Water Supply and sewerage", 5th Edition, McGraw Hill Publishers, New Delhi, 2013.
6. Peavy, Rowe, Tchobanoglous, "Environmental Engineering", 1st Edition, McGraw Hill Publishers, New Delhi, 2017.

J.P. Anil

BoS Chairman

21CE204	FLUID MECHANICS (Theory with Practical Course)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To develop knowledge on fluids in static, kinematic and dynamic equilibrium.
- To analyze the kinematics of fluid flow and problems related to equation of motion.
- To illustrate dimensional and model analysis.
- To categorize types of flow and losses of flow in pipes.
- To solve the boundary layer problems.

UNIT I	FLUID PROPERTIES AND FLUID STATICS	9

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

UNIT II	FLUID KINEMATICS AND DYNAMICS	9

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

UNIT III	DIMENSIONAL ANALYSIS AND MODEL STUDIES	9

Fundamental dimensions - dimensional homogeneity - Rayleigh's method and Buckingham Pitheorem- dimensionless parameters - similitudes and model studies - distorted models.

UNIT IV	FLOW THROUGH PIPES	9

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

UNIT V	BOUNDARY LAYER	9

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

	TOTAL : 45 PERIODS

PRACTICAL COURSE	30

List of Experiments

A. Flow Measurement

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

B. Losses in Pipes

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BoS Chairman

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

C. Determination of Metacentric height

7. Determination of Metacentric height of floating bodies

TOTAL : 75 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the basic knowledge of fluids in static, kinematic and dynamic equilibrium.

CO2: Solve problems related to kinematics of fluid flow and equation of motion.

CO3: Identify and solve dimensional and model analysis on fluid flow problems.

CO4: Associate the types of flow and estimate losses of flow in pipes.

CO5: Use the boundary layer problems in fluid flow.

TEXT BOOKS:

1. Modi P.N and Seth "Hydraulics and Fluid Mechanics including Hydraulic Machines", 21st Edition, Standard Book House New Delhi, 2017.
2. Jain.A.K.., "Fluid Mechanics" (Including Hydraulic Machines), 12th Edition, Khanna Publishers, 2016.
3. Subramanya.K, "Fluid Mechanics and Hydraulic Machines", 2nd Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2019.
4. Rajput.R.K. "Fluid Mechanics", 5th Edition, S.Chand and Co, New Delhi, 2014.

REFERENCES:

1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", 9th Edition, McGraw Hill, 2003.
2. Fox W.R. and McDonald A.T. Mitchell W.J., Introduction to Fluid Mechanics", 10th Edition, Wiley, America, 2021.
3. White, F.M., "Fluid Mechanics", Tata McGraw Hill, 5th Edition, New Delhi, 2017.
4. Bansal.R.K., "Fluid Mechanics and Hydraulic Machines", 10th Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2019.

21CE205	SURVEYING AND GEOMATICS (Theory with Practical Course)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To explain the fundamental concepts and to plot by conventional surveying.
- To identify the elevation of various points and its applications.
- To analyze the horizontal and vertical measurements by tachometer.
- To compare the various methods of geodetic control surveying.
- To examine the advanced surveying practices.

UNIT I	FUNDAMENTALS OF CONVENTIONAL SURVEYING	9

Classifications and basic principles of surveying - Equipment and accessories for ranging and chaining - Methods of ranging-Obstacles in chaining and errors in chaining - Compass - Types of

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Compass - Basic Principles- Bearing – Types - True Bearing - Magnetic Bearing - Local attraction and magnetic declination - Computation of compass traverse. Study of accessories and setting up of plane table-Radiation and intersection method - Three point and two point problem.

UNIT II	LEVELLING AND ITS APPLICATIONS	9

Levelling- Principles and theory of Levelling – Datum- - Bench Marks – Temporary and Permanent Adjustments- Methods of Levelling- Booking – Reduction - Sources of errors in Levelling - Curvature and refraction-Longitudinal and cross sectioning-Contour – Contouring – Characteristics of contours – Methods of contouring -Drawing contours and uses of contour maps-Calculation of areas and volumes by mid-ordinate, average ordinate trapezoidal and Simpson's methods.

UNIT III	THEODOLITE AND TACHEOMETRIC SURVEYING	9

Components of transit theodolite and its adjustments- Horizontal and vertical angle measurements - Heights and distances by trigonometry-Tacheometer - Stadia Constants - Analytic Lens -Tangential and Stadia Tacheometry –Tacheometric contouring.

UNIT IV	CONTROL SURVEYING AND ADJUSTMENTS	9

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

UNIT V	GEOMATICS	9

Total Station: Advantages - Fundamental quantities measured - Parts and accessories - working principle - On board calculations - Field procedure - Errors and Good practices in using Total Station. GPS Surveying: Different segments - space, control and user segments - satellite configuration - signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability. Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People. Introduction to Drone Surveying.

TOTAL : 45 PERIODS

PRACTICAL COURSE **30**

List of Experiments:

S.No.	Experiment	Conventional method	Modern Method
1	Determination of area of an enclosed boundary	Chain offset and Compass surveying	Total Station
2	Determination of elevation of points on the ground	Dumpy level	Total Station
3	Determination of elevation of tower	Theodolite –Single lane method	Total Station
4	Determination of gradient between two points	Stadia and Tangential tacheometry	Total Station

TOTAL : 75 PERIODS

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BoS Chairman

COURSE OUTCOMES:

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

CO1: prepare the map by understanding the concept of chain surveying, compass surveying and plane table surveying.

CO2: sketch the relative position of points on the earth surface using levelling principles and its application.

CO3: compare distance, elevation and gradient between inaccessible objects using tacheometric principle.

CO4: explain the concept of geodetic surveying and its application in Civil engineering field.

CO5: survey the importance of advanced techniques in contemporary surveying practice.

TEXT BOOKS:

1. Kanetkar.T.P and Kulkarni.S.V, "Surveying and Levelling", Parts 1, 1st Edition, Pune Vidyarthi Griha Prakashan, Pune, 2006.
2. Kanetkar.T.P and Kulkarni.S.V, "Surveying and Levelling", Parts 2, 1st Edition, Pune Vidyarthi Griha Prakashan, Pune, 2008.
3. Punmia.B.C., Ashok K.Jain and Arun K Jain , "Surveying Vol. I & II", 17th edition, Lakshmi Publication Pvt Ltd, New Delhi, 2016.
4. Bannister and S. Raymond, "Surveying", 7th Edition, Longman 2004.
5. Satheesh Gopi, Ra.Sathishkumar and N. Madhu, "Advanced Surveying: Total Station, GPS, GIS & Remote Sensing", 2nd Edition, Pearson education, 2017.

REFERENCES:

1. Alfred Leick, "GPS satellite surveying", 3rd Edition, John Wiley & Sons Inc., 2004.
2. Guocheng Xu, "GPS Theory, Algorithms and Applications", 3rd edition, Springer – Berlin, 2018.
3. Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India.2010.
4. James M. Anderson and Edward M. Mikhail, "Surveying, Theory and Practice", 7th Edition, McGraw Hill, 2001.

21CE206	STRENGTH OF MATERIALS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To examine the tension and compression strength of different materials.
- To analyze the shear and torsion value of mild steel rod.
- To compare the impact and hardness value of different materials.
- To estimate modulus of elasticity of metal beam by deflection test.
- To test for the compression and deflection value of springs.

LIST OF EXPERIMENTS

1. Tension test on steel rod
2. Compression test on wood
3. Double shear test on metal

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4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

CO1: examine the tension and compression strength of different materials.

CO2: calculate the shear and torsion value of mild steel rod.

CO3: point out the impact and hardness value of different materials.

CO4: interpret modulus of elasticity of metal beam by deflection test.

CO5: demonstrate the compression and deflection value of springs.

REFERENCE:

1. IS1786-2008 "High strength deformed bars and wires for concrete reinforcement – Specification", (Fourth Revision, Reaffirmed 2013).

21CE207	INTERNSHIP+SEMINAR (During II Semester Summer Vacation for 1 week)	L	T	P	C
		0	0	0	0

COURSE OBJECTIVES:

- To take part in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks.
- To develop skills in facing and solving the field problems.

STRATEGY:

- The students individually undertake training in Construction Sites on basic material testing & properties and good construction practices in the field 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, learners will be able to

CO1: Relate implementation textbook knowledge into practice.

CO2: Identify the concepts of developments and implementation of new techniques.

SEMESTER IV

21MA204	PROBABILITY, STATISTICS AND NUMERICAL METHODS *(Common to B.E., Civil Engg. & Mechanical Engg.)*	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

- To describe the necessary basic concepts in probability
- To explain the concept of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To discuss the basic concepts of solving algebraic and transcendental equations and numerical techniques of integration which plays an important role in engineering and technology disciplines.
- To describe various techniques and methods of solving ordinary differential equations.
- To explain various techniques and methods of solving partial differential equations.

UNIT I	PROBABILITY	12

Introduction-Sample Spaces and Events-Axioms of Probability-Interpretations and Properties of Probabilities-Conditional Probabilities-Baye's theorem- Independence.

UNIT II	TESTING OF HYPOTHESIS	12

Large sample test based on Normal distribution for single mean and difference of means – Tests based on t, $\chi 2$ and F distributions for testing means and variances – Contingency table (Test for Independency) – Goodness of fit.

UNIT III	SOLUTION OF EQUATIONS AND NUMERICAL INTEGRATION	12

Newton Raphson method – Solution of linear system of equations: Gauss elimination method – Pivoting – Gauss Jordan method – Gauss Seidel method – Numerical integration by Trapesoidal and Simpon's rule.

UNIT IV	NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS	12

Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method for solving first order equation – Milne's Predictor and Corrector method – Adam's Bashforth predictor – corrector method for solving first order equation.

UNIT V	BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS	12

Finite difference methods for solving second order two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit methods – One dimensional wave equation by explicit method.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

CO1: Use the basic concepts of Probability and Random variables.

CO2: Explain the test of hypothesis for small and large samples by using various tests like t-test, F-

test, Z-test and $\chi 2$ test.
CO3: Apply a suitable method to solve algebraic and transcendental equations.
CO4: Explain the knowledge of various techniques and methods for solving first and second order 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. JAY.L. Devore, "Probability and Statistics for Engineering and the Science", 8th Edition, Cengage Learning, 2012.
2. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis", 7th Edition, Pearson Education, Asia, New Delhi, 2006.
3. Johnson, R.A., Miller, I and Freund J, "Probability and Statistics for Engineers", 8th Edition, Pearson Education, Asia, 2015.

REFERENCES:

1. S.C.Gupta, V.K.Kapoor, "Fundamentals of Mathematical Statistics", 11th Edition, Sultan Chand & Sons, 2015.
2. Chapra. S.C. and Canale. R.P, "Numerical Methods for Engineers", 5th Edition, Tata McGraw Hill, New Delhi, 2007.
3. S.K.Gupta, "Numerical Methods for Engineers", 7th Edition, New age international private Ltd publishers, 2015.

21CH103	ENVIRONMENTAL SCIENCE *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- To describe the structure and function of an ecosystem and biodiversity
- To interpret the environmental impacts of natural resources.
- To demonstrate causes, effects and control measures of different types of pollution.
- To manipulate the importance of disaster management, environmental ethics and values.
- To dramatize the important social issues and sustainable practices.

UNIT I	ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY	6

Multidisciplinary nature of environmental studies - ecosystem- general structure and function of an ecosystem- ecological succession-biodiversity-types-values of biodiversity- endangered and endemic species-red data book- hot spots of biodiversity-criteria- hot spots in India-threats to biodiversity(man-animal conflicts, habitat loss, poaching)-case studies-conservation of biodiversity-in-situ and ex-situ conservation.

UNIT II	NATURAL RESOURCES AND ITS ENVIRONMENTAL IMPACTS	6

Natural resources-forest resource-ecological functions – causes, effects and control measures of deforestation-water resource-sources-conflict over water-dams benefits and problems-food resource-overgrazing- impacts of over grazing- impacts of modern agriculture-energy resource-environmental impacts of wind mills and solar panels- role of an individual in conservation of natural resources.

UNIT III	ENVIRONMENTAL POLLUTION AND CONTROL	6
Air pollution-causes, effects and control methods - water pollution- causes, effects-waste water treatment-soil pollution-causes, effects-solid waste management–e-waste- causes, effects and management-Pollution control acts-air(prevention and control of pollution) act,1981-water(prevention and control of pollution) act,1974- wildlife (protection) act,1972 - e-waste management rules,2016-case studies - role of an individual in control of pollution.		
UNIT IV	**DISASTER MANAGEMENT AND ENVIRONMENTAL ETHICS**	**6**
Disaster management-causes, effects and management of- flood, landslide, earthquake and tsunami-case studies- environmental ethics- value education-traditional value systems in India-water conservation-rain water harvesting-watershed management.		
UNIT V	**SOCIAL ISSUES AND SUSTAINABLE PRACTICES**	**6**
Unsustainable development- social issues-climate change-causes, effects and control measures-global warming-causes, effects and control measures-Acid rain-causes, effects and control measures-ozone layer depletion-causes, effects and control measures-nuclear accident and holocausts-EIA-Sustainable development-goals-target- green buildings- ISO 14000 series.		
		TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will able to

CO1: Explain the concept, structure and function of an ecosystem and biodiversity.

CO2: Demonstrate the environmental impacts of natural resources.

CO3: Illustrate the suitable management method for pollution control.

CO4: Relate the proper way of managing disaster with environmental ethics.

CO5: Apply social issues and adopt suitable sustainable practices.

TEXT BOOKS:

1. Kaushik,A & Kaushik.C.P, "Environmental Science and Engineering", 6th Edition, New Age International, 2018.
2. Garg S.K & Garg, Ecological and Environmental studies, Khanna Publishers, 2015.
3. Wright & Nebel, Environmental science towards a sustainable future, 12th Editon, Prentice Hall of India Ltd, 2015.

REFERENCES:

1. Erach Bharucha, "Text book of Environmental studies for Undergraduate courses", 3rd Edition, UGC, 2021.
2. Ravi P. Agrahari, "Environmental ecology, Biodiversity, climatic change & Disaster management", 1st Edition, McGraw Hill, 2020
3. Benney Joseph, "Environmental Science and Engineering", 1st Edition, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2017.

21CE208	STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To calculate principal stresses and planes for an element in three dimensional state of stress and theory of failures.
- To calculate the slope and deflection of beams by different methods.
- To show load carrying capacity of columns and stresses induced in cylinders.
- To interpret the behavior of members under pure torsion and shear and springs.
- To demonstrate unsymmetrical bending of various sections.

UNIT I	STATE OF STRESS AND THEORIES FAILURES	9

Plane Stress and Plane Strain Principal stresses and strains, Analytical method – Mohr's circle method, Stress tensor at a point – Stress invariants, Theories of failure - Maximum Principal stress theory – Maximum Principal strain theory – Maximum shear stress theory – Total Strain energy theory – Maximum distortion energy theory.

UNIT II	DEFLECTION OF BEAMS	9

Elastic curve – Governing differential equation - Double integration method – Macaulay's method - Area moment method - conjugate beam method for computation of slope and deflection of determinant beams.

UNIT III	COLUMNS AND CYLINDERS	9

Theory of columns – members subjected to axial load and bending moment – Euler's theory for long columns – assumptions and limitations – Rankine's formula - Thin and thick cylinders – Lame's equation - compound cylinders.

UNIT IV	TORSION AND SPRINGS	9

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

UNIT V	UNSYMMETRICAL BENDING	9

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Calculate principal stresses and planes for an element in three dimensional state of stress and solve problems using theory of failures.

CO2: Estimate the slope and deflection of beams by different methods.

CO3: Relate long and short columns and estimate stresses induced in cylinders.

CO4: Interpret the behaviour of members under pure torsion and shear and analysis of springs.

CO5: Apply the concepts in beams subjected to unsymmetrical bending.

BoS Chairman

TEXT BOOKS:

1. Rajput R.K. "Strength of Materials (Mechanics of Solids)", 7th Edition, S.Chand & company Ltd., New Delhi, 2018.
2. Rattan.S.S., "Strength of Materials", 3rd Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2017.
3. Gupta J.K, Gupta S.K, "Strength of Materials: Mechanics of Solids", 1st Edition, Cengage Learning India Pvt. Ltd., 2019.
4. Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain, SMTS –I Strength of materials, 2nd Edition, Laxmi publications., New Delhi, 2015.

REFERENCES:

1. Subramanian R, "Strength of Materials", 3rd Edition, Oxford HED, 2016.
2. Chanda Abhijit, "Strength of Materials", 3rd Edition, Wiley India Pvt. Ltd., 2016.
3. Bhavikatti S. S, "Strength of Materials", 5th Edition, Vikas Publishing House Pvt Ltd., 2022.
4. Sadhu Singh, "Strength of Materials", 1st Edition, Khanna Book Publishing Company, 2016.
5. Morrow H.W., "Statics and Strength of Materials", 7th Edition, Pearson Education India, 2013.
6. Jindal J.C., "Strength of Materials", 2nd Edition, Pearson Education India, 2017.

21CE209	WASTEWATER ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To illustrate the characteristics of wastewater.
- To calculate wastewater and storm drainage generation and know about the collection and transportation of sewage.
- To construct a suitable Primary treatment system.
- To select an appropriate Secondary treatment system.
- To prepare the suitable mode of disposal for the treated wastewater and sludge.

UNIT I	CHARACTERIZATION OF SEWAGE	9

Characteristics of sewage, decomposition – aerobic and anaerobic decomposition- physical and chemical quality of sewage – BOD and their testing– BOD equation – problems – population equivalent – Biological quality of sewage.

UNIT II	COLLECTION AND TRANSPORATION OF SEWAGE	9

Systems of sanitation– Estimating quantity of sewage – dry weather flow – estimating storm run-off by rational formula – Sewerage – separate, combined and partially separate system – hydraulic design of sewers. Sewer materials - laying and testing of sewer - sewer appurtenances, cleaning and ventilation of sewers- pumping of sewage.

UNIT III	PRIMARY TREATMENT OF SEWAGE	9

Objective – selection of treatment processes – principles, functions, design and drawing of units - onsite sanitation - septic tank with dispersion - grey water harvesting – primary treatment – principles, functions design and drawing of screen, grit chambers and primary sedimentation tanks – construction, operation and maintenance aspects.		
UNIT IV	**SECONDARY TREATMENT OF SEWAGE**	**9**
Biological treatment of sewage – aerobic treatment - activated sludge process – process mechanism, design parameters, design – modifications in ASP - Trickling filters – process mechanism, types, design parameters and design. Hybrid system – SBR, MBR, MBBR (basics only) - Natural systems - Ponds and Lagoons - Anaerobic systems – UASB, anaerobic filters and natural systems.		
UNIT V	**SLUDGE TREATMENT AND IMPACT OF DISPOSAL OF SEWAGE**	**9**
Sludge digestion – characteristics- digestion tanks, design - disposal of digested sludge - advances in sludge treatment and disposal - Impact of disposal of treated sewage – Impact on river – self purification – oxygen sag curve – Streeter Phelps equation – Impact on lakes – Eutrophication – Impact on sea - Land irrigation – sewage farming, sewage sickness - Recycling of treated sewage. Disposal of sewage in isolated buildings, plumbing system – types; Sanitary practices in rural areas. ECOSAN, Introduction to DEWATS.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Show the characteristics of wastewater generated from a town/ city.

CO2: Calculate the quantity of wastewater and storm run-off generated from the town/ city and designs a suitable collection system for the generated wastewater.

CO3: Prepare the necessary Primary treatment units for the wastewater collected from the town/city.

CO4: Plan the Secondary treatment units for the wastewater collected from the town/city.

CO5: Identify the suitable mode of disposal for the treated wastewater and sludge without endangering the environment.

TEXT BOOKS:

1. Garg, S.K., Environmental Engineering Vol. II, 41st Edition, Khanna Publishers, New Delhi, 2021.
2. Duggal K.N., "Elements of Environmental Engineering", 3rd Edition, S.Chand and Co. Ltd., New Delhi, 2014.
3. Punmia, B.C., Jain, A.K., and Jain.A.K.., Environmental Engineering, Vol.II, 2nd Edition, Laxmi Publications, 2016.

REFERENCES:

1. Manual on Sewerage and Sewage Treatment Systems Part A, B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
2. Metcalf and Eddy, "Wastewater Engineering–Treatment and Reuse", 4th Edition, Tata McGraw-Hill Company, New Delhi, 2012.
3. Syed R. Qasim, "Wastewater Treatment Plants", 2nd Edition, CRC Press, Washington D.C., 2017.

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BoS Chairman

4. Peavy, Rowe, Tchobanoglous, "Environmental Engineering", 1st Edition, McGraw Hill Publishers, New Delhi, 2017.
5. Mark J. Hammer, Mark J. Hammer, Jr, "Water and Wastewater Technology", 7th Edition, Prentice Hall of India Pvt. Ltd. New Delhi, 2011.

21CE210	HYDRAULICS AND HYDRAULIC MACHINERY (Theory with Practical Course)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To apply their knowledge of fluid mechanics in addressing problems in open channels.
- To analyze problems in gradually varied flows in steady state conditions.
- To solve problems in rapidly varied flows in steady state conditions.
- To differentiate the principles, working and application of turbines.
- To categorize the principles, working and application of pumps.

UNIT I	UNIFORM FLOW	9

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

UNIT II	GRADUALLY VARIED FLOW	9

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

UNIT III	RAPIDLY VARIED FLOW	9

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

UNIT IV	TURBINES	9

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

UNIT V	PUMPS	9

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

	TOTAL : 45 PERIODS
PRACTICAL COURSE	30

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List of Experiments

A. Pumps

1. Characteristics of Centrifugal pumps
2. Characteristics of Reciprocating pump

B. Turbines

3.Impact of Jet on vanes
4.Characteristics of Pelton wheel turbine
5. Characteristics of Francis turbine/Kaplan turbine

C. Flow Measurements

6. Determination of Coefficient of discharge of the triangular notch.

TOTAL : 75 PERIODS

COURSE OUTCOMES:

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

CO1: Identify and solve problems under uniform flow in open channels.

CO2: Solve gradually varied flows in steady state conditions.

CO3: Illustrate rapidly varied flows in steady state conditions.

CO4: Analyse the working and application of turbines.

CO5: Examine the working and application of pumps.

TEXT BOOKS:

1. Subramanya.K, "Flow in open channels", 5th Edition, Tata McGraw Hill, New Delhi, 2019.
2. Modi P.N and Seth.S.M, "Hydraulics and Fluid Mechanics including Hydraulic Machines", 22nd Edition, Standard Book House New Delhi, 2018.
3. Chandramouli P.N, "Applied Hydraulic Engineering", Yes Dee Publishing Pvt. Ltd., 2022.

REFERENCES:

1. VenTe Chow, "Open Channel Hydraulics", McGraw Hill, New York, 2009.
2. Hanif Chaudhry.M, "Open Channel Flow", 2nd Edition, Springer, 2007.
3. Jain.A.K. "Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, 12th Edition, 2016.
4. Subramanya.K. "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2018.

21CE211	CONCRETE TECHNOLOGY AND CONSTRUCTION EQUIPMENTS (Theory with Practical Course)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To analyze the basic properties of cement and aggregates.
- To explain the concept and procedure of mix design as per IS method.
- To classify the properties of concrete at fresh and hardened state and know the Non-destructive testing of concrete.

S. P. Arde

- To show the importance and application of special concretes.
- To choose the equipments used in the building construction sites.

UNIT I	**CEMENT – MORTAR - AGGREGATES**	**9**
Cement – Composition – Properties – Types and uses – Tests on cement – Lime, Gypsum – Cement Mortar – Classification – Properties of good mortar – Uses of mortar – Admixtures – Fine aggregate – Coarse aggregates – Properties and tests.		
UNIT II	**PROPORTIONING OF CONCRETE MIX**	**9**
Principles of Mix Proportioning - Properties of concrete related to Mix Design - Physical properties of materials required for Mix Design - Design Mix and Nominal Mix - BIS Method of Mix Design - Mix Design Examples.		
UNIT III	**FRESH AND HARDENED PROPERTIES OF CONCRETE**	**9**
Workability - Tests for workability of concrete - Segregation and Bleeding - Determination of strength Properties of Hardened concrete - Compressive strength – split tensile strength – Flexural strength - Stress-strain curve for concrete - Modulus of elasticity – durability of concrete – water absorption – permeability – corrosion test – acid resistance – Non Destructive Testing of concrete.		
UNIT IV	**SPECIAL CONCRETES**	**9**
Light weight concretes - foam concrete- self compacting concrete – vacuum concrete – High strength concrete - Fibre reinforced concrete – Ferrocement - Ready mix concrete – SIFCON - Shotcrete – polymer concrete - High performance concrete - Geopolymer Concrete.		
UNIT V	**CONSTRUCTION EQUIPMENT**	**9**
Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers – Equipment for foundation and pile driving. Equipment for compaction, batching, mixing and concreting - Equipment for material handling and erection of structures – types of cranes - Equipment for dredging, trenching, tunneling.		
		TOTAL : 45 PERIODS
PRACTICAL COURSE		**30**

List of Experiments

I. TEST ON CEMENT

1. Specific Gravity
2. Initital and Final Setting time
3. Consistency
4. Soundness

II. TEST ON FINE AGGREGATES

1. Grading of fine aggregates
2. Test for specific gravity and test for bulk density
3. Compacted and loose bulk density of fine aggregate

III. TEST ON COARSE AGGREGATE

1. Determination of impact value of coarse aggregate

J. P. Anie

2. Determination of elongation index
3. Determination of flakiness index
4. Determination of aggregate crushing value of coarse aggregate

IV. TEST ON CONCRETE

1. Test for Slump
2. Test for Compaction factor
3. Test for Compressive strength - Cube & Cylinder

TOTAL : 75 PERIODS

COURSE OUTCOMES:

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

CO1: Appraise the basic properties of cement and aggregates.

CO2: Apply the concept and procedure of mix design as per IS method and determine the mix proportion of concrete.

CO3: Compare the properties of concrete at fresh and hardened state and know the Non-destructive testing of concrete.

CO4: Illustrate the importance and application of special concretes.

CO5: Explain the equipments used in the building construction sites.

TEXT BOOKS:

1. Gupta.B.L and Amit Gupta, "Concrete Technology", 4th Edition, Jain Book Agency, 2010.
2. Shetty,M.S, "Concrete Technology", 8th Edition, S.Chand and Company Ltd, New Delhi, 2019.
3. Bhavikatti.S.S, "Concrete Technology", I.K.International Publishing House Pvt. Ltd., New Delhi, 2015.
4. Santhakumar. A.R., "Concrete Technology", 2nd Edition, Oxford University Press India, 2018.

REFERENCES:

1. Neville, A.M and Brooks J.J, "Concrete Technology", 2nd Edition, Pearson, 2019.
2. Gambhir, M.L; "Concrete Technology Theory and Practice", 5th Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2017.
3. IS10262-2009 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998.

21CE212	SOIL MECHANICS (Theory with Practical Course)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To classify the soil and assess the index properties of soil.
- To compare the stress concepts in soils and estimate the permeability of soil.
- To identify the settlement in soils.
- To analyze the shear strength of soil.
- To relate both finite and infinite slopes.

UNIT I	SOIL CLASSIFICATION AND COMPACTION	9

J. P. Anie

History – Formation and types of soil–Composition - Index properties – clay mineralogy structural arrangement of grains – description – Classification – BIS – US – phase relationship – Compaction – theory –factors influencing compaction.		
UNIT II	**EFFECTIVE STRESS AND PERMEABILITY**	**9**
Soil – Water – Static pressure in water - Effective Stress concept in soil – Capillary phenomena - Permeability – Darcy's law – Factors influencing permeability of soils – Seepage - Two dimensional flow – Laplace's equation – Simple problems Sheet pile and weir.		
UNIT III	**STRESS DISTRIBUTION AND SETTLEMENT**	**9**
Stress distribution in homogeneous and isotropic medium - Boussinesq's theory (point load, line load and udl)–Use of Newmark's influence chart – Settlement and its Components – Factors influencing settlement – Terzaghi's one dimensional consolidation theory – Computation of rate of settlement. – √t and log t methods – e log p relationship consolidation settlement N-C clays – OC clays - Computation.		
UNIT IV	**SHEAR STRENGTH**	**9**
Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Factors influences shear strength of soil.		
UNIT V	**STABILITY OF SLOPES**	**9**
Infinite slopes and finite slopes — Friction circle method – Use of stability number –Guidelines for location of critical slope surface in cohesive and c - soil – Slope protection measures – case studies on slope stability failures.		
		TOTAL : 45 PERIODS
PRACTICAL COURSE		**30**

List of Experiments

A. Determination of Index Properties:

1. Special gravity of soil solids
2. Grain size distribution – Sieve analysis
3. Grain size distribution Hydrometer analysis
4. Liquid limit test
5. Plastic limit test
6. Shrinkage limit
7. Field density Test (Sand replacement method)
8. Determination of moisture – density relationship using standard Proctor compaction test.
9. Core cutter method
10. Relative density

B. Determination of Engineering Properties:

11. Permeability determination (constant head and falling head methods)
12. Direct shear test in cohesion-less soil
13. Unconfined compression test in cohesive soil

TOTAL : 75 PERIODS

T. P. Ghule

COURSE OUTCOMES:

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

CO1: Categorize the soil and determine the index properties of soil.

CO2: Analyze the stresses in soils and Permeability.

CO3: Classify and determine the settlement in soils.

CO4: Examine the shear strength of soil.

CO5: Identify both finite and infinite slopes.

TEXT BOOKS:

1. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", 2nd Edition, CBS Publishers Distribution Ltd., New Delhi. 2018.
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", 7th Edition, Standard Publishers and Distributors, New Delhi, 2019 (Reprint).
3. Gopal Ranjan, A S R Rao, "Basic and Applied Soil Mechanics", 3rd Edition, New Age International Publication, 2016.
4. Punmia, B.C., "Soil Mechanics and Foundations", 16th Edition, Laxmi Publications Pvt. Ltd. New Delhi, 2019.

REFERENCES:

1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations: Basic Geotechnics", 7th Edition, Prentice-Hall, 2006.
2. Coduto, D.P., "Geotechnical Engineering – Principles and Practices", 2nd Edition, Prentice Hall of India Pvt. Ltd. New Delhi, 2010.
3. Braja M Das, "Principles of Geotechnical Engineering", 9th Edition, Cengage Learning India Private Limited, 2017.
4. Craig.R.F. "Soil Mechanics", 7th Edition, E & FN Spon, London and New York, 2012.
5. Purushothama Raj. P., "Soil Mechanics and Foundations Engineering", 2nd Edition, Pearson Education, 2018.
6. Venkatramaiah.C., "Geotechnical Engineering", 6th Edition, New Age International Pvt. Ltd., New Delhi, 2017.

21CE213	SURVEY CAMP (During III Semester Winter Vacation for 2 weeks)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVE:

- To prepare the students to get practical training in the field work to record all original field observations and calculations.
- To prepare the students to get practical training in the field work to plot and contour the given area.

LIST OF EXPERIMENTS

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

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1. Traverse - using Total station
2. Contouring
(i). Radial tachometric contouring - Radial Line at Every 45 Degree and Length not less than 60 Meter on each Radial Line
(ii). Block Level/ by squares of size at least 100 Meter x 100 Meter at least 20 Meter interval
(iii). L.S & C.S - Road and canal alignment for a Length of not less than 1 Kilo Meter at least L.S at Every 30M and C.S at every 90 M
3. Offset of Buildings and Plotting the Location
4. Sun 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 condition to give good exposure on survey.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to
CO1: Survey a building or structure using various surveying techniques.
CO2: Connect the angles and elevations of a given location / point.

21CE214	WATER AND WASTEWATER ANALYSIS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To analyse the physical and chemical and biological characteristics of water.
- To inspect the physical and chemical and biological characteristics of wastewater.
- To test for the dosage requirement for coagulation process.
- To examine the growth of micro-organism and its quantification.
- To calculate the sludge in wastewater.

LIST OF EXPERIMENTS:

1. Determination of pH, Turbidity and conductivity
2. Determination of Hardness
3. Determination of Alkalinity and Acidity
4. Determination of Chlorides
5. Determination of Phosphates and Sulphates
6. Determination of iron and fluoride
7. Determination of Optimum Coagulant dosage
8. Determination of residual chlorine and available chlorine in bleaching powder
9. Determination of Oil, and Grease
10. Determination of suspended, settleable, volatile and fixed solids

11. Determination Dissolved Oxygen and BOD for the given sample
12. Determination of COD for given sample
13. Determination of SVI of Biological sludge and microscopic examination
14. Determination of MPN index of given water sample
15. Determination of Ammonia nitrogen in wastewater samples.
16. Determination of Nitrates in water and wastewater

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

CO1: Examine the physical and chemical and biological characteristics of water.

CO2: Compare the physical and chemical and biological characteristics of wastewater.

CO3: Select the type of treatment required and amount of dosage required for the treatment.

CO4: Survey the conditions for the growth of micro-organisms.

CO5: Calculate the amount of sludge in wastewater.

REFERENCES:

1. Eaton, A.D., Clesceri, L.S., Rice, E.W., Greenberg, A.E., Franson, "Standard methods for the examination of water & wastewater", 21st Edition, American Public Health Association (APHA) M.A.H. APHA, Washington, 2005.
2. IS 3025 : Part 21 : 2009 Methods of sampling and test (Physical and Chemical) for water and wastewater : Hardness
3. IS 3025 : Part 23 : 1986 Methods of sampling and test (Physical and Chemical) for water and wastewater : Alkalinity
4. IS 3025 : Part 32 : 1988 Methods of sampling and test (Physical and Chemical) for water and wastewater : Chloride
5. IS 3025 : Part 34 : 1988 Methods of sampling and test (Physical and Chemical) for water and wastewater : Nitrate
6. IS 3025 : Part 24 : 1986 Methods of sampling and test (Physical and Chemical) for water and wastewater : Sulphate
7. IS 3025 : Part 60 : 2008 Methods of sampling and test (Physical and Chemical) for water and wastewater : Fluoride
8. IS 3025 : Part 10 : 1984 Methods of sampling and test (Physical and Chemical) for water and wastewater : Turbidity
9. IS 3025 : Part 16 : 1984 Methods of sampling and test (Physical and Chemical) for water and wastewater : FILTERABLE RESIDUE (TOTAL DISSOLVED SOLIDS)
10. IS 3025 : Part 11 : 1983 Methods of sampling and test (Physical and Chemical) for water and wastewater : pH VALUE
11. IS 3025 : Part 44 : 1993 Methods of sampling and test (Physical and Chemical) for water and wastewater : BIOCHEMICAL OXYGEN DEMAND (BOD)
12. IS 3025 : Part 39 : 1989 Methods of sampling and test (Physical and Chemical) for water and wastewater : Oil and Grease

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13. IS 3025 : Part 58 : 2006 Methods of sampling and test (Physical and Chemical) for water and wastewater : CHEMICAL OXYGEN DEMAND (COD)
14. IS 3025 : Part 31 : 1988 Methods of sampling and test (Physical and Chemical) for water and wastewater : Phosphorous

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SEMESTER-V

21CE301	STRUCTURAL ANALYSIS I	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To illustrate the concept of determinate and indeterminate beam using standard techniques.
- To apply the slope and deflection approach for analysing complex structures.
- To develop the moment distribution analysis method for analysing uncertain structures.
- To make use of the idea of the matrix flexibility approach for rigid frames, continuous beams, and indeterminate pin-jointed frames analysis.
- To utilize the concept of the matrix stiffness method to the analysis of rigid frames, continuous beams, and uncertain pin-jointed frames.

UNIT I	INDETERMINATE BEAMS	9

Introduction - Indeterminate Beams - Propped cantilever and fixed beams - fixed end moments and reactions – sinking and rotation of supports - Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

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

UNIT IV	FLEXIBLITY MATRIX METHOD	9

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

UNIT V	STIFFNESS MATRIX 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:

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

CO1: Demonstrate the indeterminate beams by conventional methods.

CO2: Solve the rigid frames and continuous beams using the slope defection technique.

CO3: Utilise moment distribution method to build continuous beams and rigid frames with and without sway.

CO4: Select the Matrix Flexibility Methods of Indeterminate Pin Jointed Plane Frames, Continuous Beams, and Rigid Frames.

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CO5: Choose the Matrix stiffness method analysis of indeterminate pin jointed planar frames, continuous beams, and rigid frames.

TEXT BOOKS:

1. Bhavikatti, S.S, "Structural Analysis", Vol.1 & 2", 5th Edition, Vikas Publishing House Pvt.Ltd., NewDelhi-4, 2021.
2. Bhavikatti, S.S, "Matrix Method of Structural Analysis", 1st Edition. Dreamtech Press, New Delhi-4, 2019.
3. Hibbeler R.C, "Structural Analysis", 9th Edition. Pearson Education, 2017.
4. Vaidyanadhan, R and Perumal, P, "Comprehensive Structural Analysis – Vol. 1 & Vol. 2", 4th Edition, Laxmi Publications Pvt. Ltd, New Delhi, 2019.

REFERENCES:

1. Punmia. B.C, Ashok Kumar Jain & Arun Kumar Jain, "Theory of structures", 13th Edition, Laxmi Publications, New Delhi, 2017.
2. Khurmi R.S, "Theory of structures", 13th Edition, S Chand, New Delhi, 2020.
3. Ramamrutham S, Narayanan R, "Theory of structures", 12th Edition, Dhanpat Rai Publishing Company Ltd., 2020.

21CE302	DESIGN OF REINFORCED CEMENT CONCRETE ELEMENTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To make use of the various design methodologies for the design of RC elements.
- To analyze and design flanged beams by limit state method and design of beams for shear, bond and torsion.
- To develop the various types of slabs and staircase by limit state method.
- To make use of axial, uniaxial and biaxial eccentric loadings for design of columns.
- To prepare design of footing by limit state method.

UNIT I	INTRODUCTION	9

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

UNIT II	DESIGN OF BEAMS	9

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

UNIT III	DESIGN OF SLABS AND STAIRCASE	9

Analysis and design of cantilever, one way simply supported and continuous slabs and supporting beams-Two way slab- Design of simply supported and continuous slabs using IS code coefficients-Types of Staircases – Design of dog-legged Staircase.		
UNIT IV	**DESIGN OF COLUMNS**	**9**
Types of columns –Axially Loaded columns – Design of short Rectangular Square and circular columns –Design of Slender columns- Design for Uniaxial and Biaxial bending using Column Curves.		
UNIT V	**DESIGN OF FOUNDATIONS**	**9**
Concepts of Proportioning footings and foundations based on soil properties-Design of wall footing – Design of axially and eccentrically loaded Square, Rectangular pad and sloped footings – Design of Combined Rectangular footing for two columns only.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify the various design approaches used to create RC components.

CO2: Utilize the limit state approach for the analysis and design of flanged beams as well as the sign of the beams for torsion, bonding, and shear.

CO3: Choose the design for various slab types and staircases using the limit state approach.

CO4: Select from the options for axial, uniaxial, and biaxial eccentric loadings for columns.

CO5: Apply the limit state technique to footing design.

TEXT BOOKS:

1. Varghese, P.C., "Limit State Design of Reinforced Concrete", 2nd Edition, P Chaukhamba Auriyantaliya, 2020.
2. Dayaratnam P, "Limit State Design of Reinforced Concrete Structures", 1st Edition, CBS Publishers and Distributors Pvt Ltd, 2018.
3. Krishnaraju.N "Design of Reinforced Concrete Structures", 4th Edition, CBS Publishers & Distributors Pvt. Ltd., 2019.

REFERENCES:

1. Jain, A.K., "Limit State Design of RC Structures", 4th Edition, Nemchand Publications, Roorkee, 2012.
2. Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", 4th Edition, McGraw Hill, 2021
3. Punmia. B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete",7th Edition, Laxmi Publication Pvt. Ltd., New Delhi, 2016.
4. Rathaliya R.P., "Design of Reinforced Concrete Structures", 1st Edition, Atul Prakashan, 2018.
5. IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000
6. SP16, IS456:1978 "Design Aids for Reinforced Concrete to Bureau of Indian Standards", New Delhi, 1999

J. P.

21CE303	FOUNDATION ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To interpret the concept of site investigation and soil exploration methods in field.
- To apply the design procedure for finding bearing capacity for various types of shallow foundations.
- To choose the foundation based on the in-situ requirements.
- To relate the load carrying capacity and settlement behavior for pile group.
- To calculate the earth pressures acting on retaining wall.

UNIT I	SITE INVESTIGATION AND SELECTION OF FOUNDATION	9

Scope and objectives – Methods of exploration – Auguring and boring- Depth and spacing of bore holes- Sampling techniques- Representative and undisturbed sampling- sampling methods- Split spoon sampler, Thin wall sampler, Stationary piston sampler- Geophysical methods – Electrical resistivity Method – Seismic refraction method - Penetration tests (SPT and SCPT)- Bore log report and Selection of foundation.

UNIT II	SHALLOW FOUNDATION	9

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 – problems- Bearing capacity from in-situ tests (plate load test)- Allowable bearing pressure- 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 footings – Contact pressure distribution: Isolated footing – Combined footings – Types and proportioning- Mat foundation – Types and applications – Proportioning – Floating foundation – Seismic force consideration – Codal Provision.

UNIT IV	PILE FOUNDATION	9

Types of piles and their function – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – static formula – dynamic formulae (Engineering news and Hileys)- Negative skin friction – Uplift capacity-Group capacity by different methods (Feld's rule, Converse – Labarra formula and block failure criterion)- Settlement of pile groups – Interpretation of pile load test (routine test only)- Under reamed piles – Capacity under compression and uplift.

UNIT V	RETAINING WALLS	9

Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesion less and cohesive soil – Coulomb's wedge theory- Earth pressure on retaining walls of simple configurations – Culmann's Graphical method- pressure on the wall due to line load – Stability analysis of retaining walls.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

J. P. Anil

BoS Chairman

CO1: Select the concept of site investigation and soil exploration methods in field.
CO2: Apply design procedure for finding bearing capacity for various types of shallow foundations.
CO3: Plan the foundation based on the in-situ requirements.
CO4: Identify the load carrying capacity and settlement behavior for pile group.
CO5: Solve the earth pressures acting on retaining wall.

TEXT BOOKS:

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", 5th Edition, CBS Publishers Distribution Ltd., New Delhi, 2018.
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", 7th Edition, Standard Publishers and Distributors, New Delhi, 2020.
3. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition, 2017.
4. Modi P.N.," Soil Mechanics and Foundation", 5th Edition, Technology & Engineering, 2019.

REFERENCES:

1. Braja M Das, "Principles of Foundation Engineering" 8th Edition, Cengage India Private Limited, 2017.
2. Venkataramaiah C. "Geotechnical Engineering", 6th Edition, New Age International, New Delhi, 2018.
3. IS Code 6403: 1981 (Reaffirmed 1997) "Bearing capacity of shallow foundation", Bureau of Indian Standards, New Delhi.
4. IS Code 8009 (Part 1):1976 (Reaffirmed 1998) "Shallow foundations subjected to symmetrical static vertical loads", Bureau of Indian Standards, New Delhi.
5. IS Code 8009 (Part 2):1980 (Reaffirmed 1995) "Deep foundations subjected to symmetrical static vertical loading", Bureau of Indian Standards, New Delhi.
6. IS Code 2911 (Part 1): 1979 (Reaffirmed 1997) "Concrete Piles" Bureau of Indian Standards, New Delhi.
7. IS Code 2911 (Part 2): 1979 (Reaffirmed 1997) "Timber Piles", Bureau of Indian Standards, New Delhi.
8. IS Code 2911 (Part 3): 1979 (Reaffirmed 1997) "Under Reamed Piles", Bureau of Indian Standards, New Delhi.
9. IS Code 2911 (Part 4): 1979 (Reaffirmed 1997) "Load Test on Piles", Bureau of Indian Standards, New Delhi.
10. IS Code 1904: 1986 (Reaffirmed 1995) "Design and Construction of Foundations in Soils", Bureau of Indian Standards, New Delhi.
11. IS Code 2131: 1981 (Reaffirmed 1997) "Method for Standard Penetration test for Soils", Bureau of Indian Standards, New Delhi.
12. IS Code 2132: 1986 (Reaffirmed 1997) "Code of Practice for thin – walled tube sampling for soils", Bureau of Indian Standards, New Delhi.
13. IS Code 1892 (1979): Code of Practice for subsurface Investigation for Foundations. Bureau of Indian Standards, New Delhi.

14. IS Code 14458 (Part 1): 1998 "Retaining Wall for Hill Area – Guidelines, Selection of Type of Wall", Bureau of Indian Standards, New Delhi.
15. IS Code 14458 (Part 2): 1998 "Retaining Wall for Hill Area – Guidelines, Design of Retaining/Breast Walls", Bureau of Indian Standards, New Delhi.
16. IS Code 14458 (Part 3): 1998 "Retaining Wall for Hill Area – Guidelines, Construction of Dry Stone Walls", Bureau of Indian Standards, New Delhi.

21MCC01	CONSTITUTION OF INDIA	L	T	P	C
		1	0	0	0

COURSE OBJECTIVES:

- To explain the basic features and fundamental principles of Constitution of India.
- To explain the salient features and characteristics of the Constitution of India
- To explain the Directive Principles of State Policy, Federal structure and distribution of legislative and financial powers
- To explain the amendment of the Constitutional Powers and Procedure, the historical perspectives of the constitutional amendments in India
- To explain the Local Self Government – Constitutional Scheme in India

SYLLABUS

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States.
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India.
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

TOTAL : 15 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the meaning of the constitution law and constitutionalism and Historical perspective

of the Constitution of India.

CO2: Explain the salient features and characteristics of the Constitution of India, scheme of the fundamental rights and the scheme of the Fundamental Duties and its legal status.

CO3: Explain the Directive Principles of State Policy, Federal structure and distribution of legislative and financial powers between the Union and the States, and Parliamentary Form of Government in India.

CO4: Explain the amendment of the Constitutional Powers and Procedure, the historical perspectives of the constitutional amendments in India, and Emergency Provisions.

CO5: Explain the Local Self Government – Constitutional Scheme in India, Scheme of the Fundamental Right to Equality.

TEXT BOOKS:

1. Durga Das Basu,"Introduction to the Constitution of India", LexisNexis Butterworths Wadhwa, 20th edition, Reprint 2011.
2. Web link: https://www.india.gov.in/my-government/ constitution-india.

21CE304	HIGHWAY AND RAILWAY ENGINEERING (Theory with Practical Course)	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

- To identify the various parts of highway development and design cross section.
- To show an overview of the roadway in terms of planning, design, construction, and maintenance in accordance with IRC standards, specifications, and methodologies.
- To examine the concepts and techniques of roadway material testing.
- To use railway planning ideas for developing the permanent route.
- To illustrate railway maintenance and operation.

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.

UNIT II	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	EVALUATION AND MAINTENANCE OF PAVEMENTS	9

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

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-Signaling.		
UNIT V	**RAILWAY CONSTRUCTION MAINTENANCE AND OPERATION**	**9**
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
PRACTICAL COURSE		**30**
List of Experiments **I TEST ON AGGREGATES** a) Specific Gravity b) Los Angeles Abrasion Test c) Water Absorption of Aggregates **II TEST ON BITUMEN** a) Specific Gravity of Bitumen b) Penetration Test c) Viscosity Test d) Softening Point Test e) Ductility Test		
		TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the various highway development and design cross section elements.

CO2: Illustrate the geometric features of road network and design of pavement as per IRC.

CO3: Appraise the concept of pavement management system, evaluation of distress and maintenance of pavements.

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

CO5: Identify the construction techniques and maintenance of track laying and railway stations.

TEXT BOOKS:

1. Khanna.S. K., Justo.C.E.G and Veeraragavan A., "Highway Engineering", 10th edition, Nemchand Publishers, 2022.

2. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", 3rd edition, Scitech Publications,2018.

3. Kadiyali.L.R. "Principles and Practice of Highway Engineering", 1st edition, Khanna Technical Publications, 6th edition Delhi,2019.

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REFERENCES:

1. Saxena Subhash C, and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi, 2020.
2. Rangwala, "Highway Engineering", 12th edition, Charotar Publishing House, 2022.
3. Rangwala, "Railway Engineering", 3rd edition, Charotar Publishing House, 2017.
4. IRC: 37-2012, "The Indian roads Congress, Guidelines for the Design of Flexible Pavements", NewDelhi.
5. IRC: 58-2012, "The Indian roads Congress, Guidelines for the Design of Flexible Pavements", NewDelhi.
6. IRC: 37–2012, "The Indian roads Congress, Guidelines for the Design of Flexible Pavements", NewDelhi.
7. IRC: 58-2012, "The Indian Road Congress, Guidelines for the Design of Rigid Pavements for Highways", NewDelhi.

21EN301	PROFESSIONAL COMMUNICATION LABORATORY *(Common to all B.E./B.Tech. Programmes)*	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To demonstrate communication skills that can lead to improved interpersonal relationships.
- To plan to set and achieve goals with focus.
- To organize themselves in work life to face the professional set up with confidence.
- To interpret ideas and participate in group discussion with positive attitude.
- To develop their confidence and help learners to attend interviews successfully.

UNIT I	**COMMUNICATION AND PROFESSIONAL ETIQUETTES**	**6**
Importance and Types of Communication Verbal communication -Presentation skills- Non-Verbal communication - Personal Appearance, Posture, Gestures, Facial Expressions, Eye Contact and Space Distancing - Professional Etiquettes.		
UNIT II	**GOAL SETTING AND MOTIVATION**	**6**
Short term and Long term Goals- Strategies to set and achieve goals- Motivation.		
UNIT III	**TIME AND STRESS MANAGEMENT**	**6**
Importance of Time - Time Management Skills - Sources of Stress - Managing Stress - Analysis of the Case Studies on time and stress management.		
UNIT IV	**GROUP DISCUSSIONS AND POSITIVE ATTITUDE**	**6**
Group Discussions - Leadership Qualities - Decision Making - Problem Solving - Negotiation Skills - Positive Attitude.		
UNIT V	**RESUME MAKING AND INTERVIEW SKILLS**	**6**
Preparing Resume - E-Resume - Covering Letter - Job Application through email - Career Portfolio -Types of Interviews - Mock Interviews.		
		TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Demonstrate effective communication skills through presentations.

CO2: Utilize their knowledge of motivation in setting and achieving goals.

CO3: Examine time and stress management.

CO4: Formulate their ideas into an effective communication in formal contexts.

CO5: Develop a well-composed resume and face interviews confidently.

TEXTBOOKS:

1. Dhanavel S P, "English and Soft Skills", 1st Edition , Orient BlackSwan Ltd, Hyderabad : 2012.
2. Dr.Tobin Porterfield & Bob Graham, "The 55 Soft Skills That Guide Employee and Organizational Success," Mason-West Publishing House, 2018.
3. Prashant Sharma, "Soft Skills Personality Development for Life Success," BPB Publications, New Delhi, 2018.

REFERENCES:

1. M. Ashraf Rizvi, "Effective Technical Communication," Tata McGraw Hill Education Pvt. Ltd. New Delhi, 2016.
2. Mohan Krishna & Meera Banerji, "Developing Communication Skills," First Edition, Trinity Press, 2017.
3. N. Krishnaswami& T. Sriraman, "Creative English for Communication,"Third edition, Laxmi Publications Private Limited, 2017.

21CE305	INTERNSHIP+SEMINAR	L	T	P	C
	(During IV Semester Summer Vacation for 2 weeks)	0	0	0	1

COURSE OBJECTIVES:

- To appraise the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks.
- To develop skills in facing and solving the field problems.
- To break down work and its function in the economy.
- To point out interests and abilities in their field of study.
- To relate theory and practice.

STRATEGY:

- The students individually undertake training in Construction Sites on basic material testing & properties and good construction practices in the field 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 faculty members.

COURSE OUTCOMES:

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

CO1: Connect the implementation of textbook knowledge into practice.

CO2: Discover the concepts of developments and implementation of new techniques.

CO3: Develop communication, interpersonal and other critical skills in the job interview process.
CO4: Categorize their interest and create a record of work experience.
CO5: Choose career alternatives prior to graduation.

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SEMESTER VI

21CE306	STRUCTURAL ANALYSIS II	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To apply the concept of strain energy method.
- To use the concept of plastic analysis and analyze beams and rigid frames.
- To identify the analysing method of three hinged, two hinged and fixed arches.
- To construct influence lines for structures and calculate critical stress resultants.
- To solve suspension bridges with stiffening girders and space structures.

UNIT I	STRAIN ENERGY METHOD	9

Strain energy in tension, compression and shear – resilience, Strain energy due to axial load (gradual, sudden and impact loadings), shear, flexure and torsion, Castigliono's theorems – determinate beams, plane frames and plane trusses, Determination of Static and Kinematic Indeterminacies – Analysis of continuous beams, plane frames and indeterminate plane trusses by strain energy method (up to two degree of redundancy).

UNIT II	PLASTIC ANALYSIS	9

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

UNIT III	ARCHES	9

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

UNIT IV	INFLUENCE LINES	9

Influence lines for reactions in statically determinate beams – Influence lines for shear force and bending moment – Calculation of critical stress resultants due to concentrated and distributed moving loads – absolute maximum bending moment - influence lines for member forces in pin jointed plane frames. Muller Breslau's principle– Influence line for Shearing force, Bending Moment and support reaction components of propped cantilever, continuous beams (Redundancy restricted to one), and fixed beams.

UNIT V	SPACE AND CABLE STRUCUTRES	9

Equilibrium of cable – length of cable - anchorage of suspension cables – stiffening girders - cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders. Analysis of Space trusses using method of tension coefficients – Beams curved in plan.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Use strain energy method to analyze continuous beams, pin-jointed indeterminate plane frames and rigid plane frames.

CO2: Select between the concept of plastic analysis and the technique for analysing rigid beams and

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frames.

CO3: Solve three hinged, two hinged and fixed arches.

CO4: Sketch the influence lines for structures and able to calculate critical stress resultants.

CO5: Interpret and analyze space constructions and suspension bridges with stiffening girders.

TEXT BOOKS:

1. Bhavikatti, S.S, "Structural Analysis, Vol.1, & 2", 5th edition, Vikas Publishing House Pvt.Ltd., NewDelhi-4, 2021.
2. Hibbeler R.C, "Structural Analysis", 9th edition, Pearson Education, 2017.
3. Vaidyanadhan, R and Perumal, P, "Comprehensive Structural Analysis – Vol. 1 & Vol. 2", 4th edition, Laxmi Publications Pvt. Ltd, New Delhi, 2019.

REFERENCES:

1. Punmia. B.C, Ashok Kumar Jain & Arun Kumar Jain, "Theory of structures", 13th edition, Laxmi Publications, New Delhi, 2017.
2. Khurmi R.S, "Theory of structures", 13th edition, S Chand, New Delhi, 2020.
3. Ramamrutham S, Narayanan R, "Theory of structures", 12th edition, Dhanpat Rai Publishing Company Ltd., 2020.

21CE307	DESIGN OF STEEL STRUCTURAL ELEMENTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To apply the concepts of various design philosophies.
- To identify the various bolted and welded connections for steel structures.
- To calculate the steel tension and compression member design.
- To utilize concept of axially loaded columns and column base connections.
- To make use of the design of various flexural members in steel

UNIT I	INTRODUCTION AND ALLOWABLE STRESS DESIGN	9

Structural steel types – Mechanical Properties of structural steel- Indian structural steel products- Steps involved in the Deign Process -Steel Structural systems and their Elements- -Type of Loads on Structures and Load combinations- Code of practices, Loading standards and Specifications - Concept of Allowable Stress Method, and Limit State Design Methods for Steel structures-Relative advantages and Limitations-Strengths and Serviceability Limit states.

Allowable stresses as per IS 800 section 11 -Concepts of Allowable stress design for bending and Shear –Check for Elastic deflection-Calculation of moment carrying capacity –Design of Laterally supported Solid Hot Rolled section beams-Allowable stress deign of Angle Tension and Compression Members and estimation of axial load carrying capacity.

UNIT II	CONNECTIONS IN STEEL STRUCTURES	9

Type of Fasteners- Bolts Pins and welds- Types of simple bolted and welded connections Relative advantages and Limitations-Modes of failure-the concept of Shear lag-efficiency of joints- Axially loaded bolted connections for Plates and Angle Members using bearing type bolts –Prying forces

and Hanger connection– Design of Slip critical connections with High strength Friction Grip bolts.- Design of joints for combined shear and Tension- Eccentrically Loaded Bolted Bracket Connections- Welds-symbols and specifications- Effective area of welds-Fillet and but Welded connections-Axially Loaded connections for Plate and angle truss members and Eccentrically Loaded bracket connections.

UNIT III	TENSION MEMBERS	9

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

UNIT IV	COMPRESSION MEMBERS	9

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

UNIT V	DESIGN OF FLEXURAL MEMBERS	9

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Interpret the fundamental knowledge of steel structural design.

CO2: Select the bolted and welded connection design for steel constructions.

CO3: Solve tension members and understand the effect of shear lag.

CO4: Choose the design concept of axially loaded columns and column base connections.

CO5: Model and design various types of flexural members.

TEXT BOOKS:

1. Subramanian.N, "Design of Steel Structures",3rd edition, Oxford University Press, 2018.
2. Gambhir. M.L., " Design of Steel Structures",5th edition, Dreamtech Press, 2019
3. Duggal. S.K, "Limit State Design of Steel Structures",3rd edition, Tata McGraw Hill Publishing Company, 2019

REFERENCES:

1. Kanthimathinathan S. "Limit State Design of Steel Structures: As per IS: 800 / 2007", 1st edition, Dreamtech Press, 2019.
2. Vijaya kumar Halakatti et.al, "Limit State Design of Steel and RCC Structures", 1st edition,

Medtech, 2019.
3. IS800 :2007, General Construction Vijaya kumar Halakatti (Author), Prakash K. E (Author), N. S Kumar (Author), Prahallada M. C (Author)n in Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007
4. SP 6(1) Hand book on structural Steel Sections

21CE308	ESTIMATION, COSTING AND VALUATION ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To make use of the various methods of estimation of buildings.
- To identify the rate analysis for all type of structures and cost estimate.
- To apply the various types of specifications, principles for report preparation, tender notices.
- To build knowledge on types of contracts.
- To develop knowledge on valuation for building and land.

UNIT I	ESTIMATE OF DIFFERENT STRUCTURES	9

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

UNIT II	RATE ANALYSIS AND COSTING	9

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

UNIT III	SPECIFICATIONS, REPORTS AND TENDERS	9

Specifications – sources – Preparation of detailed and general specifications – Principles for report preparation – report on estimate of residential building – Culvert – Roads - Tenders – TTT Act – e-tender – Preparation of Tender Notice and Document.

UNIT IV	CONTRACTS	9

Contracts – Types of contracts – Drafting of contract documents – Drafting of contract documents based on IBRD / MORTH Standard bidding documents - Arbitration and legal requirements.

UNIT V	VALUATION	9

Necessity – Basics of value engineering – Capitalised value – Depreciation – Escalation – Value of building – Calculation of Standard rent – Mortgage – Lease.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

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CO1: Illustrate the method of Estimation and calculating the quantities for different structures.
CO2: Calculate the rate analysis for all building works, canals, and roads and cost estimate.
CO3: Use the different types of specifications, principles for report preparation, tender notices types.
CO4: Identify and explain the different types of contracts.
CO5: prepare the valuation for various building and land.

TEXT BOOKS:

1. Dutta, B.N., "Estimating and Costing in Civil Engineering", 28th edition, CBS Publishers & Distributors Pvt. Ltd., 2020.
2. Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", 3rd edition, S.Chand & Company Ltd., 2018.
3. Rethaliya R, Rethaliya Mayur R, "Estimating Costing and Valuation", 1st edition, Atul Prakashan, 2018.

REFERENCES:

1. Len Holm, Schaufelberger John E, "Construction Cost Estimating", 1st edition, CBS publishers & distributors pvt. Ltd, 2018.
2. Holm Leonard et.al, "Construction Cost Estimating: Process and Practices", 1st edition, Pearson Education, 2017.
3. Ostwald Phillip F, "Construction Cost Analysis and Estimating", 1st edition, Pearson Education, 2017.

21CE309	IRRIGATION ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To make use of the knowledge and skills on crop water requirements.
- To choose the methods and management of irrigation.
- To develop knowledge on types of impounding structures.
- To illustrate the methods of irrigation including canal irrigation.
- To interpret water management on optimization of water use.

UNIT I	CROP WATER REQUIREMENT	9

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

UNIT II	IRRIGATION METHODS	9

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

UNIT III	DIVERSION AND IMPOUNDING STRUCTURES	9

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

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UNIT IV	CANAL IRRIGATION	9

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

UNIT V	WATER MANAGEMENT IN IRRIGATION	9

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the knowledge and skills on crop water requirements.

CO2: Select the methods and management of irrigation.

CO3: Relate the knowledge on types of impounding structures.

CO4: Identify the methods of irrigation including canal irrigation.

CO5: Interpret water management on optimization of water use.

TEXT BOOKS:

1. Basak N.N, "Irrigation Engineering", 5th Edition, McGraw Hill Education, 2017.
2. Punmia B.C., et. al; "Irrigation and water power Engineering", Laxmi Publications, 17th Edition, New Delhi, 2021.
3. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 35th Revised Edition, New Delhi, 2019.

REFERENCES:

1. Sharma S.K., "Irrigation Engineering and Hydraulic Structures", 1st edition, S Chand Publishing.
2. Linsley R.K. and Franzini J.B, "Irrigation Engineering", 2nd edition, Standard Book House Since 1960, 2018.
3. Modi P.N., "Irrigation Water Resources and Water Power Engineering", 1st edition, Standard Book House Since 1960, 2020.

21MCC02	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	C
		1	0	0	0

COURSE OBJECTIVES:

- To explain the concept of Indian Traditional Knowledge along with Indian Modern Knowledge.
- To explain the need and importance of protecting Traditional Knowledge, Knowledge sharing, and Intellectual property rights over Traditional Knowledge.
- To explain about the use of Traditional Knowledge to meet the basic needs of human being.
- To explain the rich biodiversity materials and knowledge preserved for practicing traditional

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lifestyle.

- To explain the use of Traditional Knowledge in Manufacturing and Industry.

UNIT-I	TRADITIONAL AND MODERN KNOWLEDGE	3

Two Worlds of Knowledge - Phase of Explorers, Sir Arthur Cotton and Irrigation, Smallpox Vaccination, Late Nineteenth Century, Voelcker, Howard and Agriculture, Havell and Indian Art; Indians at the Encounter - Gaekwad of Baroda and Technical Education, Science Education and Modern Industries, Hakim Ajmal Khan and Ayurveda, R. N. Chopra and Indigenous Drugs, Gauhar Jaan and Indian Classical Music; Linking Science and the Rural - Tagore's Sriniketan Experiment, Marthandam, the YMCA Model, Gandhi's Thoughts on Development, Nehru's View of Growth; Post- Independence Era - Modernization and Traditional Knowledge, Social Roots of Traditional Knowledge Activism, Global Recognition for Traditional Knowledge.

UNIT-II	PROTECTION AND SHARING	3

For Recognition and Protection - United Nations Educational, Scientific and Cultural Organization (UNESCO), World Health Organization (WHO), International Labour Organization (ILO), UN Working Group on Indigenous Populations, Evolution of Other Organizations; Norms of Sharing - United Nations Environment Programme (UNEP), World Intellectual Property Organization (WIPO), World Trade Organization (WTO); IPR and Traditional Knowledge - Theoretical Background, Positive Protections of TK, Defensive Strategies, IPR Facilitation for TK.

UNIT-III	TRADITIONAL KNOWLEDGE FOR BASIC NEEDS	3

Indian Midwifery Tradition—The Dai System, Surface Flow Irrigation Tanks, Housing - A Human Right, Changing Priorities—Niyamgiri.

Biodiversity and Genetic Resources: Jeevani - The Wonder Herb of Kanis, A Holistic Approach - FRLHT, Basmati - In the New Millennium, AYUSH-Based Cosmetics.

UNIT-IV	TRADITIONAL KNOWLEDGE IN MANUFACTURING	3

Drug Discovery, A Sweetener of Bengal, The Sacred Ring of Payyanur, Channapatna Toys.

UNIT-V	TRADITIONAL CULTURAL EXPRESSIONS	3

Banarasi Saree, Music, Built and Tangible Heritage, Modern Yoga, Sanskrit and Artificial Intelligence, Climate Change and Traditional Knowledge.

TOTAL :15 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to:

CO1: Explain the concept of Indian Traditional Knowledge along with Indian Modern Knowledge.

CO2: Explain the need and importance of protecting Traditional Knowledge, Knowledge sharing, and Intellectual property rights over Traditional Knowledge.

CO3: Explain about the use of Traditional Knowledge to meet the basic needs of human being.

CO4: Explain the rich biodiversity materials and knowledge preserved for practicing traditional lifestyle.

CO5: Explain the use of Traditional Knowledge in Manufacturing and Industry.

TEXT BOOKS:

1. Nirmal Sengupta "Traditional Knowledge in Modern India Preservation, Promotion, Ethical

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Access and Benefit Sharing Mechanisms" Springer, 2019.
2. Amit Jha,"Traditional Knowledge System in India", Atlantic Publishers and Distributors Pvt Ltd, 2009.
3. Basanta Kumar Mohanta, Vipin Kumar Singh "Traditional Knowledge System and Technology in India", Pratibha Prakashan, 2012.
4. Kapil Kapoor, Michel Danino "Knowledge Traditions and Practices of India", Central Board of Secondary Education, 2012.

WEB REFERENCES :

1. NPTEL video lecture on "Ayurvedic Inheritance of India", Video link: https://nptel.ac.in/courses/121/106/121106003/#.
2. Youtube video on "Introduction to Indian Knowledge Systems", Video link: https://www.youtube.com/watch?v=LZP1StpYEPM.
3. Youtube video on "12 Great achievements of Indian Civilization", Video link: https://www.youtube.com/watch?v=xmogKGCmclE.

21CE310	COMPUTER AIDED STRUCTURAL DESIGN AND DRAWING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To classify detailing practices and its software applications.
- To analyse the structural elements with different load combinations.
- To categorize the elements as per the functional requirements provided in the IS Code provisions.
- To infer design developed for elements and develop them into drawings.
- To explain and design environmental and irrigation structures.

LIST OF EXPERIMENTS:

Analyse, design and produce detailed drawing as per relevant codes using Excel and drafting software for

Part A - RCC Structures

1. Analysis and design of residential building.
2. Design and drawing of RCC cantilever type retaining walls with reinforcement details.
3. Design and drawing of RCC rectangular and circular water tank.

Part B- Steel Structures

1. Analysis, design and detailing of steel roof truss
2. Analysis and design of Framed Connections and Detailing
3. Analysis and design of Steel water Tank

Part C – Environmental

1. Analysis and Design Septic tank
2. Design of Rapid sand filter

Part D – Irrigation

1. Design of tank sluice with tower head
2. Design of tank surplus weir

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze, design and prepare detailing drawing for residential building.

CO2: Plan and draw reinforced concrete Cantilever Retaining Walls

CO3: Analyze, design and prepare detailing drawing for steel roof truss and steel water tank.

CO4: Sketch the Septic tank and Rapid sand filter

CO5: Prepare the design of tank sluice with tower head and tank surplus weir

TEXT BOOKS:

1. Sarma T S, "Design of R C C Buildings using Staad Pro V8i with Indian Examples English", 2nd edition, Educreation Publishing, 2017.
2. Aghunandan M H, "Analysis of Structural Elements by STAAD Pro for beginners [with RCC design]", 2nd edition, Kindle Edition, 2020.
3. Sarma T S, "Design of Industrial Steel Buildings Using Staad Pro: With Indian Examples", 1st edition, Notion Press; 2020.

REFERENCES:

1. Krishnamurthy, D., "Structural Design & Drawing – Vol. II and III", 2nd edition, CBS Publishers, 2018.
2. IS 456:2000 "Code of Practice for Plain and Reinforced Concrete".
3. IS 875(1-5):1987 "Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures".
4. SP (16): 1980 "Design Aids for Reinforced Concrete to IS: 456-1978".
5. IS 800:2007 "Code of Practice for General Construction in steel".
6. SP6: Part 1:1964 "Handbook for Structural Engineers".

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SEMESTER VII

21CE401	PROJECT WORK - I	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To analyze a specific problem for the current need of the society.
- To infer information related to the problem through detailed review of literature.
- To survey the methodology to solve the identified problem.
- To test and analyze the identified problem.
- To prepare project reports and to face reviews and viva-voce examination.

STRATEGY:

- The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

COURSE OUTCOMES:

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

CO1: Survey any challenging practical problems in Civil Engineering.

CO2: Simplify the problem from its identification and through literature reviews.

CO3: Discover appropriate techniques, modern Engineering tools to solve the problems.

CO4: Analyse the problem in context with societal and environmental need.

CO5: Develop project reports, presentations and to face interviews.

21CE402	COMPREHENSION	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To apply the concept of mathematics, science and engineering fundamentals and an engineering specialization to solve complex engineering problems.
- To prepare the students for higher studies and competitive examinations.

ENGINEERING GROUP I

Strength of Materials: Basics of statics - Simple Stresses and Strains - Principal stresses and strains - Shear Force and Bending Moment - Geometric properties of sections - Bending and shear stresses.

Surveying: Chain surveying- Compass surveying- Plane table surveying – Levelling - Areas and volumes - Theodolite survey – Curves - Modern methods of surveying.

Geology: General geology - Seismology-Minerals and rocks - Structural geology - Engineering Geology.

ENGINEERING GROUP II

Building Materials and Technology: Orientation in buildings - Materials for construction - Technologies for construction - Construction tools and Machinery.

Mechanics of Solids: Axial and bending stresses - Torsion of circular shafts - Slope and deflection of beams - Analysis of Trusses - Moving Loads and Influence Line - Cables, stiffening girders and arches.

Fluid Mechanics: Fluid statics - Pressure measurements - Fluid kinematics - Fluid dynamics - Flow measurements in pipes - Boundary layer theory - Flow through pipes.

Engineering Group 3

Water Supply Engineering: Demand estimation - Identification of sources, intakes and transport of water - Quality assessment - Treatment of water - Water distribution.

Concrete Technology: Concrete making Materials – Cement - Fine aggregate - Coarse aggregate - Water-Admixtures - Concrete Production & Fresh concrete - Concrete mix design - Engineering properties of concrete - Dimensional stability and Durability of concrete - Special concretes.

Engineering Group 4

Structural Analysis: ILD for indeterminate beams- Strain Energy Method- Theorem of Three Moments- Slope Deflection Method- Moment Distribution Method- Matrix Stiffness Method

Hydraulics and Hydraulic Machinery: Open channel flow- Dimensional Analysis- Impact of jets- Water turbines and Pumps

Wastewater Engineering: Characterization of sewage- Collection of sewage- Transportation of wastewater- Treatment of wastewater- Disposal of sewage.

Engineering Hydrology: Hydrologic processes- Surface runoff- Floods- Groundwater

Soil Mechanics: Physical Properties of soils- Consistency limits- Soil Classification- Permeability- Geostatic Stress- Stress due to applied loads- Shear Strength- Compressibility- Soil Compaction- Stability of Slopes

Highways and Pavement Engineering: Highway planning and Alignment- Geometric Elements- Traffic Engineering- Highway materials- Design of pavements- Highway Construction practice- Highway Maintenance

Engineering Group 5

Design of Masonry, Timber and Steel Elements: Brick masonry- Design of Timber Structures- Bolted connection in steel Structures- Welded connection in steel structures- Steel tension members- Steel compression members- Steel flexure members- Column base

Irrigation and Water Resources Engineering: Water Resources Planning- Irrigation- Dams- Diversion Head works- Cross Drainage works

Design of RC Elements: concept of working stress method, Limit state philosophy as detailed in IS code, Limit state of collapse in flexure, Limit state of collapse in shear and torsion, Limit state of collapse in compression, Limit state of serviceability, Design of footing.

Airports, Railways, Docks and Harbour: Permanent Way - its Components and their Functions, Geometric Design of Railway Tracks, Points and Crossings - Design of Turnouts, Working Principle - Signalling, Interlocking and Track Circuiting, Components of Airports, Runway Design - Orientation, Cross wind Component, Wind rose Diagram(Problems), Geometric Design,

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Requirements of Harbour components.

Foundation Engineering: Methods of Site Investigation - Depth of subsurface exploration and Spacing of bore holes - Geophysical methods, Methods of obtaining undisturbed samples, - Bearing Capacities of soils, Types of settlement, functions and types of pile foundation – Bearing capacity failure in piles - Estimating load carrying capacity of piles by Static approach, Efficiency of Pile Group, Drainage and dewatering techniques, Lateral earth Pressure and Retaining Walls.

Design of Steel Structures: Design of welded plate girder, Gantry girder- Determination of maximum bending moment and shear force due vertical component of crane wheel load, Design of gantry girder, Beam – Column -behaviour of beam-column - second order moment in beam-column, Design of Truss using Rolled steel sections – Purlins – truss members – Supports. Design of Truss using tubular sections, web angle connection – Beam to Beam Connection - clip and seat Connection – Concept of semi rigid Connection.

COURSE OUTCOMES:

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

CO1: Ouline the basic concepts of core engineering courses in the programme.

CO2: Summarize the importance of mathematics and science in the programme and its correlation in core engineering courses of the programme.

CO3: Solve basic problems in core engineering of the programme.

CO4: Apply the concepts of core engineering, mathematics and science course to solve complex problems.

21CE403	INTERNSHIP+SEMINAR (During VI Semester Summer Vacation for 4 weeks)	L	T	P	C
		0	0	0	2

COURSE OBJECTIVES:

- To appraise the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks.
- To develop skills in facing and solving the field problems.
- To break down work and its function in the economy.
- To point out interests and abilities in their field of study.
- To relate theory and practice.

STRATEGY:

- The students individually undertake training in Construction Sites on basic material testing & properties and good construction practices in the field 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, learners will be able to

CO1: Connect the implementation of textbook knowledge into practice.

CO2: Discover the concepts of developments and implementation of new techniques.

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CO3: Develop communication, interpersonal and other critical skills in the job interview process.
CO4: Categorize their interest and create a record of work experience.
CO5: Choose career alternatives prior to graduation.

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SEMESTER VIII

21CE404	PROJECT WORK - II	L	T	P	C
		0	0	20	10

COURSE OBJECTIVES:

- To analyze a specific problem for the current need of the society.
- To infer information related to the problem through detailed review of literature.
- To survey the methodology to solve the identified problem.
- To test and analyze the identified problem.
- To prepare project reports and to face reviews and viva-voce examination.

STRATEGY:

- The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

COURSE OUTCOMES:

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

CO1: Survey any challenging practical problems in Civil Engineering.

CO2: Simplify the problem from its identification and through literature reviews.

CO3: Discover appropriate techniques, modern Engineering tools to solve the problems.

CO4: Analyse the problem in context with societal and environmental need.

CO5: Develop project reports, presentations and to face interviews.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL-I: CONSTRUCTION MANAGEMENT AND GEO INFORMATICS

21PCE01	ENGINEERING MATERIALS FOR SUSTAINABILITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To interpret the concepts of sustainability in construction.
- To show the importance of Green Building Technologies.
- To identify the essential qualities of Resources and its utilisation.
- To illustrate the importance of Sustainability practices
- To construct the relationship between the Sustainability Issues with Construction Industry

UNIT I	SUSTAINABILITY	9

Introduction, concept, evolution of the concept; Social, environmental and economic sustainability concepts; Sustainable development, Nexus between Technology and Sustainable development; Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), Clean Development Mechanism (CDM).

UNIT II	GREEN BUILDING TECHNOLOGIES	9

Introduction- Necessity - Concept of Green building. Principles of green building – Selection of site and Orientation of the building – usage of low energy materials – effective cooling and heating systems – effective electrical systems – effective water conservation systems - Certification systems- Green Rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy and Environmental Design (LEED), case studies.

UNIT III	RESOURCES AND ITS UTILISATION	9

Basic concepts of Conventional and non-conventional energy, General idea about solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans and Geothermal energy.

UNIT IV	SUSTAINABILITY PRACTICES	9

Basic concept of sustainable habitat, Methods for increasing energy efficiency in buildings, Green Engineering, Sustainable Urbanisation, Sustainable cities, Sustainable transport.

UNIT V	SUSTAINABILITY ISSUES WITH CONSTRUCTION INDUSTRY	9

Global warming due to Construction, Loss of Biodiversity and Natural Habitats, Acidification due to Construction, Air Pollution due to Construction, Toxicity due to Construction, Water Resource Pollution due to Construction, Deforestation due to Construction.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1:Identify the relevance and the concept of sustainability

CO2: Make use of services integrating concepts of green buildings.

CO3: Solve the concepts related to conventional and non-conventional energy.

CO4: Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge

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and principles.

CO5: Apply the fundamentals of sustainability issues with construction industry.

TEXT BOOKS:

1. Bhavik R, "Sustainable Engineering: Principles and Practice", 1st Edition, Cambridge University Press, 2019.
2. Mike Montoya, "Green Building Fundamentals", 2nd Edition, Pearson, 2010.
3. Charles J. Kibert "Sustainable Construction - Green Building Design", 5th Edition, John Wiley & Sons, Prentice Hall, 2022.

REFERENCES:

1. Michael Ashby, "Materials and the Environment: Eco-Informed Material Choice" 1st Edition, Butterworth-Heinemann, Elsevier, Inc. Burlington, MA. ISBN: 978-1-85617-608-8, 2009.
2. Hoboken NJ and Meg Calkins, "Materials for Sustainable Sites: A Complete Guide to the Evaluation, Selection and Use of Sustainable Construction Materials", 1st Edition, John Wiley & Sons, 2009.
3. Ravindra K. Dhir OBE et al., "Sustainable Construction Materials: Recycled Aggregates", 1st Edition, Woodhead Publishing, 2019.

21PCE02	ADVANCED SURVEYING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To illustrate astronomical bodies and field astronomy.
- To relate the method and applications of collective imagery using photogrammetry.
- To discover the working and applications of total station.
- To demonstrate the concept of satellite navigation system and the field work procedure of GPS in data collection.
- To identify surveys subjected to curves, water bodies and tunnel alignments.

UNIT I	ASTRONOMICAL SURVEYING	9

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

UNIT II	AERIAL SURVEYING	9

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

UNIT III	TOTAL STATION SURVEYING	9

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

UNIT IV	GPS SURVEYING	9

Basic concepts – Space, Control and User segments – Satellite configuration – Signal structure – Orbit determination and representation – Antispoofing and selective availability – hand held and geodetic receivers – Field work procedure – Data processing Applications		
UNIT V	**MISCELLANEOUS**	**9**
Reconnaissance – Route surveys for highways, railways and waterways – simple, compound, reverse , transition and vertical curve – setting out methods - hydrographic surveying – tides – MSL – Sounding methods – measurement of current and discharge – Tunnel alignment and setting out – Settlement and Deformation studies		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the concepts of astronomical observations in surveying.

CO2: Utilize the photographs from aerial surveying.

CO3: Solve the field problems using Total station.

CO4: Experiment the concepts of GPS surveying and data processing.

CO5: Interpret data on route, hydrographic surveys and tunnel alignments.

TEXT BOOKS:

1. Punmia BC, "Surveying", 17th Edition, Laxmi Publications, 2016.
2. James M.Anderson and Edward M.Mikhail, "Surveying, Theory and Practice", 7th Edition, McGraw Hill, 2001.
3. Bannister and S.Raymond, "Surveying", 7th Edition, Longman 2004.
4. Alfred Leick, "GPS satellite surveying", 4th Edition, John Wiley & Sons Inc., 2015.

REFERENCES:

1. Arora K.R. "Surveying Vol I & II", 15th Edition, Standard Book House, 2018.
2. GuochengXu, "GPS - Theory, Algorithms and Applications", 2nd Edition, Springer – Verlag, Berlin, 2007
3. Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2004.

21PCE03	REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To build understanding on the basic concepts of remote sensing.
- To utilize information on various platforms and sensors.
- To interpret and process images.
- To make use of the concept about Geographic Information System.
- To apply the concept of GIS in civil engineering projects.

UNIT I	**EMR AND ITS INTERACTION WITH ATMOSPHERE & EARTH MATERIAL**	**9**
Definition of remote sensing and its components – Electromagnetic spectrum – wavelength regions		

important to remote sensing – Wave theory, Particle theory, Stefan-Boltzman and Wein's Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts – typical spectral reflective characteristics of water, vegetation and soil.		
UNIT II	**PLATFORMS AND SENSORS**	**9**
Types of platforms – orbit types, Sun-synchronous and Geosynchronous – Passive and Active sensors – resolution concept – Payload description of important Earth Resources and Meteorological satellites – Airborne and spaceborne TIR and microwave sensors		
UNIT III	**IMAGE INTERPRETATION AND ANALYSIS**	**9**
Types of Data Products – types of image interpretation – basic elements of image interpretation - visual interpretation keys – Digital Image Processing – Pre-processing – image enhancement techniques – multispectral image classification – Supervised and unsupervised		
UNIT IV	**GEOGRAPHIC INFORMATION SYSTEM**	**9**
Introduction – Maps – Definitions – Map projections – types of map projections – map analysis – GIS definition – basic components of GIS – standard GIS softwares – Data type – Spatial and non-spatial (attribute) data – measurement scales – Database Management Systems (DBMS).		
UNIT V	**DATA ENTRY, STORAGE AND ANALYSIS**	**9**
Data models – vector and raster data – data compression – data input by digitization and scanning – attribute data analysis – integrated data analysis – Modeling in GIS Highway alignment studies – Land Information System.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the basic concepts of Geographic information system.

CO2: Make use of various platforms and sensors used in GIS.

CO3: Develop images through processing.

CO4: Experiment with the concepts behind GIS.

CO5: Utilize GIS data for Civil engineering applications.

TEXT BOOKS:

1. Lillesand,T.M., Kiefer, R.W. and J.W.Chipman., "Remote Sensing and Image Interpretation", 7th Edition, John Willey and Sons Asia Pvt. Ltd., New Delhi, 2015.
2. Basudeb Bhatta, "Remote Sensing and GIS 3E", 3rd Edition, OUP India, 2021.
3. Anji Reddy, M. "Textbook of Remote Sensing and Geographical Information System" 2nd Edition, BS Publications, Hyderabad, 2001.

REFERENCES:

1. Lo.C.P.and A.K.W.Yeung, "Concepts and Techniques of Geographic Information Systems", 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2006.
2. Peter A.Burrough, Rachael A. McDonnell, "Principles of Geographical Information Systems", 3rd Edition, Oxford University Press, 2015.
3. Ian Heywood, Sarah Cornelivs and Steve Carver, "An Introduction to Geographical Information System", 4th Edition, Pearson Education Pvt Ltd., New Delhi, 2011.

21PCE04	CONSTRUCTION PLANNING AND SCHEDULING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To identify the basic concepts of construction planning.
- To plan the construction activities.
- To develop the cost control in construction.
- To make use of concepts in quality control and safety during construction.
- To organize information in Centralized database Management systems.

UNIT I	CONSTRUCTION PLANNING	9

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

UNIT II	SCHEDULING PROCEDURES AND TECHNIQUES	9

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

UNIT III	COST CONTROL MONITORING AND ACCOUNTING	9

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

UNIT IV	QUALITY CONTROL AND SAFETY DURING CONSTRUCTION	9

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

UNIT V	ORGANIZATION AND USE OF PROJECT INFORMATION	9

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify the basic concepts of construction planning.

CO2: Make use in construction activities.

CO3: Utilize to control the cost in a construction.

CO4: Plan for quality control and safety during construction.

CO5: Construct centralized database Management systems.

TEXT BOOKS:

1. Hinze, "Construction Planning and Scheduling", 4th Edition, Pearson Education India, 2013.
2. Chitkara, K.K. "Construction Project Management Planning, Scheduling and Control", 3rd Edition, Tata McGraw Hill Publishing Co., New Delhi, 2014.
3. Srinath,L.S., "Pert and CPM Principles and Applications", 3rd Edition, Affiliated East West Press, 2001.

REFERENCES:

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

21PCE05	HOUSING PLANNING AND MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To utilize the basic infrastructure consideration and the integrated approach on the National Housing policies.
- To interpret the basic housing programmes including the slum redevelopment and relocation using GIS and MIS.
- To illustrate on the planning, design, evaluation and construction of housing projects.
- To relate the Construction techniques and methods of Green building concept.
- To prepare the Housing finance, cost recovery and pricing of housing units.

UNIT I	INTRODUCTION TO HOUSING	9

Definition of Basic Terms – House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy, Principle of Sustainable Housing – Integrated approach on arriving holding capacity and density norms - All basic infrastructure consideration - Institutions for Housing at National, State and Local levels.

UNIT II	HOUSING PROGRAMMES	9

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods- Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing Programmes – Slum improvement – Slum redevelopment and Relocation – Use of GIS and MIS in Slum Housing Projects, Role of Public housing agencies, and Private sector in supply , quality, infrastructure and pricing – Role of Non-Government Organizations in slum housing.

UNIT III	PLANNING AND DESIGN OF HOUSING PROJECTS	9

Formulation of Housing Projects – Land Use and Soil suitability analysis -Building Byelaws and Rules and Development Control Regulations - Site Analysis, Layout Design, Design of Housing

Units (Design Problems) – Housing Project Formulation		
UNIT IV	**CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS**	**9**
New Constructions Techniques – Cost Effective Modern Materials and methods of Construction-Green building concept- Building Centres – Concept, Functions and Performance Evaluation.		
UNIT V	**HOUSING FINANCE AND PROJECT APPRAISAL**	**9**
Evaluation of Housing Projects for sustainable principles – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy- Public Private Partnership Projects – Viability Gap Funding - Pricing of Housing Units (Problems).		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Build the basic infrastructure consideration and the integrated approach on the National Housing policies.

CO2: Make use of the basic housing programmes including the slum redevelopment and relocation using GIS and MIS.

CO3: Utilize the planning, design, evaluation and construction of housing projects.

CO4: Model the Construction techniques and methods of Green building concept.

CO5: Plan the Housing finance, cost recovery and pricing of housing units.

TEXT BOOKS:

1. Donald Watson and Michael J.Crosbie, "Time Saver Standards for Architectural Design", 8th Edition, Tata McGraw Hill Edition, 2011.
2. Meera Mehta and Dinesh Mehta, "Metropolitan Housing Markets", Sage Publications Pvt. Ltd., New Delhi, 1999.
3. Francis Cherunilam and Odeyar D Heggade, "Housing in India", Himalaya Publishing House, Bombay, 1997.

REFERENCES:

1. Wiley- Blackwell, "Neufert Architects Data", 4th Edition, Blackwell Publishing Ltd, 2012.
2. Walter Martin Hosack, "Land Development Calculations", 2nd Edition, McGraw Hill USA 2010.
3. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2004.

21PCE06	INFRASTRUCTURE PLANNING AND MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To relate the various stages of infrastructure projects lifecycle and its finance.
- To explain the infrastructure privatization with case studies.
- To apply the successful infrastructure planning and the challenges in construction and maintenance of Infrastructure.
- To show the strategies in shaping and planning for successful infrastructure projects.

- To make use of the sustainable development of the Infrastructure Management Systems and Future Directions.

UNIT I	**AN OVERVIEW OF BASIC CONCEPTS RELATED TO INFRASTRUCTURE**	9

Introduction to Infrastructure-an overview of the Power Sector in India-an Overview of the Water Supply and Sanitation Sector in India- an overview of the Road, Rail-Air and Port Transportation Sectors in India- an overview of the Telecommunications Sector in India-an overview of the Urban Infrastructure in India-an overview of the Rural Infrastructure in India-an Introduction to Special Economic Zones-Organizations and layers in the field of Infrastructure-The Stages of an Infrastructure Project Lifecycle- an overview of Infrastructure Project Finance.

UNIT II	**PRIVATE INVOLVEMENT IN INFRASTRUCTURE:**	9

A Historical Overview of Infrastructure Privatization-The Benefits of Infrastructure Privatization-Problems with Infrastructure Privatization-Challenges in Privatization of Water Supply: A Case Study-Challenges in Privatization of Power: Case Study- Privatization of Infrastructure in India: Case Study-Privatization of Road Transportation Infrastructure in India.

UNIT III	**CHALLENGES TO SUCCESSFUL INFRASTRUCTURE PLANNING AND IMPLEMENTATION**	9

Mapping and Facing the Landscape of Risks in Infrastructure Projects- Economic and Demand Risks: The Case study for Political Risks- Socio-Environmental Risks- Cultural Risks in International Infrastructure Projects- Legal and Contractual Issues in Infrastructure- Challenges in Construction and Maintenance of Infrastructure.

UNIT IV	**STRATEGIES FOR SUCCESSFUL INFRASTRUCTURE PROJECT IMPLEMENTATION**	9

Risk Management Framework for Infrastructure Projects- Shaping the Planning Phase of Infrastructure Projects to mitigate risks- Designing Sustainable Contracts- Introduction to Fair Process and Negotiation- Negotiating with multiple Stakeholders on Infrastructure Projects

UNIT V	**SUSTAINABLE DEVELOPMENT OF INFRASTRUCTURE**	9

Information Technology and Systems for Successful Infrastructure Management- - Innovative Design and Maintenance of Infrastructure Facilities- Infrastructure Modeling and Life Cycle Analysis Techniques- Capacity Building and Improving the Governments Role in Infrastructure Implementation- An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Interpret the basic concepts related to Infrastructure Projects.

CO2: Show the role of private sector in infrastructure growth.

CO3: Construct the strategies for successful Infrastructure Project implementation.

CO4: Develop Infrastructure modelling and Life Cycle Analysis Techniques.

CO5: Illustrate Sustainable development of Infrastructure.

TEXT BOOKS:

1. Grigg, Neil, "Infrastructure engineering and management", John Wiley & Sons, Newyork, 1996.
2. Haas, Hudson, Zaniewski, "Modern Pavement Management", Krieger Publishing Company, Malabar, 1994.
3. Hudson, Haas, Uddin, "Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation", McGraw Hill, 1997.

REFERENCES:

1. World Development Report 1994: "Infrastructure for Development".
2. Zimmerman, K. and F. Botelho, "Pavement Management Trends in the United States," 1st European Pavement Management Systems Conference, Budapest, September, 2000.
3. Munnell, Alicia, "Is There a Shortfall in Public Capital Investment?" Proceedings of a Conference Held in June, 1990.

21PCE07	GREEN BUILDING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To develop knowledge on environmental implications of buildings.
- To apply the implications of building technologies in embodied energy of buildings.
- To make use of knowledge on comforts in building.
- To discover utility of solar energy in buildings.
- To interpret the concept of green composites for buildings.

UNIT I	ENVIRONMENTAL IMPLICATIONS OF BUILDINGS	9

Energy use, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transportation Energy for Building Materials; Maintenance Energy for Buildings.

UNIT II	IMPLICATIONS OF BUILDING TECHNOLOGIES EMBODIED ENERGY OF BUILDINGS	9

Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

UNIT III	COMFORTS IN BUILDING	9

Thermal Comfort in Buildings- Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations.

UNIT IV	UTILITY OF SOLAR ENERGY IN BUILDINGS	9

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.

UNIT V	GREEN COMPOSITES FOR BUILDINGS	9

Concepts of Green Composites. Water Utilisation in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

TOTAL : 45 PERIODS

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BoS Chairman

COURSE OUTCOMES:

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

CO1 : Interpret knowledge on environmental implications of buildings.

CO2: Relate the implications of building technologies in embodied energy of buildings.

CO3: Develop knowledge on comforts in buildings.

CO4: Identify utility of solar energy in buildings.

CO5: Illustrate the green composites for buildings.

TEXT BOOKS:

1. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao, "Alternative Building Materials and Technologies", 2nd Edition, New Age International Private Limited, 2017.
2. Ursula Eicker, "Low Energy Cooling For Sustainable Buildings", John Wiley and Sons Ltd, 2009.
3. "Sustainable Building Design Manual-Vol 1 and 2", TERI, New Delhi, 2004.

REFERENCES:

1. Osman Attmann, "Green Architecture Advanced Technologies and Materials", 1st Edition, McGraw Hill, 2010.
2. Jerry Yudelson, "Green building Through Integrated Design", 1st Edition, McGraw Hill, 2008.
3. Marian Keeler and Bill Burke, "Fundamentals of Integrated Design for Sustainable Building", John Wiley & sons, 2009.

VERTICAL-II: GEOTECHNICAL

21PCE08	GEO SYNTHETICS IN CIVIL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To choose the evolution of new construction materials in geotechnical engineering and to initiate geosynthetic materials.
- To identify the properties and the testing methods of different types of materials of geosynthetics.
- To classify manufacturing methods, uses and applications of geotextiles, geogrids, geomembranes and geocomposites.
- To show the functions of separation, reinforcement, stabilization, filtration, drainage and moisture barriers and other applications of geosynthetics
- To illustrate design criteria of reinforced earth retaining walls, gabions, pond liners, covers for reservoirs, canal liners, landfill liners, caps and closures, dams and embankments.

UNIT I	GEOSYNTHETICS	9

Basic description – Polymeric materials– Uses and Applications. Properties of Geotextiles – Geogrids – Geomembranes – Geocomposites.

UNIT II	GEOTEXTILES	9

Design criteria for Separation – Reinforcement – Stabilization – Filtration – Drainage and Moisture barriers. Geogrids: Designing for Reinforcement – Stabilization – Designing Gabions – Construction methods.

UNIT III	USE OF GEOSYNTHETICS IN ROADS	9

Geosynthetics in road ways- applications role of subgrade conditions-design criteria-survivability-application in paved roads.

UNIT IV	REINFORCED EARTH RETAINING WALLS	9

Components - External stability – Internal stability-Design of reinforced earth walls with strip, sheet and grid reinforcement

UNIT V	GEOMEMBRANES AND NATURAL GEOTEXTILES	9

Pond Liners – Covers for Reservoirs – Canal Liners – Landfill Liners– Caps and closures, moisture barriers. Geocomposites: An added advantage – Geocomposites in Separation – Reinforcement – Filtration – Geocomposites as Geowebs and Geocells - Natural fibres as geotextiles- factors governing the use of fibres-coir geotextiles-bamboo/timber-combination of geotextiles.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Utilize the need and demand for the use of geosynthetic materials in the field of geotechnical construction works.

CO2: Select the Experiments on laboratory and field tests to obtain the properties of different materials of geosynthetics.

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BoS Chairman

CO3: Relate various manufacturing methods of geotextiles, geogrids, geomembranes, natural geotextiles and geocomposites.

CO4: Make use of the concepts and design the geosynthtics for the functions of separation, reinforcement, stabilization, filtration, drainage and moisture barriers.

CO5: Develop designs for reinforced earth retaining walls, gabions, pond liners, covers for reservoirs, canal liners, landfill liners, caps and closures.

TEXT BOOKS:

1. Robert M. Koerner, "Designing with Geosynthetics", 6th Edition, Pearson Prentice Hall, 2012.
2. SivakumarBabu.G.L, "An Introduction to Soil Reinforcement and Geosynthetics", 1st Edition Universities Press (India) Pvt. Ltd., 2009.
3. Venkatappa Rao.G and Suryanarayana Raju GVS, "Engineering with Geosynthetics", Tata McGraw Hill Publishing Company Limited – New Delhi, 1990.

REFERENCES:

1. Robert M. Koerner and Josoph P. Welsh, "Construction and Geotechnical Engineering using Synthetic Fabrics", 1st Edition, John Willey and Sons, New York, 1980.
2. Bowles.J.E, "Foundation Analysis and Design", 5th Edition, McGraw Hill Publications, 2001.
3. Swami Saran, "Analysis and Design of Substructures: Limit State Design", 2nd Edition, Oxford & IBH Publishing Co Pvt.Ltd, 2018.

21PCE09	GROUND IMPROVEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To identify the various methods and selection of ground improvement techniques.
- To interpret different dewatering techniques and design for simple cases.
- To select in situ treatment of cohesion less and cohesive soils.
- To apply the concept of earth reinforcement and design of reinforced earth.
- To classify types of grouts and grouting techniques.

UNIT I	PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES	8

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

UNIT II	DEWATERING	10

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

UNIT III	INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS	10

Insitu densification of cohesionless soils – Shallow as deep compaction – Dynamic compaction -

Vibroflotation, Sand compaction piles and deep compaction. Consolidation of cohesionless soils - Preloading with sand drains, and fabric drains, Stabilization of soft clay ground using stone columns and Lime piles-Installation techniques – Simple design - Relative merits of above methods and their limitations.		
UNIT IV	**EARTH REINFORCEMENT**	**9**
Concept of reinforcement – Types of reinforcement material – Reinforced earth wall – Mechanism – Simple design - Applications of reinforced earth; Functions of Geotextiles in filtration, drainage, separation, road works and containment applications.		
UNIT V	**GROUTING TECHNIQUES**	**8**
Types of grouts – Grouting equipments and machinery – Injection methods – Grout monitoring – Stabilization with cement, lime and chemicals – Stabilization of expansive soil.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Utilize various methods and selection of ground improvement techniques.

CO2: Make use of dewatering techniques and design for simple cases.

CO3: Apply in situ treatment of cohesion less and cohesive soils.

CO4: Interpret the concept of earth reinforcement and design of reinforced earth.

CO5: Compare various types of grouts and grouting techniques.

TEXT BOOKS:

1. Purushothama Raj. P, "Ground Improvement Techniques", 2nd Edition, Lakshmi Publications, 2016.
2. NiharRanjanPatra, "Ground Improvement Techniques", 1st Edition, Vikas Publishing House, 2012.
3. Mittal.S, "An Introduction to Ground Improvement Engineering", 1st Edition, Medtech Publisher, 2013.

REFERENCES:

1. Das, B.M., "Principles of Foundation Engineering", 7th Edition, Cengage learning, 2010.
2. Coduto, D.P., "Geotechnical Engineering – Principles and Practices", 1st Edition, Prentice Hall of India Pvt.Ltd. New Delhi, 2011.
3. Koerner, R.M., "Designing with Geosynthetics" 6th Edition, Xlibris Corporation, U.S.A, 2012.
4. IS Code 9759: 1981 (Reaffirmed 1998) "Guidelines for Dewatering During Construction", Bureau of Indian Standards, New Delhi.
5. IS Code 15284 (Part 1): 2003 "Design and Construction for Ground Improvement – Guidelines" (Stone Column), Bureau of Indian Standards, New Delhi.

21PCE10	SOIL DYNAMICS AND MACHINE FOUNDATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To apply the theory and measurement of vibration.
- To make use of the concept of wave propagation in infinite medium in the design of machine foundation.
- To identify dynamic properties of soils and laboratory and field testing.
- To interpret the design of foundation for different types of machines.
- To illustrate about the liquefaction, motion isolation and vibration control.

UNIT I	THEORY OF VIBRATION	9

Introduction – Nature dynamic loads – Vibrations of single degree freedom system – Free vibrations of spring – mass systems – Forced vibrations – Viscous damping - Transmissibility – Principles of vibration measuring instruments – Effect of Transient and Pulsating loads.

UNIT II	WAVE PROPAGATION	9

Elastic waves in rods of infinite length – Longitudinal and Torsional – Effect of end conditions – Longitudinal and torsional vibrations of rods of finite length – Wave Propagation in infinite, homogeneous isotropic and elastic medium - Wave propagation in elastic half space – Typical values of compress wave and shear wave velocity – Wave propagation due to Machine foundation – Surface wave – Typical values – Particle movements and velocity.

UNIT III	DYNAMIC PROPERTIES OF SOILS	9

Dynamic stress – Strain characteristics – Principles of measuring dynamic properties – Laboratory Techniques – Field tests – Factors affecting dynamic properties – Typical values – Dynamic bearing capacity – Dynamic earth pressure.

UNIT IV	FOUNDATION FOR DIFFERENT TYPES OF MACHINES	9

Types of machines and foundation – General requirements – Modes of vibration of a rigid foundation – Method of analysis – Linear elastic weightless spring method – Elastic half space method – Analog Method – Design of block foundation – Special consideration for rotary, Impact type of machines – Codal Provisions.

UNIT V	INFLUENCE OF VIBRATION AND REMEDIATION	9

Mechanism of Liquefaction – Influencing factors – Evaluation of Liquefaction potential based on SPT-Force Isolation – Motion Isolation – Use of spring and damping materials – Vibration control of existing machine foundation – Screening of vibration – Open trenches – Pile Barriers – Salient construction aspects of machine Foundations.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the theory and measurement of vibration.

CO2: Utilize the concept of wave propagation in infinite medium and design machine foundation.

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CO3: Identify dynamic properties of soils by laboratory techniques and field testing.

CO4: Develop the types of foundation for different machines.

CO5: Identify the influence of vibrations and remediation.

TEXT BOOKS:

1. Swamisaran, "Soil Dynamics and Machine Foundations", 3rd Edition, Galgotia Publications Pvt.Ltd. New Delhi-110002, 2016.
2. Srinivasulu.P, and Vaidyanathan.C.V , "Handbook of Machine Foundations", Tata McGraw-Hill, 2007.
3. Braja M. Das, G.V. Ramana "Principles of soil dynamics", 2nd Edition, Cengage Learning, 2010.

REFERENCES:

1. IS Code 5249: 1992 (Reaffirmed 2006) "Determination of Dynamic Properties of Soil – Method of Test" Bureau of Indian Standards, New Delhi.
2. IS Code 2974: (Part 1) 1982 (Reaffirmed 2008) "Code of Practice for Design and Construction of Machine Foundations - Foundation for Reciprocating Type Machines" Bureau of Indian Standards, New Delhi.
3. IS Code 2974: (Part 2) 1980 (Reaffirmed 2008) "Code of Practice for Design and Construction of Machine Foundations - Foundations for Impact Type Machines (Hammer Foundations)" Bureau of Indian Standards, New Delhi.

21PCE11	REINFORCED EARTH STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To identify and formulate reinforced earth techniques that is suitable for different soils and different structures.
- To model reinforced earth retaining walls and understand soil nailing concepts.
- To interpret the load carrying capacity of foundations resting on reinforced earth soil bed.
- To apply geosynthetics in stabilization of roads and slopes.
- To use geosynthetics in drainage and landfill designs.

UNIT I	BASICS OF REINFORCED EARTH CONSTRUCTION	9

Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil.- Historical developments, Recent developments, manufacturing process woven & non-woven, Raw materials – Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics- Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties

UNIT II	DESIGN OF REINFORCED EARTH RETAINING WALLS	9

Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, Typical design problems- Concept, Advantages & limitations of soil nailing techniques, comparison

of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken.		
UNIT III	**DESIGN OF REINFORCED EARTH FOUNDATIONS**	**9**
Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines		
UNIT IV	**GEOSYNTHETICS FOR ROADS AND SLOPES**	**9**
Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique. Simple Numerical Stability Checking Problems on Reinforced Slopes		
UNIT V	**GEOSYNTHETICS - FILTER, DRAIN AND LANDFILLS**	**9**
Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soilretention, Geosynthetic permeability, anti-clogging, survivability and durability (No Numerical Problems) Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Make use of reinforced earth techniques that are suitable for different soils and different structures

CO2: Construct reinforced earth retaining structures and utilize soil nailing concepts

CO3: Apply the load carrying capacity of foundations resting on reinforced earth soil bed.

CO4: Choose geosynthetics for stabilization of roads and slopes.

CO5: Utilize geosynthetics in drainage and landfill designs.

TEXT BOOKS:

1. Swami Saran, "Reinforced Soil and its Engineering Applications", 3rd Edition, I. K. International Pvt. Ltd, New Delhi, 2017.
2. SivakumarBabu G. L., "An introduction to Soil Reinforcement and Geosynthetics", 1st Edition, Universities Press, Hyderabad, 2006.
3. Venkattappa Rao, G., & Suryanarayana Raju., G.V.S, "Engineering with Geosynthetics", Tata McGraw Hill publishing Company Limited., New Delhi, 2018.

REFERENCES:

1. Jones, "Earth reinforcement and Soil structure", Subsequent Edition, CJEP Butterworths, London, 2013.
2. Ingold, T.S, "Reinforced Earth", Thomas, Telford, London, 1982.
3. Sarsby R W- Editor, "Geosynthetics in Civil Engineering", 1st Edition, Woodhead Publishing Ltd & CRC Press, 2007

21PCE12	ROCK ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To illustrate the fundamentals of rock mechanics and its classifications for the Engineering purposes.
- To interpret the knowledge on the Rock strength and its mechanical properties.
- To identify the initial stresses and distribution of rocks using different methods.
- To select the application of rock mechanics in the Engineering applications.
- To choose the principles and support reactions on rock stabilizations.

UNIT I	CLASSIFICATION AND INDEX PROPERTIES OF ROCKS	9

Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose – Rock Mass Rating and Q System.

UNIT II	ROCK STRENGTH AND FAILURE CRITERIA	9

Modes of rock failure – Strength of rock – Laboratory measurement of shear, tensile and compressive strength. Stress - strain behaviour of rock under Hydrostatic compression and deviatoric loading – Mohr –Coulomb failure criteria and Hock and Brown empirical criteria.

UNIT III	INITIAL STRESSES AND THEIR MEASUREMENTS	9

Estimation of initial stresses in rocks – influence of joints and their orientation in distribution of stresses – measurements of in-situ stresses – Hydraulic fracturing – Flat jack method – Over coring method.

UNIT IV	APPLICATION OF ROCK MECHANICS IN ENGINEERING	9

Simple engineering application – Underground openings – Rock slopes – Foundations and mining subsidence.

UNIT V	ROCK STABILISATION	9

Introduction – Rock support and Rock reinforcement – Principles – Support reaction curves – Shotcreting.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Relate the index properties of rock systems.

CO2: Show the modes of failure, stress-strain characteristics, and failure criteria of rocks.

CO3: Calculate the stresses in rocks.

CO4: Utilize rock mechanics in engineering.

CO5: Identify the principles and support reactions on rock stabilizations.

TEXT BOOKS:

1. Ramamurthy T., "Engineering in Rocks for Slopes Foundations and Tunnels", 3rd Edition,PHI Learning Pvt. Ltd.,2014.
2. Goodman, P.E. "Introduction to Rock Mechanics", 2nd Edition, John Wiley and Sons, 1999.
3. Stillborg B., "Professional User Handbook for rock Bolting", Tran Tech Publications, 1996.

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REFERENCES:

1. Brady, B.H.G. and Brown, E.T., "Rock mechanics for underground mining", 3rd Edition Kluwer Academic Publishers, Dordrecht, 2006.
2. Brown, E.T. "Rock Characterisation Testing and Monitoring", Pergaman Press 1991.
3. Arogyaswamy, R.N.P., "Geotechnical Application in Civil Engineering", 1st Edition, Oxford and IBH, 1991.

21PCE13	TUNNELING ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To apply the scope and background of tunnel engineering to underground excavations.
- To interpret knowledge on types of tunnels and tunneling methods.
- To identify drilling and blasting tunneling method.
- To choose methods of tunneling
- To illustrate the supports in tunneling procedures with ground treatment, tunneling services and its hazards

UNIT I	INTRODUCTION	9

Scope and application, historical developments, art of tunneling, tunnel engineering, future tunneling considerations. Types of Underground Excavations - Tunnel, adit, decline, shaft; parameters influencing location, shape and size; geological aspects; planning and site investigations.

UNIT II	TUNNELING METHODS	9

Types and purpose of tunnels - factors affecting choice of excavation technique; Methods – soft ground tunneling, hard rock tunneling, shallow tunneling, deep tunneling; Shallow tunnels – cut and cover, cover and cut, pipe jacking, jacked box excavation techniques, methods of muck disposal, supporting, problems encountered in tunneling and remedial measures.

UNIT III	TUNNELING BY DRILLING AND BLASTING	9

Unit operations in conventional tunneling; Drilling – drilling principles, drilling equipment, drilling tools, drill selection, rock drillability factors; Blasting – explosives, initiators, blasting mechanics, blast hole nomenclature; types of cuts- fan, wedge and others; blast design, tunnel blast performance – powder factor, parameters influencing, models for prediction; mucking and transportation equipment selection.

UNIT IV	TUNNELING BY ROADHEADERS AND IMPACT HAMMERS	9

Cutting principles, method of excavation, selection, performance, limitations and problems. Tunneling by Tunnel Boring Machines - Boring principles, method of excavation, selection, performance, limitations and problems; TBM applications.

UNIT V	SUPPORTS IN TUNNELS	9

Different types of supports in tunneling and their applicability, NATM. Ground Treatment inTunneling: Adverse ground conditions and its effect on tunneling; introduction to groundcontrol.

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Tunnel Services - Ventilation, drainage and pumping. Tunneling Hazards - Explosion,flooding, chimney formation, squeezing ground
TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify tunneling and the types of underground excavations

CO2: Utilize the methods of tunneling with respect to the types of tunnels

CO3: Apply the conventional tunneling method - Drilling and blasting

CO4: Select the cutting principles and machines used for borings.

CO5: Make use of the types of supports in tunneling and ground treatment

TEXT BOOKS:

1. Srinivasan R, "Harbour, Dock and Tunneling Engineering", 30th edition, R. C. Pattii, Chal'otar Book Stall, Station Road TulsiSada, Arland (W. Rly), India, 2022.
2. Pokorovski, "Driving Horizontal Workings and Tunnel", Mir Publishers, 1980.
3. Hoek, E. and Brady, J. D. "Rock Slope Engineering", 4th Edition, Taylor and Francis, 2005.

REFERENCES:

1. Hoek, E., Brown, E, "Underground excavations in Rock", 1st Edition, CRC Press, 1980. (ebook - 2014).
2. Carlos L Jimeno, "Drilling and Blasting of Rocks", 1st Edition, A.A. Balkema/Rotterdam/Brookfield 1995.
3. Nick Barton, "Tunnel Boring Machines", 1st edition, 2000.

21PCE14	PILE FOUNDATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To classify the concepts of pile foundation.
- To illustrate the response of axial load capacity and settlement of piles and pile groups.
- To identify the importance of lateral and uplift load capacity of piles.
- To interpret and solve design techniques for deep foundations
- To develop knowledge on caissons.

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 equipment and methods – effect of pile installation on soil condition – pile raft system – basic interactive analysis - criteria for pile socketing - responsibility of engineer and contractor

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 – pile integrity test - Settlement of piles and pile group - codal provisions and IRC guide lines.		
UNIT III	**LATERAL AND UPLIFT LOAD CAPACITY 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 load tests – codal provision – IRC guide lines – case studies.		
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 – codal provision – IRC guide line.		
UNIT V	**CAISSONS**	**9**
Necessity of caisson – type and shape - Stability of caissons – principles of analysis and design – tilting of caisson – construction - seismic influences - codal provision.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify the concepts of pile foundation and its classifications.

CO2: Make use of the response of axial load capacity and settlement of piles and pile groups.

CO3: Calculate lateral and uplift load capacity of piles.

CO4: Apply the design techniques for deep foundations

CO5: Utilize knowledge on caissons.

TEXT BOOKS:

1. Reese, L. C. and Van Impe, W. F., "Single Piles and Pile Groups under Lateral Loading", 2nd Edition, Taylor and Francis, London, 2011.
2. Reese,L.C., Isenhower,W.M. and Wang,S.T. "Analysis and Design of Shallow and Deep Foundations", 1st Edition, John Wiley and Sons, New York, 2005.
3. Tomlinson, M.J. "Foundation engineering", 1st Edition, ELBS, Longman Group, U.K. Ltd., England 1995.

REFERENCES:

1. Michael Tomlinson and John Woodward, "Pile design and construction practice", 5th Edition, Taylor & Francis Group, London & New York, 2008.
2. Varghese P.C., "Design of Reinforced Concrete Foundations", 1st Edition, PHI Learning Private Limited, New Delhi, 2009.
3. Varghese P.C., "Foundation Engineering", Kindle Edition, PHI Learning Private Limited, New Delhi, 2005.

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VERTICAL-III: ENVIRONMENT

21PCE15	INDUSTRIAL WASTEWATER MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To demonstrate the concept of industries in the Indian scenario.
- To apply knowledge in Pollution Prevention and Pollution Control.
- To identify physical, chemical, and biological phenomena for successful industrial wastewater treatment.
- To utilize the dynamic processes and understand the concept of wastewater reuse and residual management.
- To interpret the importance of the environment by assessing and envisioning its impact on the human world.

UNIT I	INTRODUCTION TO INDUSTRIAL WASTEWATER	9

Industrial scenario in India – industrial activity and environment, uses of water by industry, sources and types of industrial wastewater. Regulatory requirements for treatment of industrial waste water, industrial waste survey, industrial waste water generation rates, characterization and variables, population equivalent.

UNIT II	INDUSTRIAL POLLUTION PREVENTION	9

Prevention Vs Control of industrial pollution – benefits and barriers. Source reduction techniques – waste audit, evaluation of pollution prevention options, environmental statement as a tool for pollution prevention, waste minimization circles.

UNIT III	INDUSTRIAL WASTEWATER TREATMENT	9

Equalization – neutralization, oil separation, flotation, precipitation, Aerobic and anaerobic biological treatment – sequencing batch reactors, high-rate reactors (Recall) Advanced Chemical oxidation – Electro chemical oxidation, wet air oxidation, ozonation, photocatalysis, Other Treatment Processes Heavy metal removal, Refractory organics separation by adsorption. ion exchange, membrane technologies, nutrient removal.

UNIT IV	WASTEWATER REUSE AND RESIDUAL MANAGEMENT	9

Evaporation- Evaporators types and classification. Zero effluent discharge systems - Quality requirements for wastewater reuse, industrial reuse, disposal on water and land. Residuals from industrial wastewater treatment units - quantification and characteristics of sludge – thickening, digestion, conditioning, dewatering and disposal of sludge. Management of RO rejects. Individual and common effluent treatment plants – combined treatment of industrial waste water and domestic/municipal wastewater.

UNIT V	CASE STUDIES	9

Industrial manufacturing process description, waste water characteristics, source reduction options and waste treatment flow sheet for textiles, tanneries, pulp and paper, metal finishing, sugar and distilleries.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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BoS Chairman

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

CO1: Identify the of industrial wastewater and regulatory requirements for treatment.

CO2: Select a proper tool for industrial pollution prevention.

CO3: Develop appropriate treatment systems for the pollution generated from the industries.

CO4: Make use of the possible methods to reuse wastewater and manage the obtained residues.

CO5: Apply the knowledge obtained from various industries to face real time problems.

TEXT BOOKS:

1. Thirugnanasambandham and Karchiyappan, "Industrial Wastewater Treatment", Kindle Edition, Springer Nature, Switzerland AG, 2022.
2. Eckenfelder, W.W., "Industrial Water Pollution Control", 3rd Edition, McGraw – Hill, 2000.
3. Paul L. and Bishop "Pollution Prevention: - Fundamentals and Practice", 2nd Edition, McGraw – Hill International, 2004.

REFERENCES:

1. Frank Woodard, "Industrial Waste Treatment Handbook", Kindle Edition, Butterworth Heinemann, New Delhi, 2001.
2. World Bank Group, "Pollution Prevention and Abatement Handbook, Towards Cleaner Production", World Bank and UNEP, Washington.D.C, 1998.
3. Nemerrow N. L "Theories and practices of Industrial Waste Engineering", 1st Edition, PE Cunniff, McGraw Hill, New York, 2010.

21PCE16	AIR AND NOISE POLLUTION CONTROL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To apply the basic principles on various aspects of atmospheric chemistry.
- To make use of key transformations and meteorological influence on air.
- To plan and control the air pollution with regulation on its scientific basis.
- To select the major sources and effects of Noise pollution.
- To identify and control the noise pollution with regulation on its scientific basis.

UNIT I	INTRODUCTION	9

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards. Sources, types and control of indoor air pollutants.

UNIT II	METEOROLOGY	9

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

UNIT III	CONTROL OF PARTICULATE AND GASEOUS CONTAMIN	9

Factors affecting Selection of Particulate Control Equipment – Gas Particle Interaction – Working

principle – Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Factors affecting Selection of Gaseous contamination Control Equipment – Working principle – absorption, Adsorption, condensation, Incineration, Bio filters – Process control and Monitoring.

UNIT IV	FUNDAMENTALS OF NOISE POLLUTION	9

Sound power, Sound intensity and Sound pressure levels – Sources and Effects of Noise Pollution – Characterization of Noise from Construction, Mining, Transportation and Industrial Activities – Permissible noise levels in different zones – Noise standards and indices.

UNIT V	NOISE MONITORING AND CONTROL	9

Ambient and road traffic noise monitoring – Noise Control measures – Design of Sound Absorption, Acoustic Barrier, Vibration Isolation, Vibration Damping, Muffling, Personal Protector and Green Belt for noise attenuation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Plan a better environment by knowing the effects of Air Pollution.

CO2: Identify the effect of meteorology on air pollution.

CO3: Select the suitable methodology to control particulate and gaseous contaminants.

CO4: Build proper indoor environment by knowing the fundamentals of Noise Pollution.

CO5: Make use of knowledge about noise pollution to control them.

TEXT BOOKS:

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, 2004.
2. Rao M N and Rao H V N "Air Pollution", 1st Edition, Tata McGraw-Hill, New Delhi, 2007.
3. "Environmental Noise Pollution" – PE Cunniff, 1st Edition , McGraw Hill, New York, 2021.

REFERENCES:

1. Noel de Nevers, "Air Pollution Control Engineering", 2nd Edition, McGraw Hill, New York, 1995.
2. Anjaneyulu. Y, "Air Pollution and Control Technologies", 2nd Edition, Allied Publishers (P) Ltd., India 2002.
3. Bruel & Kjaer, "Noise Control: Principles and Practices", 2nd Edition, B & K Pub., Denmark, 1982.

21PCE17	SOLID AND HAZARDOUS WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To identify sources, classification and regulatory framework for solid and hazardous waste.
- To interpret the characteristics of different types of solid and hazardous wastes.
- To choose the methods of collection, storage and transport for solid wastes

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- To select the suitable waste processing technologies
- To plan suitable technical solutions for disposal of municipal and industrial waste

UNIT I	**SOURCES, CLASSIFICATION AND REGULATORY FRAMEWORK**	**9**

Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management –Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, nuclear wastes - lead acid batteries, electronic wastes , plastics and fly ash – Elements of integrated waste management and roles of stakeholders - Financing and Public Private Participation for waste management.

UNIT II	**WASTE CHARACTERIZATION AND SOURCE REDUCTION**	**9**

Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes – Hazardous Characteristics – TCLP tests – waste sampling and characterization plan - Source reduction of wastes –Waste exchange - Extended producer responsibility - Recycling and reuse.

UNIT III	**STORAGE, COLLECTION AND TRANSPORT OF WASTES**	**9**

Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – hazardous waste manifests and transport.

UNIT IV	**WASTE PROCESSING TECHNOLOGIES**	**9**

Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration – solidification and stabilization of hazardous wastes- treatment of biomedical wastes - Health considerations in the context of operation of facilities, handling of materials and impact of outputs on the environment.

UNIT V	**WASTE DISPOSAL**	**9**

Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – Rehabilitation of open dumps – landfill remediation.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Make use of the role legislation and policy drivers play in stakeholders' response to the waste.

CO2: Organize the composition of solid waste generated from the community.

CO3: Utilize the collection methods and transport modes of generated solid waste.

CO4: Relate the various processing technologies for solid waste management.

CO5: Select appropriate disposal methods for environmental safety.

TEXT BOOKS:

1. George Tchobanoglous et al., "Integrated Solid Waste Management: Engineering Principles and

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Management Issues", International Edition, McGraw Hill Publishers, New York, 1993.
2. Michael D. et al., "Environmental Resources Management", Kindle Edition, Hazardous waste Management, Mc-Graw Hill International Edition, New York, 2001.
3. Vesilind P.A, et al., "Solid waste Engineering", 1st Edition, Thomson Learning Inc., Singapore, 2002.

REFERENCES:

1. "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2000.
2. Bhide, A. D. and Sundaresan, B. B. "Solid Waste Management Collection, Processing and Disposal", NEERI, Nagpur, 2001.
3. Paul T Williams, "Waste Treatment and Disposal", 2nd Edition, John Wiley and Sons, England, 2005.

21PCE18	ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To develop knowledge on Environmental regulation and legislations.
- To identify and predict environmental impacts.
- To relate social and economic impact.
- To prepare environmental management and monitoring plan.
- To apply knowledge to assess impacts of similar projects based on case studies.

UNIT I	INTRODUCTION	9

Historical development of Environmental Impact Assessment (EIA). Environmental Clearance- EIA in project cycle. Legal and regulatory aspects in India – types and limitations of EIA –EIA process-screening – scoping - terms of reference in EIA- setting – analysis – mitigation. Cross sectoral issues –public hearing in EIA- EIA consultant accreditation.

UNIT II	IMPACT INDENTIFICATION AND PREDICTION	9

Matrices – networks – checklists – cost benefit analysis – analysis of alternatives – expert systems in EIA. prediction tools for EIA – mathematical modeling for impact prediction – assessment of impacts – air – water – soil – noise – biological — cumulative impact assessment.

UNIT III	SOCIO-ECONOMIC IMPACT ASSESSMENT	9

Socio-economic impact assessment - relationship between social impacts and change in community and institutional arrangements. Factors and methodologies- individual and family level impacts. communities in transition-rehabilitation.

UNIT IV	EIA DOCUMENTATION AND ENVIRONMENTAL MANAGEMENT PLAN	9

Environmental management plan - preparation, implementation and review – mitigation and rehabilitation plans – policy and guidelines for planning and monitoring programmes – post project audit – documentation of EIA findings – ethical and quality aspects of environmental impact

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assessment.		
UNIT V	**CASE STUDIES**	**9**
Mining, power plants, cement plants, highways, petroleum refining industry, storage & handling of hazardous chemicals, common hazardous waste facilities, CETPs, CMSWMF, building and construction projects.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Utilize the environmental clearance, its legal procedure, need of EIA, its types, stakeholders and their roles.

CO2: Make use of various impact identification methodologies, prediction techniques and model of impacts on various environments.

CO3: Build relationship between social impacts and change in community due to development activities and rehabilitation methods.

CO4: Organize the EIA findings and prepare environmental management and monitoring plan.

CO5: Identify, predict and assess impacts of similar projects based on case studies.

TEXT BOOKS:

1. EIA Notification including recent amendments, by Ministry of Environment, Forest and Climate Change, Government of India, 2006.
2. Sectoral Guidelines under EIA Notification by Ministry of Environment, Forest and Climate Change, Government of India, 2020.
3. Lawrence, D.P., "Environmental Impact Assessment – Practical solutions to recurrent problems", Wiley–Blackwell, 2005.

REFERENCES:

1. Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification Assessment and Control, 4th Edition, Butterworth Heineman, 2012.
2. Lee N. and George C." Environmental Assessment in Developing and Transitional Countries", 1st Edition, Wiley, 2000.
3. World Bank –Source book on EIA, 1999.

21PCE19	ENVIRONMENT, HEALTH AND SAFETY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To identify environmental hazards in communities and occupational health and hygiene in work place.
- To develop safety practices and environmental issues in construction.
- To identify potential hazards and prepare a risk assessment report for highly polluting industries.
- To apply work place safety acts and rules and establishes safety systems for any industry.

- To utilize complete knowledge about Health and safety.

UNIT I	INTRODUCTION TO OCCUPATIONAL HEALTH AND HYGIENE	9

Need for developing Environment, Health and Safety systems in work places-Status and relationship of Acts, Regulations and Codes of Practice-Role of trade union safety representatives and international initiatives-Ergonomics and work place. Occupational health and hygiene: 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, OHSAS ISO 18001 certification.

UNIT II	WORKPLACE SAFETY AND SAFETY SYSTEMS	9

Features of the satisfactory design of work premises HVAC, ventilation-Safe installation and use of electrical supplies-Fire safety and first aid provision – construction safety management – environmental issues in management- construction safety provision at site – significance of human factors in the establishment and effectiveness of safe systems-Safe systems of work for manual handling operations.

UNIT III	TECHNIQUES OF ENVIRONMENTAL SAFETY	9

Elements of a health and safety policy and methods of its effective implementation and review-Functions and techniques of risk assessment, inspections and audits-Investigation of accidents-Principles of quality management systems in health and safety management-Relationship between quality manuals, safety policies and written risk assessments-Records and other documentation required by an organization for health and safety-Industry specific EHS issues.

UNIT IV	SAFETY PRACTICES IN CONSTRUCTION	9

Construction accidents, Construction safety management, Environmental issues in construction, Occupational and safety hazard assessment, Job site assessment, Safety in hand tools, Construction safety provision at site, operations of machineries, Hoisting apparatus and conveyors, Safety in the use of mobile cranes, Safety in demolition work, Fire hazards and preventing methods.

UNIT V	EDUCATION AND TRAINING	9

Requirements for and benefits of the provision of information, instruction, training and supervision-Factors to be considered in the development of effective training programmes-Principles and methods of effective training-Feedback and evaluation mechanism.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Develop solution which will address the environmental hazards in communities and occupational health and hygiene in work place.

CO2: Choose proper safety practices to handle environmental issues in industries.

CO3: Identify potential hazards and prepare a risk assessment report for highly polluting industries.

CO4: Make use of work place safety acts and rules to establish safety systems for any industry.

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CO5: Plan a training program which addresses the health and safety in Industrial environment.

TEXT BOOKS:

1. Bill Taylor, "Effective Environmental, Health, and Safety Management Using the Team Approach", 1st Edition, Culinary and Hospitality Industry Publications Services, 2005.
2. Nicholas P. Cheremisinoff and Madelyn L. Graffia, "Environmental and Health and Safety Management", William Andrew Inc. NY, 2013.
3. Gupta Anil K, Sreeja S. Nair, "Environmental Knowledge for Disaster Risk Management", 1st Edition, NIDM, New Delhi, 2011.

REFERENCES:

1. Brian Gallant, "The Facility Manager's Guide to Environmental Health and Safety", 1st Edition, Government Inst Publ., 2007.
2. Dan Hopwood and Steve Thompson, "Workplace Safety: A Guide for Small and Midsized Companies", 1st Edition", 2006.
3. Mansdorf S Z., "Handbook of Occupational Safety and Health", 3rd Edition, Wiley, 2019.

21PCE20	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To interpret exposure to disasters, their significance and types.
- To identify and understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- To build a preliminary understanding of approaches to Disaster Risk Reduction (DRR).
- To make use of institutional processes in the country.
- To choose rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

UNIT I	INTRODUCTION TO DISASTERS	9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Do's and Don'ts during various types of Disasters.

UNIT II	APPROACHES TO DISASTER RISK REDUCTION (DRR)	9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority (SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III	INTER RELATIONSHIP BETWEEN DISASTER AND	9

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	DEVELOPMENT	
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.		
UNIT IV	**DISASTER RISK MANAGEMENT IN INDIA**	**9**
CHazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.		
UNIT V	**DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS**	**9**
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify the types of disasters, causes and their impact on the environment and society.

CO2: Select vulnerability and various methods of risk reduction measures as well as mitigation.

CO3: Solve the impact of developmental projects and the scenarios with respect to Indian context.

CO4: Develop hazard and vulnerability profile of India and the role of GIS and IT in the context of damage assessment.

CO5: Apply the disaster management strategies to their surroundings with potential disaster response.

TEXT BOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2019.
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012.
3. Gupta Anil K and Sreeja S. Nair, "Environmental Knowledge for Disaster Risk Management", 1st Edition, NIDM, New Delhi, 2011.

REFERENCES:

1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
2. Government of India, National Disaster Management Policy, 2009
3. Kapur Anu, "Vulnerable India: A Geographical Study of Disasters", 1st Edition, IIAS and Sage Publishers, 2018.

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21OCH01	CLIMATE CHANGE AND ITS IMPACTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To describe the impacts of greenhouse gases.
- To identify the effects of greenhouse effect and global warming.
- To predict the consequences of climate change.
- To apply the mitigation measures of climate change.
- To summarize the policies at international level.

UNIT I	INTRODUCTION TO CLIMATE CHANGE	9

Introduction – General issues of climate change – weather, climate and greenhouse gases – climate system –climate change scenario – factors determining Earth's temperature – human contribution.

UNIT II	GLOBAL WARMING AND ITS IMPACTS	9

Introduction – green house effect – global warming – sea level changes – ocean acidity – ocean temperatures – wild fire – Artic sea ice content – heat related mortality – Indian scenario – carbon credit – carbon footprint – total carbon emission trading-case studies.

UNIT III	IMPACTS OF CLIMATE CHANGE	9

Introduction –perception on climate change and its impacts – IPCC's perceptions–Wikipedia perceptions – Hypothetical perceptions– Impacts on nature – weather system – water resources– ecosystems – unusual events –agriculture-case studies.

UNIT IV	CLIMATE CHANGE - MITIGATION AND ADAPTATION	9

Introduction to climate change mitigation – early warning system - low carbon development – agriculture – forestry – Barriers to mitigation – Introduction to climate change adaptations – Adaptation strategies in agriculture – forestry – coastal region – waste water management – Synergies in adaptation and mitigation – linking adaptation and mitigation within climate policy mechanisms – climate risk management-case studies.

UNIT V	INTERNATIONAL LEGAL AND POLICY FRAMEWORK FOR CLIMATE CHANGE- PROTOCOLS	9

International Policy – Intergovernmental Panel On Climate Change (IPCC) – UN Framework Convention On Climate Change (UNFCCC) – United Nations Framework Convention on Climate Change – Kyoto Protocol – Paris Agreement – 2019 Climate Action Summit – Nobel Peace Prize – India: National Action Plan On Climate Change (NAPCC).

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

CO1: Discuss the issues of climate change.

CO2: Demonstrate the impact of global warming.

CO3: Summarize the perceptions of climate change.

CO4: Identify the methods of mitigating the climate change.

CO5: Illustrate the protocols of climate change.

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TEXT BOOKS:

1. Colleen Murphy, Gordon Paolo, Robert McKim, "Climate Change and its Impacts-Risks and Inequalities", Springer Publications, 2018.
2. S. Jeevananda Reddy, "Climate Change and its Impacts: Ground Realities", BS Publications / BSP Books, Hyderabad, 2018.
3. Wei-Yin Chen, Maximilian Lackner and Toshio Suzuki, "Handbook of Climate Change Mitigation and Adaptation", 2nd Edition, Springer Publications, 2017.

REFERENCES:

1. N. NakiCeizovi, W.D. Arordhnus, R. Richels, F.L.Toth, "Integrative Assessment of Mitigation, Impacts, and Adaptation to Climate Change", IIASA Publications, Austria, 1994.
2. Seinfeld J.H. and Pandis S.N, "Atmospheric Chemistry and Physics-from Air Pollution to Climate Change", 3rd Edition, Wiley Publications, US, 2016.
3. Andreas Schmittner, "Introduction to Climate Science", Regan State University Press, 2018.

VERTICAL-IV: STRUCTURES

21PCE21	PRESTRESSED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To illustrate the concept and behavior of prestressing in a structure.
- To demonstrate the method of designing prestressed concrete beams for flexure and shear based on Indian standards.
- To build understanding of concept on deflection and the design concept of anchorage zone on prestressed concrete beams.
- To analyze and design composite and continuous beams.
- To identify the behavior of prestressed members subjected to tensile and compressive forces.

UNIT I	INTRODUCTION – THEORY AND BEHAVIOUR	9

Basic concepts – Advantages and disadvantages – Materials required – Systems and methods of prestressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections - Losses of prestress – Estimation of crack width..

UNIT II	DESIGN FOR FLEXURE AND SHEAR	9

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 – 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 – Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.

UNIT V	TENSION AND COMPRESSION MEMBERS	9

Role of prestressing in members subjected to Tensile forces and compressive forces - Design of tension and compression members – Tanks, pipes and poles – Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify the behaviour of prestressed concrete members.

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CO2: Solve the prestressed concrete members for flexure and shear as per the relevant design code (IS 1343).
CO3: Calculate for the deflection of prestressed concrete members and design the anchorage zone.
CO4: Compare the concept of analyzes and design of composite beams and continuous beams.
CO5: Relate the behavior of prestressed members subjected to tensile and compressive forces.

TEXT BOOKS:

1. Krishna Raju N., "Prestressed concrete", 6th Edition, Tata McGraw Hill Company, New Delhi, 2018.
2. Pandit.G.S. and Gupta.S.P, "Prestressed Concrete", Kindle Edition, CBS Publishers and Distributers Pvt. Ltd, 2019.
3. Hurst.M.K., "Prestressed Concrete Design", 2nd Edition, CRC Press, 2017.

REFERENCES:

1. Rajagopalan.N, "Prestressed Concrete", 2nd Edition, Narosa Publishing House, 2017.
2. Dayaratnam.P., "Prestressed Concrete Structures", 5th Edition, Oxford and IBH, 2013.
3. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", 3rd Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
4. IS 1343:1980 (Reaffirmed 1999), Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, 2012.

21PCE22	REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To illustrate the approaches for maintenance and repair.
- To demonstrate the various patterns of fractures and moisture flow both within and outside.
- To relate the characteristics of special concrete.
- To discover appropriate ways for removing distressing from concrete and steel buildings.
- To choose appropriate repair options for various degradation.

UNIT I	MAINTENANCE AND REPAIR STRATEGIES	9

Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating damaged structure, causes of deterioration.

UNIT II	STRENGTH AND DURABILITY OF CONCRETE	9

Quality assurance for concrete–Strength, Durability- Cracks, different types, causes–Effects due to climate, temperature, Sustained elevated temperature, Corrosion.

UNIT III	SPECIAL CONCRETES	9

Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

UNIT IV	TECHNIQUES FOR REPAIR AND PROTECTION METHODS	9

Non-destructive Testing Techniques, Load Test for Stability-Epoxy injection, Shoring, Underpinning, Corrosion protection techniques–Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.		
UNIT V	**REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES**	**9**
Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage, earthquake-Transportation of Structures from one place to other –Structural Health Monitoring-demolition techniques-Engineered demolition methods-Case studies.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Use the importance of maintenance and assessment method of distressed structures.

CO2: Apply the concept to identify the strength and durability properties, their effects due to climate and temperature.

CO3: Interpret the properties and applications of special concretes.

CO4: Choose appropriate techniques for repair and protection methods.

CO5: Select the repair, rehabilitation and retrofitting of structures and demolition methods.

TEXT BOOKS:

1. Nandini Devi G, "Maintenance, Repair, Rehabilitation, and Retrofitting of Structures", Wiley India Pvt Ltd, 2021.
2. Vidivelli B, "Rehabilitation of Concrete Structures", 1st Edition, Standard Publishers Distributors, New Delhi, 2015.
3. Varghese.P.C, "Maintenance Repair and Rehabilitation & Minor works of building", Prentice Hall India Pvt Ltd, 2014.
4. Dr.Sumitra K, "Repair and Rehabilitation of structures", Kindle Edition, Sree kamalamani publications, 2018.

REFERENCES:

1. Guha P.K, "Maintenance and Repairs of Buildings", 2nd Revised Edition, New Central Book Agency Pvt. Ltd, Calcutta, 2011.
2. Dr.Rethaliya R P, "Repairs and Rehabilitation of Concrete Structures", 1st Edition, Atul Prakashan, 2019.
3. Bhattacharjee J, "Concrete Structures Repair Rehabilitation and Retrofitting", 1st Edition, CBS Publishers & Distributors Pvt. Ltd, 2019.

21PCE23	PREFABRICATED STRUCTURES	L	T	P	C
		3	0	0	3

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COURSE OBJECTIVES:

- To demonstrate the importance of Prefabrication.
- To illustrate the process of prefabrication of various structural elements.
- To interpret the assembling and dismantling of prefabricated components.
- To relate the design considerations in the process of prefabrication.
- To choose the techniques in prefabrication to avoid collapse.

UNIT I	**INTRODUCTION**	**9**
Need for prefabrication – Principles of prefabrication – Modular coordination – Standarization – Materials – Systems – Production – Transportation – Erection.		
UNIT II	**PREFABRICATED COMPONENTS**	**9**
Behaviour and types of structural components – Large panel systems – roof and floor slabs – Walls panels - Beams - Columns - Shear walls.		
UNIT III	**DESIGN PRINCIPLES**	**9**
Design philosophy- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems.		
UNIT IV	**JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS**	**9**
Types of Joints – based on action of forces - compression joints - shear joints - tension joints - based on function - construction, contraction, expansion. Design of expansion joints - Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation.		
UNIT V	**DESIGN FOR ABNORMAL LOADS**	**9**
Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Relate modular construction and industrialised construction.

CO2: Apply principles and design philosophy of prefabricated elements.

CO3: Make use of the design considerations in the process of prefabrication.

CO4: Select the types of joints and connections of structural members.

CO5: Plan the appropriate techniques in prefabrication to avoid collapse.

TEXT BOOKS:

1. Alfred Steinle et.al., "Precast Concrete Structures", 2nd Edition, Wiley - Ernst & Sohn, Berlin, 2019.
2. Bruggeling A.S. G and Huyghe G.F, "Prefabrication with Concrete", 1st Edition, CRC Press, 1991
3. Lewitt. M, "Precast Concrete- Materials, Manufacture, Properties and Usage", Applied Science Publishers, London and New Jersey, 1982.

REFERENCES:

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1. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
2. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.
3. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.

21PCE24	INTRODUCTION TO FINITE ELEMENT METHOD	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To identify the application and characteristics of Finite Element Method.
- To construct element characteristic equation and generation of global equation.
- To interpret numerical problems on beams and shafts.
- To demonstrate heat transfer problems.
- To apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axisymmetric problems.

UNIT I	INTRODUCTION TO FINITE ELEMENT METHOD	9

General steps of the finite element method. Engineering applications of finite element method. Advantages of the Finite Element Method. Boundary conditions: Homogeneous and non-homogeneous for structural, heat transfer and fluid flow problems. Potential energy method, Rayleigh Ritz method, Galerkin's method, Displacement method of finite element formulation. Convergence criteria, Discretisation process. Types of elements: 1D, 2D and 3D, Node numbering, Location of nodes. Interpolation models: Simplex, complex and multiplex elements, linear interpolation polynomials in terms of global coordinates 1D, 2D, 3D Simplex Elements.

UNIT II	INTRODUCTION TO THE STIFFNESS (DISPLACEMENT) METHOD	9

Introduction, Derivation of stiffness matrix, Derivation of stiffness matrix for a spring element, Assembly the total stiffness matrix by superposition. One-Dimensional Elements-Analysis of Bars and Trusses, Linear interpolation polynomials in terms of local coordinate's for1D, 2Delements.

UNIT III	BEAMS AND SHAFTS	9

Boundary conditions, Load vector, Hermite shape functions, Beam stiffness matrix based on Euler-Bernoulli beam theory, Examples on cantilever beams, propped cantilever beams, Numerical problems on simply supported, fixed straight and stepped beams using direct stiffness method with concentrated and uniformly distributed load. Torsion of Shafts: Finite element formulation of shafts, determination of stress and twists in circular shafts.

UNIT IV	HEAT TRANSFER	9

Basic equations of heat transfer: Energy balance equation, Rate equation: conduction, convection, radiation, 1D finite element formulation using vibration method, Problems with temperature gradient and heat fluxes, heat transfer in composite sections, straight fins.

UNIT V	AXISYMMETRIC SOLID ELEMENTS	9

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Derivation of stiffness matrix of axisymmetric bodies with triangular elements, Numerical solution of axisymmetric triangular element(s) subjected to surface forces, point loads, angular velocity, pressure vessels.
TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Make use of application and characteristics of Finite Element Method.

CO2: Experiment element characteristic equation and generation of global equation.

CO3: Solve numerical problems on beams and shafts.

CO4: Calculate heat transfer in composite sections.

CO5: Relate suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axisymmetric problems.

TEXT BOOKS:

1. Daryl L. Logan, "A first course in the Finite Element Method", 6th Edition, Cengage Learning, 2016.

2. Sinigiresu S. Rao, "Finite Element Method in Engineering", 5th Edition, Pergaman Int. Library of Science, 2010.

3. Tirupathi R. Chandrupatla and Ashok D. Belegundu, "Introduction to Finite Elements in Engineering", 4th Edition, Pearson Publisher, 2011.

REFERENCES:

1. C.S.Krishnamoorty, "Finite Element Analysis – Theory and Programming", 2nd Edition, Tata McGraw-Hill Education (India) Pvt, Limited, 2001.
2. David V. Hutton, "Fundamentals of Finite Element Analysis", 1st Edition, Tata McGraw-Hill Education (India) Pvt, Limited, 2017.
3. D. Maity, "Computer Analysis of Framed Structures", I.K. International Pvt. Ltd. New Delhi, 2013.

21PCE25	STEEL CONCRETE COMPOSITE STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To develop knowledge on composite construction and composite behaviour of steel concrete composite structures.
- To prepare the design of composite beams, columns, floors, slabs and concrete filled steel tubes.
- To demonstrate the connection design of composite structures.
- To illustrate the behaviour of composite box girder bridges.
- To interpret composite construction and seismic behaviour of composite structures through case studies.

UNIT I	THEORY OF COMPOSITES	9

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Introduction to steel - Concrete composite construction - Behaviour of composite structures - Composite construction - Design of composite beams.		
UNIT II	**DESIGN OF COMPOSITE MEMBERS**	**9**
Design of composite slabs, composite columns and composite trusses.		
UNIT III	**DESIGN OF CONNECTIONS**	**9**
Types of connections - Design of connections in the composite structures - Shear connections - Degree of shear connection - Partial shear interaction.		
UNIT IV	**COMPOSITE BOX GIRDER BRIDGES**	**9**
Introduction - Behaviour of box girder bridges - Design concepts.		
UNIT V	**SEISMIC BEHAVIOUR**	**9**
Case Studies on Steel-Concrete composite construction in buildings - Seismic behaviour of composite structures – sandwich structure – Behaviour and applications.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify the behaviour of composite structures.

CO2: Calculate various composite structural elements such as beams, columns, floors, slabs and concrete filled steel tubes.

CO3: Interpret the connection behaviour and design.

CO4: Apply the behaviour of box girder bridges and design concepts of the same.

CO5: Relate the concepts of various structural elements and design concepts through case studies.

TEXT BOOKS:

1. Johnson R.P., "Composite Structures of Steel and Concrete", 4th Edition, Wiley - Blackwell Scientific Publications, 2018.
2. Oehers D.J. and Bradford M.A., "Composite Steel and Concrete Structural Members, Fundamental Behaviour", 1st Edition, Permagon Press, Oxford, 2013.
3. Narayanan. R, "Steel-Concrete Composite Structures Stability and Strength", 1st Edition, CRC Press, 2019.

REFERENCES:

1. Richard Liew J.Y, "Design of Steel-Concrete Composite Structures Using High-Strength Materials", 1st Edition, Woodhead Publishing, 2021.
2. INSDAG Materials, Volume I and II. 2000.
3. Course material of workshop on "Steel Concrete Composite structures" conducted by Anna University, 2007.

21PCE26	BRIDGE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To interpret loads on bridges and selection of type of bridge for the site condition.

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BoS Chairman

- To illustrate the super structure by various methods.
- To make use of the design of trussed bridge and plate girder bridges.
- To prepare the design of reinforced concrete slab and T beam bridges and prestressed concrete bridges.
- To use the appropriate sub structural systems, bearings and expansion joints for the bridges.

UNIT I	**INTRODUCTION**	**9**

History of bridges - Components of a bridge - Classification of road bridges - Selection of site and initial decision process - Survey and alignment; Geotechnical investigations and interpretations. River Bridge: Selection of Bridge site and planning - Collection of bridge design data - Hydrological calculation Road Bridges - IRC codes - Standard Loading for Bridge Design - Influence lines for statically determinate and indeterminate structures - Transverse distribution of Live loads among deck longitudinal - Load combinations for different working state and limit state designs Railway Bridges: Loadings for Railway Bridges; Railroad data. Pre-design considerations - Railroad vs. Highway bridges.

UNIT II	**SUPERSTRUCTURES**	**9**

Bridge decks – Structural forms and behaviour – Choices of superstructure types – Behaviour and modeling of bridge decks – Simple beam model – Plate model – Grillage method – Finite Element method - Different types of superstructure (RCC and PSC); Longitudinal Analysis of Bridge.- Transverse Analysis of Bridge - Temperature Analysis - Distortional Analysis - Effects of Differential settlement of supports - Reinforced earth structures.

UNIT III	**DESIGN OF STEEL BRIDGES**	**9**

Design of Truss Bridges – Design of Plate girder bridges.

UNIT IV	**DESIGN OF RC AND PRESTRESSED CONCRETE BRIDGES**	**9**

Design of slab bridges – T beam bridges – Prestressed Concrete bridges.

UNIT V	**SUBSTRUCTURE, BEARINGS AND EXPANSION JOINTS, PARAPETS AND RAILINGS**	**9**

Substructure - Pier; Abutment - Wing walls- Importance of Soil-Structure Interaction - Types of foundations - Open foundation- Pile foundation- Well foundation- Simply supported bridge- Continuous Bridge - Bearings and Expansion Joints - Different types of bridge bearings and expansion joints - Parapets and Railings for Highway Bridges.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify loads on bridges and selection of type of bridge for the site condition.

CO2: Relate the super structure by various methods.

CO3: Interpret the trussed bridge and plate girder bridges.

CO4: Illustrate reinforced concrete slab and T beam bridges and prestressed concrete bridges.

CO5: Prepare the appropriate sub structural systems, bearings and expansion joints for the bridges.

TEXT BOOKS:

1. Praveen Nagarajan, "Design of Concrete Bridges: As per latest IRC Codes", Wiley, 2020.

J. P. Anle

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2. Jagadeesh. T.R. and Jayaram. M.A., "Design of Bridge Structures", 2nd Edition, Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2009.
3. Johnson Victor D., "Essentials of Bridge Engineering", 6th Edition, Oxford and IBH Publishing Co., New Delhi, 2019.
4. Krishna Raju. N, "Design of Bridges" 5th Edition, Oxford and IBH Publishing Co., New Delhi, 2019.

REFERENCES:

1. Rajagopalan. N. "Bridge Superstructure", Alpha Science International, 2006
2. Phatak D.R., "Bridge Engineering", SatyaPrakashan, New Delhi, 1990.
3. Ponnuswamy S., "Bridge Engineering", 3rd Edition, Tata McGraw-Hill, New Delhi, 1996.

21PCE27	STRUCTURAL DYNAMICS AND ASEISMIC DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To demonstrate the concept in the theory of vibrations.
- To solve multiple degree of freedom system.
- To identify the importance of elements of seismology.
- To illustrate the response of structure to earthquake.
- To apply suitable codes for design methodology.

UNIT I	THEORY OF VIBRATIONS	9

Concept of inertia and damping – Types of Damping – Difference between static forces and dynamic excitation – Degrees of freedom – SDOF idealisation – Equations of motion of SDOF system for mass as well as base excitation – Free vibration of SDOF system – Response to harmonic excitation – Impulse and response to unit impulse – Duhamel integral.

UNIT II	MULTIPLE DEGREE OF FREEDOM SYSTEM	9

Two degree of freedom system – Normal modes of vibration – Natural frequencies - Mode shapes - Introduction to MDOF systems – Decoupling of equations of motion – Concept of mode superposition.

UNIT III	ELEMENTS OF SEISMOLOGY	9

Causes of Earthquake – Geological faults – Tectonic plate theory – Elastic rebound – Epicentre – Hypocentre – Primary, shear and Raleigh waves – Seismogram – Magnitude and intensity of earthquakes – Magnitude and Intensity scales – Spectral Acceleration - Information on some disastrous earthquakes

UNIT IV	RESPONSE OF STRUCTURES TO EARTHQUAKE	9

Response and design spectra – Design earthquake – concept of peak acceleration – Site specific response spectrum – Effect of soil properties and damping – Liquefaction of soils – Importance of ductility – Methods of introducing ductility into RC structures.

UNIT V	DESIGN METHODOLOGY	9

IS 1893, IS 13920 and IS 4326 – Codal provisions – Design as per the codes – Base isolation techniques – Vibration control measures – Important points in mitigating effects of earthquake on structures.
TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the concept of inertia in the theory of vibrations.

CO2: Interpret and solve multiple degree of freedom system.

CO3: Identify the methods of measuring seismic activity.

CO4: Relate the response of structures and effects of earthquake.

CO5: Utilize the codal provisions for aseismic design.

TEXT BOOKS:

1. Agarwal. P and Shrikhande. M, "Earthquake Resistant Design of Structure", 3rd Edition, Prentice Hall of India Pvt.Ltd., 2011.
2. Mario Paz and William Leigh, "Structural Dynamics Theory and Computation", 5th Edition, Kluwer Academic Publishers, 2006.
3. Chopra, A.K., "Dynamics of Structures – Theory and Applications to Earthquake Engineering", 2nd Edition, Pearson Education, 2003.

REFERENCES:

1. Biggs, J.M., "Introduction to Structural Dynamics", 1st Edition, McGraw–Hill Book Co., N.Y., 1964.
2. Dowrick, D.J., "Earthquake Resistant Design", 2nd Edition, John Wiley & Sons, London, 2009.
3. Clough R.W and Penzien. J, "Dynamics of Structures", 2nd Edition, McGraw Hill International Edition, 1995.

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VERTICAL-V: WATER RESOURCES

21PCE28	GROUNDWATER ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To relate aquifer properties and its dynamics.
- To illustrate the exposure towards well design and practical problems of groundwater aquifers.
- To interpret the basics of ground water modelling.
- To develop the knowledge on groundwater quality concepts.
- To utilize the knowledge on groundwater conservation.

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– Ground water table fluctuation and its interpretations – Groundwater development and Potential in India – GEC norms.

UNIT II	WELL HYDRAULICS	9

Objectives of Groundwater hydraulics – Darcy's Law - Groundwater equation – steady state flow – Dupuit Forchheimer assumption - Unsteady state flow - Theis method - Jacob method -Slug tests - Image well theory – Partial penetrations of wells.

UNIT III	GROUNDWATER MANAGEMENT	9

Need for Management Model – Database for groundwater management –groundwater balance study – Introduction to Mathematical model – Conjunctive use – Collector well and Infiltration gallery.

UNIT IV	GROUNDWATER QUALITY	9

Ground water chemistry - Origin, movement and quality - Water quality standards – Health and aesthetic aspects of water quality - Saline intrusion – Environmental concern and Regulatory requirements.

UNIT V	GROUNDWATER CONSERVATION	9

Artificial recharge techniques – Remediation of Saline intrusion– Ground water management studies – Protection zone delineation, Contamination source inventory, remediation schemes - Ground water Pollution and legislation.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply aquifer properties and its dynamics.

CO2: Solve exposure towards well design and practical problems of groundwater aquifers.

CO3: Develop the basics of ground water modelling.

CO4: Build the knowledge on groundwater quality concepts.

CO5: Utilize the importance of artificial recharge.

TEXT BOOKS:

1. Raghunath H.M., "Ground Water Hydrology", 4th Edition, New Age International (P) Limited,

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New Delhi, 2021.
2. Todd D.K., "Ground Water Hydrology", 3rd Revised Edition, John Wiley and Sons, New York, 2011.
3. Saxena R.N and Gupta D.C, "Elements of Hydrology and Groundwater", PHI Learning, India, 2017.

REFERENCES:

1. Fitts R Charles, "Groundwater Science", 2nd Revised Edition, Elsevier, Academic Press, 2012.
2. Ramakrishnan, S, "Ground Water", 1st Edition, K.J. Graph arts, Chennai, 1998.
3. Vijay Pal Meena, "Ground Water Hydrology", 1st Edition, Oxford Book Company, India, 2022.

21PCE29	HYDROLOGY AND WATER RESOURCES ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To identify the key drivers on water resources, hydrological processes.
- To utilize the knowledge on integrated behaviour in catchments.
- To build and apply a range of hydrological models to surface water and groundwater problems.
- To prepare spatial analysis of rainfall data and design water storage reservoirs.
- To make use of the concept and methods of ground water management.

UNIT I	PRECIPITATION AND ABSTRACTIONS	9

Hydrological cycle- Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges-Spatial analysis of rainfall data using Thiessen and Isohyetal methods-Interception - Evaporation. Horton"s equation, pan evaporation measurements and evaporation suppression - Infiltration-Horton"s equation - double ring infiltrometer, infiltration indices.

UNIT II	RUNOFF	9

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical – Strange's table and SCS methods – Stage discharge relationships- flow measurements- Hydrograph – Unit Hydrograph – IUH.

UNIT III	FLOOD AND DROUGHT	9

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts- Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP).

UNIT IV	RESERVOIRS	9

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve.

UNIT V	GROUNDWATER AND MANAGEMENT	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

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COURSE OUTCOMES:

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

CO1: Relate the key drivers on water resources and hydrological processes.

CO2: Calculate runoff and discharge using empirical formula.

CO3: Estimate flood and analyze drought.

CO4: Plan and design water storage reservoirs.

CO5: Classify aquifers and know about artificial recharge of water bodies.

TEXT BOOKS:

1. Subramanya .K. "Engineering Hydrology", 5th Edition, Tata McGraw Hill, 2020.
2. Jayarami Reddy .P. "Hydrology", 1st Edition, Tata McGraw Hill, 2016.
3. Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", 1st Edition, McGraw Hill International Book Company, 1995.

REFERENCES:

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

21PCE30	PARTICIPATORY WATER RESOURECS MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To relate the basic concepts of participatory water resource management.
- To organise farmers participation in water resources management.
- To show the issues related to water conservation and watershed Development.
- To demonstrate global challenges in participatory water conservation.
- To identify the concept, principle, approach of watershed management.

UNIT I	FUNDAMENTALS: SOCIOLOGY AND PARTICIPATORY APPROACH	9

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

UNIT II	UNDERSTANDING FARMERS PARTICIPATION	9

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	9

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

UNIT V	PARTICIPATORY WATERSHED DEVELOPMENT	9

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 participation – Entry point activities - Evaluation of watershed management measures.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Build the knowledge on various processes involved in participatory water resource management.

CO2: Make use of farmer's participation in water resources management.

CO3: Solve the issues related to water conservation and watershed Development.

CO4: Utilize the knowledge in participatory water conservation.

CO5: Develop the concept, principle, approach of watershed management.

TEXT BOOKS:

1. Siva subramaniyan K. "Water Management", SIMRES Publication, Chennai, 2011.
2. Uphoff N., "Improving International Irrigation management", 1st Revised Edition, 2011.
3. Tideman E.M., "Watershed Management", Omega Scientific Publishers, New Delhi, 1996.

REFERENCES:

1. Rodolfo S S, "Integrated and Participatory water resources management", 1st Edition, Elsevier Science, 2007.
2. Dian Tristi Agustini, "Overview of participatory water management", 4th International Conference on Sustainability Science, 2021.
3. Chambers Robert, "Managing canal irrigation", 1st Edition, Cambridge University Press, 1989

21PCE31	INTEGRATED WATER RESOURCES MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To prepare objectives, principles and evolution of integrated water resources management.
- To sketch an idea of contextualizing Integrated Water Resources Management.
- To interpret the knowledge in emerging issues in water management, flood, drought, pollution and poverty.
- To identify the water resources development in India and wastewater reuse.
- To apply the knowledge on integrated development of water management.

UNIT I	IWRM FRAMEWORK	9

Definition – Objectives – Principles - Evolution of IWRM - IWRM relevance in water resources management – Paradigm shift: Processes and prospective outcomes.

UNIT II	CONTEXTUALIZING IWRM	9
UN formulations – Sustainable Development Goals (SDG) - IWRM in Global, Regional and Local water partnership – Institutional transformation - Bureaucratic reforms - Inclusive development.		
UNIT III	EMERGING ISSUES IN WATER MANAGEMENT	9
Emerging Issues – Drinking water management in the context of climate change - IWRM and irrigation - Flood – Drought – Pollution – Linkages between water, health and poverty.		
UNIT IV	IWRM AND WATER RESOURCES DEVELOPMENT IN INDIA	9
Rural Development - Ecological sustainability- -Watershed development and conservation - Ecosystem regeneration – Wastewater reuse - Sustainable livelihood - Food security.		
UNIT V	ASPECTS OF INTEGRATED DEVELOPMENT	9
Capacity building - Conceptual framework of IWRM – Problems and policy issues - Solutions for effective integrated water management - Case studies.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Utilize the knowledge of integrated water resources management in process outcomes.

CO2: Develop reforms to attain Sustainable Development Goals (SDG).

CO3: Develop the knowledge in emerging issues in water management, flood, drought, pollution and poverty.

CO4: Plan the water resources development in India and wastewater reuse.

CO5: Build the knowledge on integrated development of water management.

TEXT BOOKS:

1. Sarbhukan M.M, "Integrated water resources management", 1st Edition, CBS Publishers and Distributors Pvt limted, 2013.
2. Sithamparanathan, Rangasamy, A., and Arunachalam, N., "Ecosystem Principles and Sustainable Agriculture", 1st Edition, Scitech Publications (India) Pvt.Ltd, 1999.
3. Mollinga P. et al. "Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006.

REFERENCES:

1. Murthy, J.V.S., "Watershed Management in India", 1st Edition, New Age International Publishers, 2017.
2. Cech Thomas V., "Principles of Water Resources: History, Development, Management and Policy", 3rd Revised Edition, John Wiley and Sons Inc., New York, 2009.
3. Dalte, S.J.C., "Soil Conservation and Land Management", 1st Edition, International Book Distribution, India, 1986.

21PCE32	RIVER ENGINEERING	L	T	P	C

J.P. Anil

		3	0	0	3

COURSE OBJECTIVES:

- To classify river morphology.
- To illustrate hydraulic geometry and behavior of river.
- To relate socio-cultural influences and ethics of stream restorations.
- To show the flow and sediment transport in rivers and channels.
- To plan and design guide band, embankments and flood protection systems.

UNIT I	**INTRODUCTION**	**9**

Introduction, classification of Rivers, Mechanics of alluvial rivers including channel and flood plain features, Sediment transport and budgets, River morphology and various classification schemes.

UNIT II	**BEHAVIOR OF RIVERS**	**9**

Introduction, River Channel patterns, Straight river channels, causes, characteristics and shapes of meanders and control, cut off, Braided Rivers, Bed forms, Instability of rivers, Hydraulic geometry, Delta formation and control.

UNIT III	**STREAM RESTORATION**	**9**

Mechanics of Alluvial Rivers, Rivers and restoration structures, Socio-cultural influences and ethics of stream restoration.

UNIT IV	**NATURAL CHANNEL DESIGN**	**9**

Bio-engineering Techniques, Classification review, Natural Channel Design Analysis, Time Series, analysis of flow, Sediment and channel geometry data.

UNIT V	**RIVER TRAINING AND PROTECTION WORKS**	**9**

Introduction, Classification of River Training, Types of training works, Protection for Bridges with reduced waterway, Design of Guide Band, embankment and spurs/dampners and other river/ flood protection works.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify the river morphology and its classification.

CO2: Utilize the hydraulic geometry and predict behavior of river.

CO3: Apply the socio-cultural influences to ethics of stream restorations.

CO4: Solve problems on flow and sediment transport in rivers and channels.

CO5: Prepare design of guide band, embankments and flood protection systems.

TEXT BOOKS:

1. Santosh Kumar, "River Engineering", Khanna Publishing House, 2021.
2. Margaret S. Petersen, "River Engineering", 1st Edition, Prentice-Hall, 1986
3. "River Behavior Management and Training (Vol. I & II)", Central board of Irrigation and Power, New Delhi.1994.

REFERENCES:

1. Pierre Y Julien, "River Engineering", 2nd edition, Cambridge University Press, 2018.

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2. Punmia B C and Pande B. B. Lal. "Irrigation & Water Power Engineering", 1st Edition, Laxmi Publications Pvt Limited, 2009.
3. Jansen. P. Ph, "Principles of River Engineering: The non tidel alluvial river", VSSD, 1994.

21PCE33	COASTAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To show various coastal topography.
- To construct an overview of the analysis and design procedures used in the field of coastal engineering.
- To identify the characteristics of waves.
- To illustrate coastal structures and shore protection.
- To develop modelling in coastal engineering.

UNIT I	COASTAL ZONE	9

Definition and sub division – Factors influencing coastal topography - Waves: Definitions - Classification – Liner wave theory – Assumptions and derivations of relationships – Pressure within progressive wave – Wave energy – Problems.

UNIT II	WAVE PROPERTIES AND ANALYSIS	9

Introduction to non-linear waves and their properties – Waves in shallow waters – Wave Refraction, Diffraction and Shoaling – Hindcasting of waves - Short term wave analysis – wave spectra and its utilities - Long term wave analysis- Statistical analysis of grouped wave data.

UNIT III	TYPES AND WAVE TRANSFORMATION	9

Tide analysis and prediction, storm surge, seiches and seasonal fluctuations - Long term water level fluctuations – Wave shoaling; wave refraction; wave breaking; wave diffraction.

UNIT IV	COASTAL STRUCTURES AND SHORE PROTECTION	9

Risk analysis – design wave – Break waters – Shore protection – groins, seal walls, offshore breakwaters and artificial nourishment.

UNIT V	MODELING IN COASTAL ENGINEERING	9

Physical modelling in Coastal Engineering – Limitations and advantages – Role of physical modeling in coastal engineering – Numerical modeling – Modeling aspects – limitations.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify the problems associated with Indian coast and apply Linear wave theory and use wave tables for solving the dispersion equation.

CO2: Solve linear and non-linear wave theories.

CO3: Classify the Types of waves, wave shoaling, diffraction, refraction.

CO4: Construct and design shore defence structures and describe the problems from reliability and risk perspective.

T. P. Davis

CO5: Select physical and mathematical coastal models and critique the advantages and disadvantages between them.

TEXT BOOKS:

1. Mani, J. S. Coastal Hydrodynamics, 2nd Edition, PHI Learning Pvt. Ltd., 2012.
2. Kamphuis, J.W., Introduction to Coastal engineering and management, 2nd Edition, World scientific, 2000.
3. Dean, R.G. and Dalrymple, R.A., Water wave mechanics for Engineers and Scientists, 1st edition Clarendon Press, 1995.

REFERENCES:

1. Washington DC, Coastal Engineering Manual, Vol. I-VI, Coastal Engineering Research Centre, Dept. of the Army, US Army Corps of Engineers, 2006.
2. Ippen, A.T., Estuarine and coastline Hydrodynamics, 1st Edition, American Society of Civil Engineers, 2002.
3. Sorenson, R.M., Basic Coastal Engineering, A Wiley-Interscience Publication, NewYork, 1978.

21PCE34	WATERSHED CONSERVATION AND MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To apply the concept and terminology of watersheds.
- To identify the planning principles and complete evaluation systems.
- To interpret the knowledge on the participatory watershed management.
- To utilize the concept in watershed conservation practices.
- To make use of information about the watershed development programme.

UNIT I	INTRODUCTION	9

Watershed – Definition - concept - Objectives – Land capability classification - priority watersheds - land resource regions in India

UNIT II	WATERSHED PLANNING	9

Planning principles – collection of data – present land use - Preparation of watershed development plan - Estimation of costs and benefits - Financial plan – selection of implementation agency - Monitoring and evaluation system

UNIT III	WATERSHED MANAGEMENT	9

Participatory watershed Management - run off management - Factors affecting runoff - Temporary & Permanent gully control measures - Water conservation practices in irrigated lands - Soil and moisture conservation practices in dry lands.

UNIT IV	WATER CONSERVATION PRACTICES	9

In-situ & Ex-situ moisture conservation principle and practices - Afforestation principle - Micro catchment water harvesting - Ground water recharge – percolation ponds -Water harvesting - Farm pond - Supplemental irrigation - Evaporation suppression - Seepage reduction.

UNIT V	WATERSHED DEVELOPMENT PROGRAMME	9

River Valley Project (RVP) - Hill Area Development Programme (HADP) - National Watershed Development Programme for Rain fed Agriculture (NWDPRA) - Other similar projects operated in India – Govt. of India guidelines on watershed development programme - Watershed based rural development – infrastructure development - Use of Aerial photography and Remote sensing in watershed management - Role of NGOs in watershed development.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify the concept and terminology of watersheds.

CO2: Organize the planning principles and complete evaluation systems.

CO3: Utilize knowledge on the participatory watershed management.

CO4: Interpret watershed conservation practices.

CO5: Build the watershed development programme.

TEXT BOOKS:

1. Suresh, R., "Soil and Water Conservation Engineering", Standard Publishers & Distributors. 2020.
2. Murty, V.V.N. "Land and water management", 6th Edition, Kalyani publishers, 2013.
3. Ghanashyam Das, "Hydrology and Soil Conservation Engineering", 2nd Edition, Prentice Hall of India Private Limited, 2009.

REFERENCES:

1. Gurmel Singh et al, "Manual of soil and water conservation practices", Oxford & IBH publishing, 2019.
2. Suresh, R, "Land and water management principles", 1st Edition, Standard Publishers & Distributors, 2008.
3. Tripathi R.P. and H.P.Singh, "Soil erosion and conservation", 1st Edition, Willey Eastern Ltd, 1993.

J. P. Anile

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VERTICAL-VI: TRANSPORTATION

21PCE35	AIRPORTS, DOCKS AND HARBOR ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To plan the location of the airport and its components.
- To develop and design airport components.
- To relate the design and construction of docks, harbours and ports as a whole.
- To identify the needs of a Harbour plan in terms of international standards.
- To classify the coastal protection structures.

UNIT I	AIRPORT PLANNING	9

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

UNIT II	AIRPORT DESIGN	9

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

UNIT III	HARBOUR ENGINEERING	9

Modern trends in water transportation - Elements of water transportation - Advantages and disadvantages of water transportation - Definition of Basic Terms: Harbour, Port, Satellite Port, Docks, Waves and Tides – Requirements and Classification of Harbours - Site Selection & Selection Investigation. Classification of dredging works, Types of dredgers, Uses of dredged material, Execution of dredging work.

UNIT IV	HARBOUR LAYOUT AND TYPES	9

Harbour layout and terminal facilities - piers, break waters, wharves, jetties, quays; Spring fenders, dolphins and floating landing stage - Mooring Accessories - Necessity, Types of navigation aids, Requirement of signals, Fixed and floating navigation aid - Harbour docks, Wet docks, Repair docks, Lift docks, Floating docks, Slipways - Types of ports and harbours - Port building facilities, Transit sheds, Warehouses, Cargo handling facility, Services for shipping terminals, Inland port facilities planning.

UNIT V	COASTAL STRUCTURES	9

Coastal protection structures – natural and artificial – design of shore protection structures, seawalls, groins, breakwaters; Types - Sea wall, Revetment, Bulkhead, Cathodic Protection and factors determining selection and stability of breakwaters - latest technologies in shore protection techniques; Environmental impacts of coastal developments.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Select the site and plan the airport.

CO2: Prepare the design of airport elements.

CO3: Develop knowledge on the various features in Harbours and Ports, their construction.

CO4: Apply knowledge on planning of components of docks and harbours to suggest an appropriate layout.

CO5: Choose the types of coastal protection works and coastal regulations to be adopted.

TEXT BOOKS:

1. Srinivasan R, "Harbour, Dock and Tunnel Engineering", Charotar Publishing House Pvt. Ltd.; 30th Edition, 2022.
2. Saxena Subhash C, "Airport Engineering Planning and Design", CBS Publishers & Distributors Pvt. Ltd, 2020.
3. Dr. Rethaliya R P, "Harbour Airport Engineering", 2nd Edition, Atul Prakashan, 2014.
4. Gupta B L, "Roads, Railways, Bridges, Tunnels & Harbour Dock", Standard Publishers Distributors, 2018.

REFERENCES:

1. C.Venkatramaiah., "Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels", 1st Edition, The Orient Blackswan, 2016.
2. Rangwala, "Airport Engineering", Charotar Publishing House, 2017.
3. Subramian K.P., "Highway, Railway, Airport and Harbour Engineering", 1st Edition, Scitech Publications Private Limited, 2013.

21PCE36	PAVEMENT ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To classify the types pavement and its stress distribution.
- To identify various IRC guidelines for designing rigid pavements.
- To develop information on various IRC guidelines for designing flexible pavements.
- To select the maintenance measures based on performance evaluation.
- To choose the method of stabilization of pavements.

UNIT I	TYPE OF PAVEMENT AND STRESS DISTRIBUTION ON LAYERED SYSTEM	9

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

UNIT II	DESIGN OF FLEXIBLE PAVEMENTS	9

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

UNIT III	DESIGN OF RIGID PAVEMENTS	9

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

UNIT IV	PERFORMANCE EVALUATION AND MAINTENANCE	9

Pavement Evaluation - Causes of distress in rigid and flexible pavements – Evaluation based on

Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling, Roughness, Skid Resistance. Structural Evaluation by Deflection Measurements - Pavement Serviceability index, - Pavement maintenance (IRC Recommendations only).

UNIT V	STABILIZATION OF PAVEMENTS	9

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify types of rigid and flexible pavements.

CO2: Prepare the design of flexible pavements.

CO3: Develop design of rigid pavements.

CO4: Identify the causes of distress in rigid and flexible pavements.

CO5: Select method of stabilization of pavements based on testing and field control.

TEXT BOOKS:

1. Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, "Highway Engineering", Revised 10th Edition, New Chand and Brothers, 2014.
2. Rajib B. Mallick and Tahar El-Korchi, "Pavement Engineering: Principles and Practice", 3rd Edition, CRC Press; 2017.
3. Kadiyali, L.R., "Principles and Practice of Highway Engineering", 1st Edition, Khanna tech. Publications, New Delhi, 2005.

REFERENCES:

1. Yoder, E.J. and Witchak M.W. "Principles of Pavement Design", 2nd Edition, John Wiley 2011.
2. Guidelines for the Design of Flexible Pavements, The Indian roads Congress, New Delhi IRC-37–2001.
3. Guideline for the Design of Rigid Pavements for Highways, The Indian Road Congress, New Delhi IRC 58-1998.

21PCE37	TRANSPORTATION PLANNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To relate the urban travel characteristics and transportation planning.
- To develop the land use and urban design.
- To make use of environmental considerations with mitigation strategies in the system planning process.
- To prepare the road and highway planning with the performance monitoring.
- To illustrate the transportation system management, linking planning and operations.

UNIT I	INTRODUCTION TO TRANSPORTATION PLANNING	9

Introduction-The Transportation Planning Process-Changing Context for Transportation Planning-

Transportation System Characteristics - Urban Travel Characteristics- Estimating Travel Characteristics and Volumes.		
UNIT II	**LAND USE AND URBAN DESIGN**	**9**
Introduction-What Drives Development and Resulting Urban Form-Urban Form-Urban Design-Land-Use Forecasting and Transportation Planning-Scenario Analysis for Urban Form- Highway Facility-Related Strategies.		
UNIT III	**ENVIRONMENTAL CONSIDERATIONS**	**9**
Environmental Considerations in Transportation Planning and Decision Making - General Principles Regarding Environmental Content and Level of Detail - Land Use and Economic Development Impacts-Social and Community Impacts-Natural Resource Impacts-Construction Impacts - Considering Mitigation Strategies during the Systems Planning Process.		
UNIT IV	**ROAD AND HIGHWAY PLANNING**	**9**
Modeling Travel Demand - Demand Models and Tools- Best Practice for Urban Roadway Systems-Context-Sensitive Solutions (CSS-Traffic Calming- Table of Contents-Green Roads- Complete Streets -System Performance and Capacity Measures- Condition Measures and Management Systems- State Highway Plans and City Thoroughfare Plans- Road Investment Programs and Performance Monitoring.		
UNIT V	**TRANSPORTATION SYSTEM MANAGEMENT AND OPERATIONS.**	**9**
Understanding Network and Facility Performance-Planning and Organizing for TSM&O- Active Transportation and Demand Management-Examples of Management and Operations (M&O) Strategies- Linking Transportation Planning and Planning for Operations- Dissemination of Operations Data- The Connected Transportation System.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Show the relation between the transportation planning process and its characteristics.

CO2: Make use of land use forecasting for urban transportation design.

CO3: Develop system planning process considering environmental impacts.

CO4: Model the roads and highways based on system performance.

CO5: Select the transportation system management, linking planning and operations.

TEXT BOOKS:

1. Michael D. Meyer, "Transportation Planning", 4th Edition, Institute of Transportation Engineers, by John Wiley & Sons, Inc. 2016.
2. Sarkar Prabir Kumar, Maitri Vinay, "Transportation Planning: Principles, Practices and Policies", 1st Edition, Prentice Hall India Learning Private Limited, 2014.
3. Englewood Clifts, "Transportation Planning", Handbook, the Institute of Transportation Engineers, Prentice Hall, 1992.

REFERENCES:

1. Kadiyali L.R, "Traffic Engineering and Transportation Planning" Khanna Publishers, Delhi,

1999.
2. Papacostas "Transportation Engineering and Planning, Pearson Education India", 3rd Edition, 2015.
3. Flaherty, "Transportation Planning and Traffic Engineering", 1st Edition, Elesevier India Pvt Ltd., 2018.

21PCE38	URBAN PLANNING AND DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To classify areas of human settlement.
- To identify and prepare different level of plans.
- To prepare development plans.
- To develop urban layout design for projects.
- To relate legislation and urban development.

UNIT I	TYPES OF HUMAN SETTLEMENT	9

Definition of Human settlement, Urban area, Town, City, Urbanisation, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Classification of urban areas – Trend of Urbanisation at International, National, Regional and State level.

UNIT II	PLANNING PROCESS	9

Principles of Planning – Types and Level of Plan, Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Surveys and Questionnaire Design.

UNIT III	DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION	9

Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, Development Control Rules, Transfer of Development Rights, Special Economic Zones- Development of small town and smart cities-case studies.

UNIT IV	PLANNING AND DESIGN OF URBAN DEVELOPMENT PROJECTS	9

Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects.

UNIT V	LEGISLATION, DEVELOPMENTAND MANAGEMENT OF URBAN SYSTEM	9

Town and Country Planning Act, Land Acquisition and Resettlement Act etc., Urban Planning Standards and Regulations, Involvement of Public, Private, NGO, CBO and Beneficiaries.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify basic issues of Urbanisation and Suburbanisation.

CO2: Select various planning process.

CO3: Develop plans, plan formulation and evaluation.
CO4: Plan and implement urban development projects.
CO5: Utilize legislation for urban development.

TEXT BOOKS:

1. Goel, S.L "Urban Development and Management", 1st Edition, Deep and Deep publications, New Delhi, 2002.
2. Singh V.B, "Revitalised Urban Administration in India", 1st Edition, Kalpaz publication, Delhi, 2001.
3. 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, Government of Tamil Nadu, Chennai.
2. Goel S.L., Urban Development and Management, Deep and Deep Publications, New Delhi, 2002.
3. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005.
4. CMDA, Second Master Plan for Chennai, Chennai 2008.

21PCE39	INTELLIGENT TRANSPORTATION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To plan and collect data for Intelligent Transportation System.
- To identify advanced traveller information systems.
- To relate Intelligent Transportation System and public transportation.
- To model safety of Intelligent Transportation System.
- To apply knowledge of Intelligent Transportation System in transportation management.

UNIT I	BASIC ELEMENTS OF INTELLIGENT TRANSPORTATION SYSTEMS	9

Basic elements of intelligent transportation systems (ITS), focusing on technological, systems and institutional aspects. Benefits of ITS -ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.

UNIT II	ADVANCED TRAVELER INFORMATION SYSTEMS	9

Advanced traveler information systems-transportation network operations-commercial vehicle operations and intermodal freight.

UNIT III	PUBLIC TRANSPORTATION APPLICATIONS	9

Public transportation applications- ITS and regional strategic transportation planning, including regional architectures.

UNIT IV	ITS AND CHANGING TRANSPORTATION INSTITUTIONS	9
ITS and changing transportation institutions-ITS and safety-ITS and security-ITS as a technology deployment program-research-development and business models-ITS and sustainable mobility.		
UNIT V	TRAVEL DEMAND MANAGEMENT	9
Electronic toll collection, and ITS and road-pricing-Automated Highway Systems- Vehicles in Platoons –ITS in World – Overview of ITS Implementations in developed countries-ITS in developing countries.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Organize data for Intelligent Transportation System.

CO2: To interpret advanced traveller information systems.

CO3: Apply the concept of information technology for planning public transportation.

CO4: Use advance information to the travellers and improve safety.

CO5: Make use of Intelligent Transportation System in transportation management.

TEXT BOOKS:

1. Pradip Kumar Sarkar, Amit Kumar Jain, "Intelligent Transport Systems", PHI Learning Publishers, 2018.
2. Choudury M A and Sadek A, "Fundamentals of Intelligent Transportation Systems Planning", 1st Edition, Artech House, 2003.
3. Sussman, J. M., "Perspective on ITS", Artech House Publishers, 2005.

REFERENCES:

1. Kan Paul Chen, "ITS Hand Book 2000: Recommendations for World Road Association (PIARC)", John Miles, 2000.
2. US Department of Transportation, "National ITS Architecture Documentation", (CDROM), 2007.
3. Turban. E and Aronson. J. E, "Decision Support Systems and Intelligent Systems", 6th Edition, Prentice Hall, 2004.

21PCE40	PLANNING OF SMART CITIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To relate the smart city and the various types of infrastructure systems.
- To choose the planning and development of smart city infrastructure.
- To make use of the intelligent transport system in smart city.
- To plan water and wastewater management.
- To apply legislations and policies for smart cities.

UNIT I	FUNDAMENTAL OF SMART CITY & INFRASTRUCTURE	9
Introduction of Smart City, Concept of smart city, Objective for smart cities, History of Smart city		

world and India. Need to develop smart city, Challenges of managing infrastructure in India and world, various types of Infrastructure systems, Infrastructures need assessment.		
UNIT II	**PLANNING AND DEVELOPMENT OF SMART CITY INFRASTRUCTURE**	**9**
Energy and ecology, solar energy for smart city, Housing, sustainable green building, safety, security, disaster management, economy, cyber security, Project management.		
UNIT III	**INTELLIGENT TRANSPORT SYSTEMS**	**9**
Smart vehicles and fuels, GIS, GPS, Navigation system, traffic safety management, mobility services, E-ticketing.		
UNIT IV	**MANAGEMENT OF WATER RESOURCES AND RELATED INFRASTRUCTURE**	**9**
Storage and conveyance system of water, sustainable water and sanitation, sewerage system, flood management, conservation system.		
UNIT V	**INFRASTRUCTURE MANAGEMENT SYSTEM & POLICY FOR SMART CITY**	**9**
Integrated infrastructure management systems for smart city, Infrastructure management system applications for existing smart city. Worldwide policies for smart city Government of India - policy for smart city, Mission statement & guidelines, Smart cities in India, Case studies of smart city.		
		TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify the various types of infrastructure systems for smart city.

CO2: Identify the aspects of smart city infrastructure.

CO3: Use Intelligent Transport System for smart city development.

CO4: Select the management of water resources related to the infrastructure development.

CO5: Utilize the infrastructure management system and the policies for smart cities.

TEXT BOOKS:

1. Xianyi Li, "Smart City on Future Life - Scientific Planning and Construction", 1st Edition, 2012.
2. Nicos Komninos, "The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities)", 1st Edition, Routledge, 2018.
3. Anthony Townsend, "Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia", Reprint Edition, W.W.Nortan & Company, 2014.

REFERENCES:

1. Grig N.S., "Infrastructure Engineering and Management", 1st Edition, Wiley-Interseience, 1988
2. Hudson W.R., Haas R., Uddin W., Infrastructure Management, McGraw-Hill, 1997.
3. Carol L. Stimmel, "Building Smart Cities", 1st Edition, Auerbach Publications, 2022.

21PCE41	TRAFFIC ENGINEERING AND MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To identify the traffic components and assess the traffic characteristics and related problems.
- To relate the concepts of traffic surveys and its level of service.
- To build traffic control devices and its techniques in transportation interaction.
- To relate road accidents, traffic and environment hazards in transportation interaction.
- To classify traffic management systems.

UNIT I	TRAFFIC PLANNING AND CHARACTERISTICS	9

Road Characteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India – Integrated planning of town, country, regional and all urban infrastructure – Towards Sustainable approach - land use & transport and modal integration.

UNIT II	TRAFFIC SURVEYS	9

Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including non-motorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of service – Concept, applications and significance.

UNIT III	TRAFFIC DESIGN AND VISUAL AIDS	9

Intersection Design - channelization, Rotary intersection design – Signal design – Coordination of signals — Grade separation - Traffic signs including VMS and road markings – Significant roles of traffic control personnel - Networking pedestrian facilities & cycle tracks.

UNIT IV	TRAFFIC SAFETY AND ENVIRONMENT	9

Road accidents – Causes, effect, prevention, and cost – Street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, abatement measures – Promotion and integration of public transportation – Promotion of non-motorized transport.

UNIT V	TRAFFIC MANAGEMENT	9

Area Traffic Management System - Traffic System Management (TSM) with IRC standards — Traffic Regulatory Measures-Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods- Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Choose the fundamental traffic flow theories and identify basic traffic variables.

CO2: Identify the Traffic survey & different types of traffic control device.

CO3: Develop signalized intersections including isolated, signals and parking arrangements.

CO4: Interpret the traffic impacts on environment and safety.

CO5: Plan, evaluate and justify methods of traffic management system.

TEXT BOOKS:

1. Kadiyali.L.R. "Traffic Engineering and Transport Planning", 1st Edition, Khanna Publishers,

Delhi, 2013.
2. Dr.Rethaliya R P, "Traffic Engineering and Management", 1st Edition, Atul Prakashan, 2021.
3. Hobbs.F.D. "Traffic Planning and Engineering", 2nd Edition, University of Brimingham, Peragamon Press Ltd, 1979.
4. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management, 2018.

REFERENCES:

1. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, "Principles of Highway Engineering and Traffic Analysis", 3rd Edition, Wiley India Pvt. Ltd., New Delhi, 2007.
2. Garber and Hoel, "Principles of Traffic and Highway Engineering", 5th Edition, Cengage Learning, New Delhi, 2019.
3. SP: 43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques", Urban Areas, 1994.

ONE CREDIT COURSES

21OCCE01	STAAD PRO	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To develop 2D/3D drawings or shapes of frames, beam elements, truss elements or any rotations using rectangular or polar coordinate systems.
- To analyze and design the elements as per the functional requirements provided in the IS Code provisions.

LIST OF EXPERIMENTS

1. Design of simply supported RCC beam.
2. Design of cantilever RCC beam.
3. Design of continuous RCC beam.
4. Design of simply supported Steel beam.
5. Design of continuous Steel beam.
6. Design of RCC columns with different end conditions.
7. Design of Steel columns with different end conditions.
8. Design of steel trusses.
9. Design of RCC portal frames.
10. Design of steel portal frames.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

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

CO1: Prepare polar or rectangular coordinate systems-based 2D or 3D drawings or models of frames, beam elements, truss elements, or any rotations.

CO2: Plan, design and analyze the concrete beams, columns, and slabs in accordance with the principal international norms.

TEXT BOOKS:

1. Sarma T S, "Design of R C C Buildings using Staad Pro V8i with Indian Examples English", Educreation Publishing, 2017.
2. Aghunandan M H, "Analysis of Structural Elements by STAAD Pro for beginners [with RCC design], Second Edition, Kindle Edition, 2020.
3. Sarma T S, "Design of Industrial Steel Buildings Using Staad Pro: With Indian Examples", 1st Edition, Notion Press, 2020.

REFERENCES:

1. Krishnamurthy, D., "Structural Design & Drawing – Vol. II and III, CBS Publishers, 2018.
2. Shah V L and Veena Gore, "Limit State Design of Steel Structures IS800-2007", 3rd Edition, Structures Publications, Pune, 2013.
3. IS 456:2000 Code of Practice for Plain and Reinforced Concrete.
4. IS 875(1-5):1987 Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures.

5. SP (16): 1980 "Design Aids for Reinforced Concrete to IS: 456-1978".
6. IS 800:2007 "Code of Practice for General Construction in Steel".
7. SP6: Part 1:1964 "Handbook for Structural Engineers".

21OCCE02	REVIT ARCHITECTURE	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To develop higher-quality and more accurate architectural designs; make use of tools specifically built to support Building Information Modelling workflows.
- To plan a 3D building model with walls, curtain walls, windows, and doors.

LIST OF EXPERIMENTS

1. Single storey residential building (load bearing wall structure and framed structure) – Plan and Elevation.
2. Single storey residential building (load bearing wall structure and framed structure) – Interior design and Exterior Design.
3. Multi-storey residential building (load bearing wall structure and framed structure) – Plan and Elevation.
4. Multi storey residential building (load bearing wall structure and framed structure) – Interior design and Exterior Design
5. 3D view of a residential building.
6. Fully panelled door / partly glazed and wooden panelled door
7. Fully panelled window / fully glazed window
8. Draw the Dog legged staircase
9. Estimation of single storey residential building (load bearing wall structure and framed structure).
10. Estimation of multi-storey residential building (load bearing wall structure and framed structure).

TOTAL : 30 PERIODS

COURSE OUTCOMES:

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

CO1: Sketch the detailed building plan and elevation of residential buildings.

CO2: Plan and design different components like Column, Beam, Floor, Wall, Door, Window, Stair, Ramp of residential building.

TEXT BOOKS:

1. Sham Tickoo, "Exploring Autodesk Revit 2021 for Structural Engineers", 11th Edition, BPB Publications, 2021.
2. Harshul Savla et.al, "Building Information Modeling: Global & Indian Perspective, 1st Edition, Notion Press; 2021.

REFERENCES:

1. Bhat N. D. and Panchal V. M., "Engineering Drawing Plane and Solid Geometry", 53rd edition, Charotar Publishing House, 2019.
2. Ashit Bajaj and Mamta Kataria., "Building Drawing (Civil Engineering Drawing-I)", 1st edition, North Publication, 2020.

21OCCE03	PRIMAVERA	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To model and manage project enterprise structure within Primavera P6 database.
- To develop resource loaded or simple project schedule and manage the project time frame related constraints

LIST OF EXPERIMENTS

1. Estimation of single storey residential building (load bearing wall structure and framed structure).
2. Estimation of multi-storey residential building (load bearing wall structure and framed structure).
3. Planning and scheduling of single storey residential building (load bearing wall structure and framed structure).
4. Planning and scheduling of multi-storey residential building (load bearing wall structure and framed structure).
5. Planning, scheduling and Estimation of Retaining wall structure.
6. Planning, scheduling and Estimation of Septic tank.
7. Planning, scheduling and Estimation of Underground water tank.
8. Planning, scheduling and Estimation of Industrial building.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

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

CO1: Calculate the required man-hours for various activities up to total project by resource assignment.

CO2: Identify critical tasks and developing various structured reports.

TEXT BOOKS:

1. Vimala A and Vinayagam P, "Planning and Managing Projects with PRIMAVERA (P6) Project Planner", Dreamtech Press, 2020.
2. Jayakumar V, "Process Planning and Cost Estimation", Lakshmi Publications, 2013.

REFERENCES:

1. Rangwala. "Civil Engineering Drawing", 3rd Edition, Charotar Publishing House Pvt. Ltd., 2019.
2. Panneerselvam R. and Sivasankaran P., "Process Planning and Cost Estimation", PHI Learning Pvt Ltd, 2015.

21OCCE04	GPS SURVEYING	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES:

- To plan land surveying using Global Positioning System (GPS).
- To identify the different aspects of GPS systems.

COURSE LAYOUT

Lecture 1: Introduction, GPS System.
Lecture 2: GPS Positioning, GPS Observables.
Lecture 3: GPS Data Processing.
Lecture 4: GPS Field Surveying, GPS Field Data Processing.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to
CO1: Make use of GPS data and compare the results of GPS derived positions with classical survey methods over small areas.
CO2: Identify the pros and cons of surveying with GPS vs. other (traditional surveying) methods.

TEXT BOOKS:

1. Gopi Satheesh et.al, "Advanced Surveying: Total Station, GPS, GIS & Remote Sensing", 2nd Edition, Pearson Education, 2017.
2. Agor R, "Advanced Surveying", 5th Edition, Khanna Publishers, 2016.

REFERENCES:

1. Khasiya R B, "Advanced Surveying", 6th Edition, Mahajan Publishing House, 2017.
2. Swapnil S and Sawant, "Advanced Surveying", 1st Edition, Gigatech Publishing House, 2018.

21OCCE05	VISUAL COMMUNICATION DESIGN FOR DIGITAL MEDIA	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES:

- To develop knowledge on the different aspects of visual communication design, emphasizing on virtual media platform.
- To identify the aesthetic content of artistic works within a cultural context.

COURSE LAYOUT

Lecture 1: Introduction to Visual Design Introduction to Virtual Media Technology.
Lecture 2: Applications of Visual Design in Virtual Media Paradigm Design Thinking and Visual Cognition.
Lecture 3: Contemporary Trends in Virtual-Media Visual Design Methodology.
Lecture 4: Visual Design Methodology Case Studies of Visual Design in Virtual Media Technology.

TOTAL : 15 PERIODS

COURSE OUTCOMES:

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

CO1: Illustrate the nature, process, types, models and theories of communication over small areas.
CO2: Identify the meaning and functions of visual communication with its relationships.

TEXT BOOKS:

1. Paul Martin, "Visual Communication", 2nd Edition, Global vision, 2016.
2. Bhatia Arun, "Visual Communication", Rajat Publications, 2016.

REFERENCES:

1. Giorgia Aiello, "Visual Communication: Understanding Images in Media Culture", 1st Edition, SAGE Publications Ltd, 2019.
2. Mathur Pratish K, "Visual Communication", Authors Press, 2016.

21OCCE06	DESIGN THINKING - A PRIMER	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES:

- To interpret the importance of design thinking for designing social innovation projects specifically targeting the needs of marginalised social groups
- To develop the design thinking as a method to come up with ideas and implement them.

COURSE LAYOUT

Lecture 1: Introduction to Design Thinking
Lecture 2: Empathize Phase: Customer Journey Mapping
Lecture 3: Analyze Phase: 5-Whys and How might we...
Lecture 4: Solve Phase: Ideation: Free Brainstorming & Make/Test Phase: Prototype

TOTAL : 15 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to
CO1: Develop and expand complementary content such as images, video or simulator construction instructions
CO2: Apply design thinking to a systematic method of solving problems.

TEXT BOOKS:

1. Ravindran et.al, "Introduction to Design Thinking", Notion Press, 2017.
2. Pavan Soni, "Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving", Penguin Random House India Private Limited, 2020.

REFERENCES:

1. Kilian Langenfeld, "Design Thinking for Beginners: Innovation as a factor for entrepreneurial success", Personal Growth Hacker, 2019.
2. Don Norman, "The Design of Everyday Things", Basic Books, 2014.

21OCCE07	INNOVATION BY DESIGN	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES:

- To utilize the experiences of customers in design thinking to reshape the experiences of the innovators themselves.
- To develop many creative ideas through structured brainstorming sessions.

COURSE LAYOUT

Lecture 1 :
Module 1 – Introduction,
Module 2 - First C: The Cause
Lecture 2 :
Module 3 - Second C: The Context,
Module 4 - Third C: The Comprehension
Lecture 3 :
Module 5 - Fourth C: The Check,
Module 6 - Fifth C: The Conception
Lecture 4 :
Module 7 - Sixth C: The Crafting,
Module 8 - Seventh C: The Connection

TOTAL : 15 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able to
CO1: Develop rapid prototypes to bring their ideas into reality and obtain feedback.
CO2: Select broad group of stakeholders and understand their needs through the ethnographic method.

TEXT BOOKS:

1. Tom Kelly, "The Art of Innovation", Profile, 2016.
2. Patitapaban Das, "Design and Innovation in Moral Teaching", 1st edition, Notion Press, 2022.

REFERENCES:

1. Thomas Lockwood and Edgar Papke, "Innovation by Design: How Any Organization Can Leverage Design Thinking to Produce", Career Press, 2017.
2. Ashwini Kumar Singh, "Creativity & Innovation", Notion Press, 2021.

21OCCE08	TEKLA STRUCTURES	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To develop the design elements for design options, review mode, design member of concrete & Steel, Lateral loading wind loadings and finally outputting reports and generating drawings.

- To analyze an information-rich 3D model that contains all the structural data needed for building and maintaining the structure.

LIST OF EXPERIMENTS

1. Modelling and rebar detailing for underground water tank
2. Modelling and rebar detailing for cantilever retaining wall
3. Modelling and rebar detailing for stair case
4. Modelling and rebar detailing for pile cap
5. Modelling and detailing for industrial building
6. Modelling and rebar detailing for single storey structure
7. Modelling and rebar detailing for multi storey structure

TOTAL : 30 PERIODS

COURSE OUTCOMES:

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

CO1: Apply BIM model to detail connections, performing model checks, generating fabrication & erection drawings, generating bills of material.

CO2: Develop pre model settings, construction levels and gridlines, element releases, applying 2D loadings and validation, Analysis and viewing graphical results.

TEXT BOOKS:

1. Celfrey Salamanes, "Tekla Structures Structural Steel Modeling and Detailing (DIY)", Kindle Edition, 2017.
2. Krishnamurthy, D., "Structural Design & Drawing – Vol. II and III, CBS Publishers, 2018.

REFERENCES:

1. Shah V L and Veena Gore, "Limit State Design of Steel Structures IS800-2007", Structures Publications, 2009.
2. Sarma T S, "Staad Pro V8i for Beginners: With Indian Examples, Notion Press; First edition, 2014.
3. IS 456:2000, "Code of Practice for Plain and Reinforced Concrete"
4. IS 875(1-5):1987, "Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures".
5. SP (16): 1980, "Design Aids for Reinforced Concrete to IS: 456-1978".
6. IS 800:2007, "Code of Practice for General Construction in steel".
7. SP6: Part 1:1964 "Handbook for Structural Engineers".

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COURSE OBJECTIVES:

- To explain the Finite Element Analysis (FEA) concepts and make familiar with the tools and techniques of the ANSYS software package.
- To calculate deflection and stresses in 2D and 3D trusses and beams.

LIST OF EXPERIMENTS

1. Analysis of simply supported RCC beam.
2. Analysis of cantilever RCC beam.
3. Analysis of continuous RCC beam.
4. Analysis of simply supported Steel beam.
5. Analysis of continuous Steel beam.
6. Analysis of RCC columns with different end conditions.
7. Analysis of Steel columns with different end conditions.
8. Analysis of steel trusses.
9. Analysis of RCC portal frames.
10. Analysis of steel portal frames.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze basic engineering analysis problems using FEA techniques.

CO2: Develop pre model settings and determination of deflections component and principal and Von-mises stresses in plane stress, plane strain and Axisymmetric components.

TEXT BOOKS:

1. Divya Zindani, "Working with ANSYS A Tutorial Approach", Dreamtech Press, 2020.
2. Ramamrutham S, Narayanan R, "Theory of structures", 12th edition, Dhanpat Rai Publishing Company Ltd., 2020.

REFERENCES:

1. Punmia. B.C, Ashok Kumar Jain & Arun Kumar Jain, "Theory of structures", 13th Edition, Laxmi Publications, New Delhi, 2017.
2. Khurmi R.S, "Theory of structures", 13th edition, S Chand, New Delhi, 2020.

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