DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)

PERAMBALUR - 621212

REGULATIONS – 2023

CHOICE BASED CREDIT SYSTEM

CURRICULA AND SYLLABI

DEPARTMENT OF CIVIL ENGINEERING

(Applicable to the students admitted from the Academic year 2023 – 2024 and subsequently under choice based credit system)

Discussed in BOS meeting Dated: 12.04.2023/ Civil Ratified & Approved in Academic Council on 02.09.2023

VISION MISSION OF THE INSTITUTION

VISION

An active and committed centre of advanced learning focused on research and training in the fields of Engineering, Technology and Management to serve the nation better.

MISSION

- To develop eminent scholar with a lifelong follow up of global standards by offering UG,PG and Doctoral Programmes.
- To pursue Professional and Career growth by collaborating mutually beneficial partnership with industries and higher institutes of research.
- To promote sustained research and training with emphasis on human values and leadership qualities.
- To contribute solutions for the need based issues of our society by proper ways and means as dutiful citizen.

DEPARTMENT VISION AND MISSION

VISION

To produce globally competent civil engineers for the benefit of the society to pioneer in the technological revolution and challenges in the world

MISSION

- To create a unique learning environment adequately equipped to face the challenges for competent student of civil engineering.
- Educate the students with the state of art knowledge and technology to meet the demand of the industry and nation.
- To provide ethical and value based education for addressing the challenges of society.
- Establish reliable and bilateral relationship between industry and department for mutual benefit.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Graduates of the programme B E Civil Engineering will

I. Gain knowledge and skills in Civil engineering which will enable them to have a career and professional accomplishment in the public or private sector organizations

II. Become consultants on complex real life Civil Engineering problems related to Infrastructure development especially housing, construction, water supply, sewerage, transport, spatial planning.

III. Become entrepreneurs and develop processes and technologies to meet desired infrastructure needs of society and formulate solutions that are technically sound, Economically feasible, and socially acceptable.

IV. Perform investigation for solving Civil Engineering problems by conducting research using modern equipment and software tools.

V. Function in multi-disciplinary teams and advocate policies, systems, processes and equipment to support civil engineering

PROGRAM OUTCOMES (POs)

PO# Graduate Attribute

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

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

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

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

5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6 The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

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

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

10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12 Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

On successful completion of the Civil Engineering Degree programme, the Graduates shall exhibit the following:

PSO1 Knowledge of Civil Engineering discipline

Demonstrate in-depth knowledge of Civil Engineering discipline, with an ability to evaluate, analyze and synthesize existing and new knowledge.

PSO2 Critical analysis of Civil Engineering problems and innovation Critically analyze complex Civil Engineering problems, apply independent judgment for synthesizing information and make innovative advances in a theoretical, practical and policy context.

PSO3 Conceptualization and evaluation of engineering solutions to Civil Engineering Issues Conceptualize and solve Civil Engineering problems, evaluate potential solutions and arrive at technically feasible, economically viable and environmentally sound solutions with due consideration of health, safety, and socio cultural factors

(For the candidates admitted from 2023-2024 onwards)

SEMESTER I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	IP3151	Induction Programme	-	-	-	-	-	**0**
THEORY								
2.	U23HST11	Communicative English I	HSMC	3	1	0	2	3
3.	U23MAT12	Matrices and Calculus	BSC	5	3	1	0	4
4.	U23PHT13	Physics for engineers and Technologist	BSC	3	3	0	0	3
5.	U23CYT14	Chemistry for Engineering and Technology	BSC	3	3	0	0	3
6.	U23GET16	Engineering graphics	ESC	6	2	0	4	4
7	U23GE3252	தமிழர்மரபு/Heritage of Tamils	HSMC	1	1	0	0	1
PRACTICALS								
8.	U23BSP11	Physics and Chemistry Laboratory	BSC	4	0	0	4	2
9	U23HSP12	English Laboratory	HSMC	1	1	0	0	1
10	U23GEP14	Engineering Practices Laboratory	ESC	4	0	0	4	2
.								
			Total	**30**	**14**	**1**	**14**	**23**

SEMESTER II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	U23HST21	Professional English	HSMC	3	1	0	2	2
2.	U23MAT22	Statistics and Numerical Methods	BSC	5	3	1	0	4
3.	U23GET15	Problem Solving and Python Programming	ESC	3	3	0	0	3
4.	U23PHT23	Applied Material Science	BSC	3	3	0	0	3
5.	U23CET21	Engineering Geology and Construction Materials	PCC	3	3	0	0	3
6.	U23MET21	Engineering Mechanics	PCC	3	3	0	0	3
7.	U23GE3252	Tamils and Technology	HSMC	1	1	0	0	1
PRACTICALS								
8.	U23GEP13	Problem solving and Python Programming Laboratory	ESC	4	0	0	4	2
9.	U23CEP21	Building Planning and Drawing Laboratory	ESC	4	0	0	4	2
10.	U23HSP22	Communication Laboratory	EEC	2	0	0	2	2
			Total	**31**	**17**	**1**	**12**	**25**

SEMESTER III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	U23MAT31	Transforms and Partial Differential Equations	BSC	5	3	1	0	4
2.	U23CET31	Strength of Materials-I	PCC	5	3	0	0	3
3.	U23CET32	Fluid Mechanics	PCC	5	3	0	0	3
4.	U23CET33	Surveying and Levelling	PCC	3	3	0	0	3

5.	U23CET34	Concrete Technology	PCC	3	3	0	0	3
6.	U23CET35	Artificial Intelligence in Civil Engineering	PCC	3	3	0	0	3
7.	U23CEP31	Material Testing Laboratory	PCC	4	0	0	4	2
8.	U23CEP32	Surveying Laboratory	PCC	4	0	0	4	2
				34	**18**	**1**	**8**	**23**

SEMESTER IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	U23CET41	Strength of Materials-II	PCC	5	3	1	0	4
2.	U23CET42	Soil Mechanics	PCC	5	3	0	0	3
3.	U23CET43	Hydraulics and Hydraulic Machinery	PCC	3	3	0	0	3
4.	U23CET44	Water Supply Engineering	PCC	3	3	0	0	3
5.	U23CET45	Highway Engineering	OEC	3	3	0	0	3
6.	U23GET41	Environmental Sciences and Sustainability	ESC	3	3	0	0	3
7.	U23CEP41	Environmental Engineering Laboratory	PCC	3	0	0	3	1.5
8.	U23CEP42	Fluid Mechanics and Hydraulics Engineering Laboratory	**PCC**	3	0	0	3	1.5
				31	**08**	**01**	**09**	**22**

SEMESTER V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	U23CET51	Structural Analysis I	PCC	5	3	0	0	3
2.	U23CET52	Foundation Engineering	PCC	5	3	0	0	3
3.	U23CET53	Reinforced Concrete Design	PCC	5	3	0	0	3
4.	U23CET54	Railway, Airport and Harbour Engineering	PCC	3	3	0	0	3
5.	U23CET55	Wastewater Engineering	OEC	3	3	0	0	3
6.		Professional Elective I (V1-Water Res)	PEC	3	3	0	0	3
PRACTICALS								
7.	U23CEP51	Geotechnical Engineering Laboratory	PCC	4	0	0	3	1.5
8.	U23CEP52	Concrete and Highway Engineering Laboratory	PCC	4	0	0	3	1.5
				33	**17**	**6**	**10**	**21**

SEMESTER VI

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	U23CET61	Structural Analysis II	PCC	5	3	0	0	3
2.	U23CET62	Design of Steel Structures	PCC	5	3	0	0	3
3.	U23CET63	Advanced Reinforced Concrete Design	PCC	5	3	0	0	3
4.	U23CET64	Construction Planning and Management	PCC	3	3	0	0	3
5.		Professional Elective II (V2-Transport)	PEC	3	3	0	0	3
6.		Open Elective – I	OEC	3	3	0	0	3

PRACTICALS								
7.	U23HSP61	Professional Communication	PCC	4	0	0	3	1.5
8.	U23CEP61	Computer Aided Analysis and Design Laboratory	PCC	4	0	0	3	1.5
				34	**18**	**6**	**10**	**21**

SEMESTER VII

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	U23CET71	Estimation and Quantity Surveying	PCC	3	3	0	0	3
2.	U23CET72	Pre-Stressed Concrete structures	PCC	4	3	2	0	3
3.	U23CET73	Structural Dynamics and Earthquake Engineering	PCC	4	1	0	2	3
4.		Professional Elective III (V3-Environment)	PEC	3	3	0	0	3
5.		Professional Elective IV(V4- CTP)	PEC	3	3	0	0	3
6.		Open Elective – II	OEC	3	3	0	0	3
PRACTICALS								
7.	U23CEP71	Industrial Training	EEC		0	0	2	1
8.	U23CEP72	Design Project	EEC	4	0	0	2	1
				35	**18**	**2**	**6**	**20**

SEMESTER VIII

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.		Profession Elective - V(V5-Structures)	PEC	3	3	0	0	3
2.		Profession Elective - VI(V6- Geotech)	PEC	3	3	0	0	3
PRACTICALS								

3.	U23CEP81	Project Work – II	CGC	4	0	0	4	6
				17	**4**	**0**	**4**	**12**

SUMMARY

B. E., Civil Engineering											
S. No	**Subject Area**	**Credits per Semester(DSEC)**								**Credits Total**	**Percentage %**
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**		
1	Humanities and social sciences (HSMC)	5	3							8	**4.79**
2	Basic Sciences(BSC)	12	7	4						23	**13.77**
3	Engineering Sciences	06	07		03					16	**9.58**
4	Professional Cores(PCC)		06	19	16	15	15	09		80	**47.90**
5	Professional Electives(PEC)					3	3	06	06	18	**10.77**
6	Open Electives(OEC)				03	3	03	03		12	**7.18**
7	Employability Enhancement Courses		2					02	6	10	**5.90**
Total		23	25	23	22	21	21	20	12	167	**100.00**

Vertical -1	Vertical -2	Vertical -3	Vertical -4	Vertical -5	Vertical -6	Vertical -7	Vertical-8
WATER RESOURCES	**TRANSPORTATION**	**ENVIRONMENT**	**CONSTRUCTION TECHNIQUES AND PRACTICES**	**STRUCTURES**	**GEOTECHNICAL**	**(Ocean Engineering)**	**(Diversified Course)**
Hydrology And Water Resources Engineering	Road Safety System	Climate Change Adaptation and Mitigation	Prefabricated Construction	Concrete Structures	Geo-Environmental Engineering	Ocean Wave Dynamics	Steel Concrete Composite Structures
Groundwater Engineering	Traffic Engineering and Management	Air and Noise Pollution Control Engineering	Construction Equipment and Machinery	Steel Structures	Ground Improvement Techniques	Marine Geotechnical Engineering	Finance For Engineers
Water Resources Systems Engineering	Urban Planning and Development	Environmental Impact Assessment	Sustainable Construction and Lean Construction	Rehabilitation/ Heritage Restoration	Soil Dynamics and Machine Foundations	Coastal Engineering	Earth and Rock fill Dams
Watershed Conservation and Management	Smart cities	Industrial Wastewater Management	Digitalized Construction Lab	Dynamics and Earthquake Resistant Structures	Rock Mechanics	Off shore Structures	Computational Fluid Dynamics
Integrated Water Resources Management	Intelligent Transport Systems	Solid and Hazardous Waste Management	Construction Management and Safety	Introduction to Finite Element Method	Earth and Earth Retaining Structures	Port and Harbour Engineering	Rainwater Harvesting
Urban Water Infrastructure	Pavement Engineering	Environmental Policy and Legislations	Advanced Construction Techniques	Bridge Engineering	Pile Foundation	Coastal Hazards and Mitigation	Transport and Environment
Water Quality and Management	Transportation planning Process	Environment, Health and Safety	Energy Efficient Buildings	Tall Buildings	Tunneling Engineering	Coastal Zone Management and Remote Sensing	Environmental quality Monitoring

PROFESSIONAL ELECTIVE COURSES : VERTICALS

Vertical -1 WATER RESOURCES

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	U23CEV11	Hydrology And Water Resources Engineering	PEC	3	0	0	3	3
2	U23CEV12	Groundwater Engineering	PEC	3	0	0	3	3
3	U23CEV13	Water Resources Systems Engineering	PEC	3	0	0	3	3
4	U23CEV14	Watershed Conservation and Management	PEC	3	0	0	3	3
5	U23CEV15	Integrated Water Resources Management	PEC	3	0	0	3	3
6	U23CEV16	Urban Water Infrastructure	PEC	3	0	0	3	3
7	U23CEV17	Water Quality Management	PEC	3	0	0	3	3

Vertical II TRANSPORTATION

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	U23CEV21	Road Safety System	PEC	3	0	0	3	3
2	U23CEV22	Traffic Engineering and Management	PEC	3	0	0	3	3
3	U23CEV23	Urban Planning and Development	PEC	3	0	0	3	3
4	U23CEV24	Smart cities	PEC	3	0	0	3	3
5	U23CEV25	Intelligent Transport Systems	PEC	3	0	0	3	3
6	U23CEV26	Pavement Engineering	PEC	3	0	0	3	3
7	U23CEV27	Transportation planning Process	PEC	3	0	0	3	3

Vertical III ENVIRONMENT

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	U23CEV31	Climate Change Adaptation and Mitigation	PEC	3	0	0	3	3
2	U23CEV32	Air and Noise Pollution Control Engineering	PEC	3	0	0	3	3
3	U23CEV33	Environmental Impact Assessment	PEC	3	0	0	3	3
4	U23CEV34	Industrial Wastewater Management	PEC	3	0	0	3	3
5	U23CEV35	Solid and Hazardous Waste Management	PEC	3	0	0	3	3
6	U23CEV36	Environmental Policy and Legislations	PEC	3	0	0	3	3
7	U23CEV37	Environment, Health and Safety	PEC	3	0	0	3	3

Vertical IV CONSTRUCTION TECHNIQUES AND PRACTICES

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	U23CEV41	Prefabricated Construction	PEC	3	0	0	3	3
2	U23CEV42	Construction Equipment and Machinery	PEC	3	0	0	3	3
3	U23CEV43	Sustainable Construction and Lean Construction	PEC	3	0	0	3	3
4	U23CEV44	Digitalized Construction Lab	PEC	3	0	0	3	3
5	U23CEV45	Construction Management and Safety	PEC	3	0	0	3	3

6	U23CEV46	Advanced Construction Techniques	PEC	3	0	0	3	3
7	U23CEV47	Energy Efficient Buildings	PEC	3	0	0	3	3

VERTICAL V CONSTRUCTION TECHNIQUES AND PRACTICES

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	U23CEV51	Concrete Structures	PEC	3	0	0	3	3
2	U23CEV52	Steel Structures	PEC	3	0	0	3	3
3	U23CEV53	Rehabilitation/ Heritage Restoration	PEC	3	0	0	3	3
4	U23CEV54	Dynamics and Earthquake Resistant Structures	PEC	3	0	0	3	3
5	U23CEV55	Introduction to Finite Element Method	PEC	3	0	0	3	3
6	U23CEV56	Bridge Engineering	PEC	3	0	0	3	3
7	U23CEV57	Tall Buildings	PEC	3	0	0	3	3

VERTICAL VI GEOTECHNICAL

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	U23CEV61	Geo- Environmental Engineering	PEC	3	0	0	3	3
2	U23CEV62	Ground Improvement Techniques	PEC	3	0	0	3	3
3	U23CEV63	Soil Dynamics and Machine Foundations	PEC	3	0	0	3	3
4	U23CEV64	Rock Mechanics	PEC	3	0	0	3	3
5	U23CEV65	Earth and Earth Retaining Structures	PEC	3	0	0	3	3

6	U23CEV66	Pile Foundation	PEC	3	0	0	3	3
7	U23CEV67	Tunneling Engineering	PEC	3	0	0	3	3

OPEN ELECTIVES

(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories)

OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	U23CEO11	Energy conservation and management	OEC	3	0	0	3	3
2	U23CEO12	Traffic engineering and management	OEC	3	0	0	3	3
3	U23CEO13	Industrial safety	OEC	3	0	0	3	3
4	U23CEO14	Geographical information system	OEC	3	0	0	3	3
5	U23CEO15	Building services	OEC	3	0	0	3	3
6	U23CEO16	Gps and survey methods	OEC	3	0	0	3	3
7	U23CEO17	Green building and vastu	OEC	3	0	0	3	3
8	U23CEO18	Textile effluent treatments	OEC	3	0	0	3	3
9	U23CEO21	Biodiversity conservation	OEC	3	0	0	3	3
10	U23CEO22	Biotechnology for waste management	OEC	3	0	0	3	3
11	U23CEO23	Remote sensing concepts	OEC	3	0	0	3	3
12	U23CEO24	Fire safety engineering	OEC	3	0	0	3	3

13	U23CEO25	Nanomaterials and applications	OEC	3	0	0	3	3
14	U23CEO26	Plastic materials for engineers	OEC	3	0	0	3	3
15	U23CEO27	Introduction to non-destructive testing	OEC	3	0	0	3	3
16	U23CEO28	Air pollution and control	OEC	3	0	0	3	3

U23HST11	COMMUNICATIVE ENGLISH	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To enhance students listening ability for academic and Professional purposes.
2. To learn to use basic grammatic structures in suitable contexts
3. To help students acquire the ability to speak effectively in English in real -life situations.
4. To help learners use language effectively in professional contexts
5. To develop students ability to read and write complex texts, summaries, articles, definitions, Paragraph user manuals

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION 9

Define communication. Kinds of communication. Quintessential of communication in technical progression. Key characteristics of an effective communicator- listening, attitude modification, way of response with appropriate language, tone modulationListening- Listening to TV news, Guest lectures. Speaking- Answering the Questions.Reading - Reading brochures and technical magazines (technical context), telephone messages / social media messages relevant to technical contexts and emails, Writing-Reading comprehension, Parts of Speech.

UNIT II READING QUEST 9

Listening- listening and responding to video lectures/talks. Speaking- Day today conversations. Reading –Edison of India-GD Naidu "The Great Inventor". Writing- Emails / Informal Letters - Inviting, Congratulating & Thanking, Punctuations

UNIT III LANGUAGE RESOURCE GROWS CRITICAL JUDGEMENT 9

Listening- listening to specific task-focused audio tracks. Speaking- summary of Robert Frost - "Stopping by woods on a snowy evening". Reading – Reading advertisements, gadget reviews; user manuals. Writing – Essay Writing: Analytical essay: Narrative Essay, Developing Hints, Usage of tenses in sentence formation. Voices.

UNIT IV LANGUAGE IN LIFE SKILL 9

Listening- Listening to speech of Great Scholars. Speaking- mechanics of presentation. Reading – Newspaper articles, power point presentation. Writing – Checklist, Jumbled sentences-Rearrange the sentences in correct order, WH-Questions-Form questions by using statements, Prefixes and Suffixes.

UNIT V IMPROVING SPEAKING &READING 9

Listening- listening to situational based dialogues; Speaking- Stating intention to do something-Expressing opinion-asking people to repeat themselves. Reading – Summary of O.Henry's "The last Leaf". Writing – Dialogue Writing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Remember appropriate words in a situational conversation.
CO2 : Gain understanding of basic grammatical structures and use them in right context.
CO3 : Read and infer the denotative and connotative meanings of technical texts.
CO4 : Write Dialogue, Letter and paragraphs on various topics.
CO5 : Make the students prepare effective notes for main sources available.
CO6 : Enhance them to give operational talk.

TEXT BOOKS:

1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. English for Science & Technology Cambridge University Press 2021.
3. Authored by Dr. VeenaSelvam, Dr. SujathaPriyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.
4. The Gift of the Magi by O.Henry, McClure,Philips and company

REFERENCE BOOKS:

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

		L	T	P	C
U23MAT12	**MATRICES AND CALCULUS**	**3**	**1**	**0**	**4**

COURSE OBJECTIVES

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

1. To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
2. To familiarize the students with differential calculus.
3. To familiarize the student with functions of several variables.
4. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.
5. To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems

UNIT I MATRICES 12

Introduction – Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Cayley Hamilton theorem – Diagonalization of the matrices by Orthogonal Transformations – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II DIFFERENTIAL CALCULUS 12

Limit of a function – Continuity – Derivatives – Differentiation rules – Implicit differentiation – Logarithmic differentiation – Maxima and Minima of functions of one variable.

UNIT III MULTIVARIABLE CALCULUS 12

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

UNIT IV MULTIPLE INTEGRAL AND THEIR APPLICATIONS 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.

UNIT V ORDINARY DIFFERENTIAL EQUATIONS 12

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

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

CO2 : Use both the limit definition and rules of differentiation to differentiate functions.

CO3 : Apply differential calculus tools in solving various application problems.

CO4 : Able to use differential calculus ideas on several variable functions.

CO5 : Apply multiple integral ideas in solving areas, volumes and other practical problems.

CO6 : Solve the ordinary differential equations using different techniques for that model engineering problems.

TEXT BOOKS:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal. B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6 , 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCE BOOKS:

1. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt.,Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications,

New Delhi, 5th Edition,2016.
3. Narayanan. S. and Manicavachagom Pillai. T. K.,“Calculus" Volume I and II, S.Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
4. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt.Ltd, New Delhi, 2016.
5. Thomas. G. B., Hass. J, and Weir. M.D,"Thomas Calculus", 14th, Pearson India, 2018.

U23PHT13	PHYSICS FOR ENGINEERS AND TECHNOLOGISTS (COMMON TO ALL B.E./ B.TECH. PROGRAMMES)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To make the students to gain the knowledge in elastics and plastic nature of the materials in the presence and absence of load.
2. To understand the students to know the application of the sound waves in different fields.
3. To motivate the students towards the applications of photo electric phenomena.
4. To know the physical principle of LASER, the working of LASER applications.
5. To understand the propagation of light in optical fibers and its applications.

UNIT I ELASTICITY 9

Introduction- Elasticity - plasticity– Hooke’s law - relationship between three Modulii of elasticity (Qualitative) – stress & strain diagram and its uses -Poisson’s ratio - factors affecting elasticity - twisting ouple of wire - Torsion Pendulum: theory and experiment.Beam: Internal bending moment – Cantilever: theory and experiment – Young’s Modulus: uniform and non – uniform bending (Qualitative) – I-shaped girders- advantages and applications.

UNIT II ULTRASONICS 9

Introduction – classification of sound- properties of infrasonic, audible and ultrasonics - production: Magnetostriction and Piezoelectric methods – determination of velocity of sound in liquid (Acoustic Grating Method) – general applications – industrial application: Non - Destructive Testing: pulse echo system through transmission and reflection modes. ultrasonic scanning methods – medical application: sonogram.

UNIT III MODERN PHYSICS 9

Introduction –Black Body Radiation – Classical and Quantum Laws of Black Body Radiation - Photon and its Properties - Wave Particle Duality and Matter waves – De - Broglie Wavelength - Schrodinger’s Time Independent and Time Dependent Wave Equations - Physical Significance of The Wave Function. Application: Particle in One Dimensional Box - Normalization Process – Photo Electric Effect – Laws Governing the Photoelectric Effect – Einstein’s Formula - Derivation – Applications: Solar Cell – Solar Water Heater – Photo resistor (LDR).

UNIT IV LASERS 9

Lasers: Introduction - Properties of Laser-Spontaneous and Stimulated Emission Process - Einstein’s Theory of Matter Radiation Interaction & A and B Coefficients; Amplification of Light By Population Inversion – Pumping Methods - Types of Lasers: Solid-State Laser (Homo And

Hetero Junction Semiconductor Lasers), Gas Laser (CO_2), Applications: Laser Cutting and Welding, LIDAR and Barcode Scanner

UNIT V FIBER OPTICS AND APPLICATIONS 9

Optical Fiber: Structure - advantages- Principle [TIR]–Propagation Phenomena in optical fiber - Expression For Acceptance Angle and Numerical Aperture – Relation between Refractive Index of Core, Numerical Aperture and Fractional Index Change – Fabrication: Double Crucible Method - Types: Material, Mode, Refractive Index - Applications: Optical Fiber Communication System – fiber optic sensors (Displacement and pressure sensors) – Medical Endoscope.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Differentiate the elastic and plastic nature of the materials.

CO2 : Know the experimental techniques in both production and applications of ultrasonic waves.

CO3: Gain knowledge in the basics of quantum mechanics concepts.

CO4: Develop new devices based on LASER source.

CO5: Understand the advantages of optical fiber than metal wire.

CO6: Demonstrate the some useful experiments based on optical fibre

TEXT BOOKS:

1. Dr. P.Mani, "Engineering Physics", Dhanam Publications, 2013.
2. Dr. G. Senthilkumar, "Engineering Physics", VRB Publishers, 2017.
3. K. Thyagarajan, Ajoy Ghatak, "Lasers Fundamentals and Applications" II nd Edition, Springer, 2010.
4. D.K. Bhattacharya, Poonam Tandon," Engineering Physics", Oxford HED Publishers, 2017.

REFERENCE BOOKS:

1. Marikani, "Engineering Physics", PHI, New Delhi, 2013.
2. Engineering Physics – Bhattacharya, Bhaskaran – Oxford Publications, 2012
3. Modern Physics by R Murugeshan, Kiruthiga, Sivaprasath S Chand Publishing, 2021
4. Quantum Mechanics by Sathyaprakash, Pragati Prakashan, Meerut, 2016 Marikani, "Engineering Physics", PHI, New Delhi, 2013.
5. Engineering Physics – Bhattacharya, Bhaskaran – Oxford Publications, 2012
6. Modern Physics by R Murugeshan, Kiruthiga, Sivaprasath S Chand Publishing, 2021

U23 CYT14 CHEMISTRY FOR ENGINEERING & TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. To inculcate sound understanding of water quality parameters and water treatment techniques.
2. To impart knowledge on the basic principles and preparatory methods of nanomaterials.
3. To introduce the basic concepts and applications of phase rule and composites
4. To facilitate the understanding of different types of fuels, their preparation, properties

and combustion characteristics.

5. To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I Water Treatment

Water: Sources , impurities, Parameters. Types of water Hardness of water -types – expression of hardness – units – Estimationof hardness of water by EDTA. Desalination - Reverse Osmosis. Boiler troubles: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralisation and zeolite process

UNIT II Electro and Nano chemistry

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf by Poggendorff's compensation principle. Single electrode potential – Nernst equation – reference electrodes -types–Calomel electrode - electrolysis of water.Nanomaterials:Basics of Nano Chemistry: Distinction between molecules, nanomaterials and bulkmaterials. Preparation of nanomaterials- laser ablation method and Chemical VapourDeposition(CVD). Application of Nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III Phase Rule and Composites

Phase rule terms with examples. water system; Reduced phase rule Two component system: lead-silver system – Composites , Need , Constitution: Matrix materials, Applications and Reinforcement

and applications of Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples

UNIT IV Fuels & Combustion

Fuels –Classification-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

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 the students would be able to

CO1 : Develop innovative methods to produce soft water for industrial use and potable

water at cheaper cost.

CO2 : Apply the basic knowledge of Corrosion and various electrodes.

CO3 : Know the economically and new methods of synthesis nano materials.

CO4 : Apply the knowledge of phase rule and composites for material selection requirements.

CO5 : Understand the concepts of suitable fuels for engineering processes and applications.

CO6 : Have the knowledge of 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", Tata McGraw-Hill Publishing Company Ltd, New Delhi,2008.
3. S.S. Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.
4. Dr.J.Manivel , "Engineering Chemistry" R.K.Publishers, 1st Edition 2022.

REFERENCE BOOKS:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018
2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition,2017.
3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4. ShikhaAgarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.

U23GET16	ENGINEERING GRAPHICS	L	T	P	C
		2	0	4	4

COURSE OBJECTIVES

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

1. To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
2. To expose them to existing national standards related to technical drawings.
3. Develop proficiency in 2D drafting using drawing tools.
4. Learn sectional views and assembly drawing techniques.
5. Enhance visualization skills for improved problem-solving and communication in engineering.

UNIT I PLANE CURVES AND ORTHOGRAPHIC PROJECTION 6+12

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimension. Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization

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

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

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

UNIT III PROJECTION OF SOLIDS 6+12

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

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+12

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

UNITV ISOMETRIC PROJECTION 6+12

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

TOTAL: 30+60=90 PERIODS

COURSE OUTCOMES:

At the end ofthe course the students would be able to

CO1 : Identify the significance of graphics in engineering applications.
CO2 : Project straight lines inclined to both principal planes and determine true lengths and inclinations.
CO3: Apply orthographic projection techniques to project solids.
CO4: Apply the principles of development to prisms, pyramids, cylinders, and cones.
CO5: Combine two solid objects in simple vertical positions using isometric projection.
CO6: Utilize the isometric scale effectively.

TEXT BOOKS:

1. Natrajan K.V., ―A text book of Engineering Graphics‖, Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., ―Engineering Graphics‖, New Age International (P) Limited, 2008

REFERENCE BOOKS:

1. Bhatt N.D. and Panchal V.M., ―Engineering Drawing‖, Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal and Agarwal C.M., ―Engineering Drawing‖, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., ―Engineering Drawing‖ (Vol. I&II combined), Subhas Stores, Bangalore, 2007.

4. Luzzader, Warren.J. andDuff,John M., ―Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
6. N S Parthasarathy and Vela Murali, ―Engineering Graphics‖, Oxford University, Press, New Delhi, 2015.

U23GE3252	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

UNIT I LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils

UNIT III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNITV CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL: 15 PERIODS

TEXT-CUM-REFERENCE BOOKS:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே கே பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).

2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

		L	T	P	C
U23BSP11	**PHYSICS AND CHEMISTRY LABORATORY (COMMON TO ALL B.E. / B.TECH. PROGRAMMES)**	**0**	**0**	**3**	**2**

COURSE OBJECTIVES

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

1. To learn the proper use of various kinds of physics laboratory equipment.
2. To learn how data can be collected, presented and interpreted in a clear and concise manner.
3. To learn problem solving skills related to physics principles and interpretation of experimental data.
4. To determine error in experimental measurements and techniques used to minimize such error.
5. To make the student as an active participant in each part of all lab exercises.
6. To inculcate experimental skills to test basic understanding of water quality parameters, as, acidity, alkalinity, chloride.
7. To Induce the students to analyze the hardness of water
8. To induce the students to familiarize with electro analytical techniques such as, pH metry, conductometry in the determination of impurities in aqueous solutions.

LIST OF EXPERIMENTS

1. Torsion pendulum - Determination of rigidity modulus of wire and moment of inertia of regular disc.
2. Non - Uniform bending–Determination of Young's modulus.
3. Laser – (i) Determination of the wavelength of the laser using grating.
   (ii) Determination of size of the particles using laser source.
4. Air wedge – Determination of thickness of a thin sheet/wire.
5. Determination of Band gap of a semiconductor using PN junction kit.

6. To study the V-I Characteristics of Light Dependent Resistor (LDR).

7. Determination of types and amount of alkalinity in water sample.
8. Determination of total, temporary & permanent hardness of water by EDTA method.
9. Determination of chloride content of water sample by Argentometric method.
10. Determination of strength of given hydrochloric acid using pH meter.
11. Determination of strength of acids in a mixture of acids using conductivity meter.
12. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	Torsion pendulum set up (Metal Disc, Symmetrical Mass(2x100g), Stop Clock, Screw Gauge)	**5**
2.	Non – Uniform bending set up (Travelling Microscope, Knife Edges, Weight Hanger with Mass(5x50g), Screw Gauge, Vernier Caliper, Meter Scale)	**5**
3.	Laser set up (Semiconductor Laser, Screen, Grating Stand, Wooden Stand With Meter Scale)	**5**
4.	Air wedge (Air Wedge Set Up, Travelling Microscope, Sodium Vapour Lamp, Transformer)	**5**
5.	Band gap of a semiconductor (PN Junction Kit, Thermometer, Heater, Beaker, Oil)	**5**
6.	Light Dependent Resistor (Power Suppy, Voltmeter, Ammeter, LDR, Bulb, Resistors)	**5**
7.	PH meter	**5**
8.	Conductivity meter	**10**
9.	Common Apparatus(Pipette, Burette, Conical Flask, Porcelain tile, Dropper)	**15**

COURSE OUTCOMES:

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

CO1 : Understand the functioning of various physics laboratory equipment.
CO2 : Observe and tabulate experimental data.
CO3: Solve problems individually and collaboratively.
CO4: Analyse the quality of water samples with respect to their acidity, alkalinity
CO5: Determine the amount of hardness in the water
CO6: Analyse quantitatively the impurities in solution by electro analytical techniques

U23HSP12	ENGLISH LABORATORY (COMMON TO ALL B.E. / B.TECH. PROGRAMMES)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

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

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

LIST OF EXPERIMENTS

1. Listening for general information-specific details.
2. Conversation: Introduction to classmates.
3. Speaking - making telephone calls-Self Introduction.
4. Talking about current and temporary situations & permanent and regular situations.
5. Listening to podcasts, anecdotes / stories / event narration.
6. Event narration; documentaries and interviews with celebrities.
7. Events-Talking about current and temporary situations & permanent and regular situations.
8. Engaging in small talk.
9. Describing requirements and abilities- Picture description.
10. Discussing and making plans.
11. Talking about tasks- progress- positions -directions of movement.
12. Talking about travel preparations and transportation.
13. Listening to debates/ discussions.
14. Making prediction talking about a given topic.
15. Describing processes.

TOTAL: 30 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl no	Name of the Equipment	Quantity
1.	Communication laboratory with sufficient computer systems	**30**
2.	Server	**1**
3.	Head phone	**30**
4.	Audio mixture	**1**
5.	Collar mike	**1**
6.	Television	**1**
7.	Speaker set with amplifier	**1**
8.	Power point projector and screen	**1**
9.	Cordless mike	**1**

COURSE OUTCOMES:

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

CO1 : Identify and comprehend complex academic texts.

CO2 : Interpret accurately and fluently in formal and informal communicative contexts.

CO3: Demonstrate their opinions effectively in both oral and written medium of communication.

CO4: Plan travelogue and construct paragraphs on various aspects.

CO5: Develop journal reading skills and small talk.

CO6: Utilizing technical terms and making power point presentations.

		L	T	P	C
U23GEP14	**ENGINEERING PRACTICES LABORATORY**	**0**	**0**	**4**	**2**

COURSE OBJECTIVES:

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

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

GROUP – A (CIVIL AND MECHANICAL)

PART I CIVIL ENGINEERING PRACTICES PLUMBING WORK: 30

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

WELDING WORK:

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

b) Practicing gas welding.

BASIC MACHINING WORK:

a) Turning

b) Drilling

c) Tapping

ASSEMBLY WORK:

a) Assembling a centrifugal pump.

b) Assembling a household mixer.

SHEET METAL WORK:

a) Making of a square tray

WOOD WORK:

a. Sawing,
b. Planing and
c. Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

PART II ELECTRICAL & ELECTRONICS 30

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

ELECTRONICS

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.

2. Study of logic gates AND, OR, EX-OR and NOT.

3. Generation of Clock Signal.

4. Soldering practice – Components Devices and Circuits Using general purpose PCB.

5. Measurement of ripple factor of HWR and FWR.

TOTAL = 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15Sets.
2. Carpentry vice (fitted to work bench) 15Nos.
3. Standard woodworking tools 15 Sets.
4. Models of industrial trusses, door joints, furniture joints 5each
5. Power Tools: (a) Rotary Hammer 2 Nos (b) Demolition Hammer 2 Nos (c) Circular Saw 2 Nos (d) Planer 2 Nos (e) Hand Drilling Machine 2 Nos (f) Jigsaw 2Nos

MECHANICAL

Arc welding transformer with cables and holders 5 Nos.

1. Welding booth with exhaust facility 5Nos.
2. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5Sets.
3. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2Nos.
4. Centre lathe 2Nos.
5. Hearth furnace, anvil and smithy tools 2Sets.
6. Moulding table, foundry tools 2Sets.
7. Power Tool: Angle Grinder 2Nos
8. Study-purpose items: centrifugal pump, air-conditioner One each

ELECTRICAL

1. Assorted electrical components for house wiring 15Sets
2. Electrical measuring instruments 10Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1No.
5. Power Tools:
   a) Range Finder 2Nos
   b) Digital Live-wire detector 2Nos

ELECTRONICS

1. Soldering guns 10Nos.
2. Assorted electronic components for making circuits 50Nos.
3. Small PCBs 10Nos.
4. Multimeters 10Nos.

Study purpose items: Telephone, FM radio, low-voltage power supply.

COURSE OUTCOMES:

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

CO1 : Draw pipe line plan; lay and connect various pipe fittings used in common household plumbingwork; Saw; plan; make joints in wood materials used in common household wood work.

CO2 : Wire various electrical joints in common household electrical wire work.

CO3: Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of

common

Household equipments; Make a tray out of metal sheet using sheet metal work.

CO4: Solder and test simple electronic circuits; Assemble and test simple electronic components onPCB.

CO5: Apply fundamental engineering principles to analyze and solve real-world problems.

CO6: Demonstrate proficiency in using engineering tools and equipment.

U23GEP14	**ENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

COURSE OBJECTIVES

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

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

LIST OF EXPERIMENTS

GROUP – A (CIVIL AND MECHANICAL)

PART I : CIVIL ENGINEERING PRACTICES

PLUMBING WORK:

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

WELDING WORK:

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

BASIC MACHINING WORK:

1. Turning

2. Drilling
3. Tapping

ASSEMBLY WORK:

1. Assembling a centrifugal pump.
2. Assembling a household mixer.

SHEET METAL WORK:

1. Making of a square tray

WOOD WORK:

1. Sawing,
2. Planing and
3. Making joints like T-Joint Mortise joint and Tenon joint and Dovetail joint.

PART II: ELECTRICAL & ELECTRONICS:

ELECTRICAL:

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

ELECTRONICS:

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

COURSE OUTCOMES:

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

CO1 : Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.

CO2 : Wire various electrical joints in common household electrical wire work.

CO3: Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.

CO4: Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

U23HST21	PROFESSIONAL ENGLISH (COMMON TO ALL B.E. / B.TECH. PROGRAMMES)	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

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

1. To engage learners in meaningful language activities to improve their reading and writing skills.
2. To learn various reading strategies and apply in comprehending documents in professional context.
3. To help learners understand the purpose, audience, contexts of different types of writing.
4. To enable students write letters and reports effectively in formal and business situations.
5. To demonstrate an understanding of job applications and interviews for internship and placements.

UNIT I PREPARATORY DOCUMENTATIONS 9

Listening- Listening to formal conversations and Participating**.Speaking-** speaking about one's family. **Reading –** Summary of W.W Jacobs "The monkey's paw". **Writing –** Subject verb Agreement, Numerical -Adjectives, Kinds of sentences**,** Writing reviews (book / film),writing Instructions, Writing Recommendation.

UNIT II LECTURA ENRICHMENT AND PASSAGE COMPOSE 9

Listening- listening to lectures on academic topics; **Speaking-** Asking for and giving directions. **Reading -** Reading longer technical texts; **Writing -** Compound words, Homophones and Homonyms, Cause and Effect expressions. Essay Writing, Writing Letter to the Editor (complaint, acceptance, Requesting, Thanking).

UNIT III ANALYTICAL SKILL 9

Listening- Watching videos/documentaries and responding to questions based on them. **Speaking –**Speaking about ones favourite place**. Reading –** Summary of the poem – John keats "Ode to a Nightingale". **Writing-** Purpose statement, Extended Definitions. Writing Job/ Internship application – Cover letter & Resume.

UNIT IV REPORT WRITING 9

Listening- Listening to class room lectures/talks on engineering/technology. **Speaking–** Introduction to technical presentations. **Reading –** Newspaper articles; **Writing –** Comparative Adjectives Direct and Indirect speech**.** Report Writing- Fire Accident Report, Road Accident, Feasibility Report).

UNIT V ENABLING LINGUA IDEALITY & INFORMATION 9

Listening- TED/Ink talks. **Speaking –** Making presentation on a given topic. **Reading –**Company profiles, Statement of Purpose, (SOP), **Writing –** Relative Clauses, If conditions, Cause and Effect. Chart Interpretations - Bar Chart, Pie Chart, Flow Chart & Tables.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Compare and contrast products and ideas in technical texts.

CO2 : Identify cause and effects in events, industrial processes through technical texts.

CO3: Analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format.

CO4: Motivate students to write reports and winning job applications.

CO5: Recall and comprehend different discourses and genres of texts.

CO6: Making the students to become virtuous presenters.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
3. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Developing Communication Skills by Krishna Mohan, MeeraBannerji-Macmillan India Ltd. 1990, Delhi.

U23MAT22	STATISTICS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

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

1. This course aims at providing the necessary basic concepts of a few statistical tools and give procedures for solving different kinds of problems occurring in engineering and technology.
2. To acquaint the knowledge of classifications of design of experiments in the field of agriculture.
3. To introduce the basic concepts of solving algebraic and transcendental equations.
4. To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
5. To acquaint the knowledge of various techniques and methods of solving ordinary

differential equations.

UNIT I TESTING OF HYPOTHESIS 12

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

UNIT II DESIGN OF EXPERIMENTS 12

Introduction – Analysis of variance – One way and two way classifications – Completely randomized design – Randomized block design – Latin square design.

UNIT III SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 12

Solution of algebraic and transcendental equations – Fixed point iteration method – Newton Raphson method – Solution of linear system of equations – Gauss elimination method – Gauss Jordan method — Iterative methods of Gauss Jacobi and Gauss Seidel - Eigen Value of a matrices by power method and jacobi's method for Symmetric matrices.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION 12

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

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

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

TOTAL: 60 PERIODS

COURSE OUTCOMES

Learners are able to

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

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

CO3 Solve the algebraic and transcendental equations.

CO4 Understand the knowledge of numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.

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

CO6 Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.

TEXT BOOKS

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

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

REFERENCES:

1 Burden,R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.

2 Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi , 8th Edition, 2014.

3 Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.

4 Gupta S.C. and Kapoor V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi,12th Edition, 2020.

5 Spiegel.M.R.,Schiller.J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.

U23GET15	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

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

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

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

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, 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-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return

values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

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

UNITV 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 the students would be able to

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

TEXT BOOKS:

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.
3. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
4. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.

REFERENCE BOOKS:

1. John V Guttag, "Introduction to Computation and Programming Using Python'", Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.

4. Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem-Solving Focus”, Wiley India Edition, 2013.

		L	T	P	C
U23PHT23	APPLIED MATERIALS SCIENCE (COMMON TO AERO, AS, MECH, ROBO, CIVIL PROGRAMMES)	3	0	0	3

COURSE OBJECTIVES

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

1. To make the students to understand the basics of crystallography and its importance in studying materials properties.
2. To understand the electrical properties of materials including free electron theory, applications.
3. To expand their knowledge in applications of magnetic and superconducting materials.
4. To instill knowledge on physics of semiconductors, determination of charge carriersand device applications.
5. To inculcate an idea of significance of new materials, nanostructures ensuing nano device applications.

UNIT I CONDENSED MATTER PHYSICS 9

Introduction - Lattice - Unit Cell - Seven Crystal Systems -Bravai’s Lattices - Lattice Planes - Calculation of Number of Atoms per Unit Cell, Atomic Radius, Coordination Number and Packing Factor for SC, BCC, FCC and HCP Structures. Miller Indices – Derivation for Inter-Planar Spacing in terms of Miller Indices-Crystal Growth Techniques: Melt Growth Technique (Bridgman and Czochralski Techniques).

UNIT II CONDUCTING AND INSULATING MATERIALS 9

Conducting Materials: Classical Free Electron Theory: Postulates – Derivation of Electrical Conductivity and Thermal Conductivity- Derivation. Wiedemann-Franz Law and Its Verification-Merits and Demerits of Classical Free Electron Theory. Density of States – Carrier Concentration in Metals. Insulating Materials: Types of Polarization Mechanisms - Langevin- Debye Equation - Internal Field – Clausius - Mossotti Relation – Applications of Insulating Materials.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Magnetic Materials: Dia, Para and Ferromagnetic Materials and Its Properties – Ferromagnetic Domains – Wiess Theory of Ferromagnetism – Hysteresis - B-H Curve Studies – Soft and Hard Magnetic Materials- Applications. Superconducting Materials: Properties – Type I and Type II Superconductors – London equations – Applications: Magnetic Levitated Train – Magnetic Resonance Imaging.

UNIT IV PHYSICS OF SEMICONDUCTOR 9

Introduction – Properties - Intrinsic Semiconductors – Energy Band Diagram – Direct and Indirect Band Gap Semiconductors – Carrier Concentration in Intrinsic Semiconductors – Extrinsic Semiconductors - Carrier Concentration in N-Type & P-Type Semiconductors – Variation of Carrier Concentration with Temperature – Carrier Transport in Semiconductors: Drift, Mobility and Diffusion – Hall Effect And Devices.

UNIT V MODERN ENGINEERING MATERIALS 9

Shape Memory Alloys – Structures – Properties – Applications. Metallic Glasses – Preparation and Applications. Ceramics – Types - Properties and Applications. Nano materials – Types – Properties and Applications – Preparation Techniques: Electro deposition – Pulsed Laser Deposition. CNT – Structure – Types – Properties – Applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Know basics of crystallography and its importance for varied materials properties.

CO2 : Familiarize with theories of electrical and thermal conduction is solids, basic quantummechanics, and energy bands.

CO3: Gain knowledge on the magnetic and superconductor properties of materials and theirapplications.

CO4: Acquire knowledge on basics of semiconductor physics and its applications in various devices.

CO5: Get knowledge on newly developed materials in micro and nano scale.

CO6: Understand the different structures of CNT in Nano range

TEXT BOOKS:

1. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
2. Jasprit Singh, Semiconductor Devices: Basic Principles, Wiley (India), 2007.
3. G.W.Hanson. Fundamentals of Nanoelectronics. Pearson Education (Indian Edition), 2009.
4. Dr. P. Mani, “Physics for Electronics Engineering” Dhanam Publications, 2017.
5. Dr. G. Senthilkumar, “Engineering Physics II” VRB Publishers, 2013.

REFERENCE BOOKS:

1. R.Balasubramaniam, Callister’s Materials Science and Engineering. Wiley (Indian Edition), 2014.
2. Wendelin Wright and Donald Askeland, Essentials of Materials Science and Engineering, CL Engineering, 2013.
3. S. Rajivgandhi, Dr. I. Cicil Ignatius & A. Ravikumar, “ Engineering Physics II”, RK Publications, 2023
4. Robert F. Pierret, Semiconductor Device Fundamentals, Pearson, 2006.
5. Ben Rogers, Jesse Adams and Sumita Pennathur, Nanotechnology: Understanding Small Systems, CRC Press, 2017.

U23CET21	ENGINEERING GEOLOGY AND CONSTRUCTION MATERIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To know the overview of the geological agents, their processes, and various properties of minerals
2. To give complete exposure on various classifications of rocks and geological investigations’ give
3. Complete exposure on stones, bricks, and their suitability and to explore the need of

timber and modern construction materials.

UNIT I GENERAL GEOLOGY & MINEROLOGY 9

Role of Geology in Civil engineering - Branches of geology - Earth structures and composition- Weathering- Physical properties of minerals – Quartz group, Feldspar group, Pyroxene – Hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals

UNIT II PETROLOGY & STRUCTURAL GEOLOGY 9

Classification of rocks - Distinction between Igneous, Sedimentary and Metamorphic rocks- Study of structures – folds, Faults and Joints – Relevance to civil engineering. Geophysical methods – Seismic and electrical methods for subsurface investigations

UNIT III STONES – BRICKS – CONCRETE BLOCKS 9

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stonework – 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.

UNIT IV LIME – CEMENT – AGGREGATES – MORTAR 9

Lime – Preparation of lime mortar – Cement – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Compressive strength – Tensile strength – Fineness–Soundness and consistency – Setting time – Fine aggregates – River sand – Crushed stone sand –Properties – Coarse Aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance – Grading.

UNIT V TIMBER AND OTHER MATERIALS 9

Timber – Market forms – Industrial timber– Plywood – Veneer – Thermocol – Panels of laminates – Steel– Aluminum and Other Metallic Materials – Composition – Aluminium composite panel- Paints –Varnishes – Distempers – Bitumens- Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products- Geomembranes and Geotextiles for earth reinforcement.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Understand the importance of geological knowledge such as earth, properties of minerals

CO2 : Gain knowledge about types of rocks and geological structure.

CO3: Compare the properties of most common and advanced building materials.

CO4: Acquire knowledge on typical and potential applications of lime, cement and aggregates

CO5: Learn the importance of modern material for construction.

TEXT BOOKS:

1. Parbin Singh. A "Textbook of Engineering and General Geology", Katson Publishing House,Ludhiana 2013
2. Varghese, P.C., “Building construction”, Prentice Hall of India Pvt. Ltd, New Delhi, 2016.

REFERENCE BOOKS:

1. Venkat Reddy. D. Engineering Geology, Vikas Publishing House Pvt. Lt, 2010.
2. Bell .F.G. "Fundamentals of Engineering Geology", B.S. Publications. Hyderabad 2011.

U23MET21	ENGINEERING MECHANICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To Learn the use scalar and vector analytical techniques for analysing forces in statically determinate structures.
2. To introduce the equilibrium of rigid bodies, vector methods and free body diagram.
3. To study and understand the distributed forces, surface, loading on beam and intensity.
4. To learn the principles of friction, forces and to determine the apply the concepts of frictional forces at the contact surfaces of various engineering systems.
5. To develop basic dynamics concepts – force, momentum, work and energy.

UNIT I STATICS OF PARTICLES 9

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

UNIT II EQUILIBRIUM OF RIGID BODIES 9

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

UNIT III DISTRIBUTED FORCES 9

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

UNIT IV FRICTION 9

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

UNITV DYNAMICS OF PARTICLES 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Illustrate the vector and scalar representation of forces and moment
CO2 : Analyse the rigid body in equilibrium
CO3: Evaluate the properties of distributed forces
CO4: Determine the friction and the effects by the laws of friction
CO5: Calculate dynamic forces exerted in rigid body
CO6: Apply the concepts of mechanics and work in force analysis

TEXT BOOKS:

1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi, VectorMechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 12thEdition, 2019.
2. Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018.

REFERENCE BOOKS:

1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
3. Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics, 4thEdition, Pearson Education Asia Pvt. Ltd., 2005.

		L	T	P	C
U23GE3252	**TAMILS AND TECHNOLOGY**	**1**	**0**	**0**	**1**

UNIT I WEAVING AND CERAMIC TECHNOLOGY 9

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 9

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 9

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold-Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 9

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNITV SCIENTIFIC TAMIL & TAMIL COMPUTING 9

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

TOTAL: 15 PERIODS

TEXT BOOKS:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே கே பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services

Corporation, Tamil Nadu)

U23GEP13	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

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

1. understand the problem solving approaches.
2. learn the basic programming constructs in Python.
3. practice various computing strategies for Python-based solutions to real world problems.
4. use Python data structures - lists, tuples, dictionaries.
5. To do 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

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl no	Name of the Equipment	Quantity
1.	Intel Desktop System With Suitable software	30

COURSE OUTCOMES:

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

CO1 : Develop algorithmic solutions to simple computational problems
CO2 : Develop and execute simple Python programs.
CO3: Implement programs in Python using conditionals and loops for solving problems.
CO4: Deploy functions to decompose a Python program.
CO5: Process compound data using Python data structures.
CO6: Utilize Python packages in developing software applications.

		L	T	P	C
U23HSP22	**COMMUNICATION LABORATORY (COMMON TO ALL B.E. / B.TECH. PROGRAMMES)**	**0**	**0**	**4**	**2**

COURSE OBJECTIVES:

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

1. To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
2. To be able to communicate effectively through writing.
3. Encouraging plan designing and decision making.
4. Understanding and writing technical instruction.
5. To understand the value of letter writing with correct format.

LIST OF EXPERIMENTS:

1. Speaking-Role Play Exercises Based on Workplace Contexts.
2. Talking about competition.
3. Discussing progress toward goals-talking about experiences.
4. Discussing likes and dislikes.
5. Discussing feelings about experiences.
6. Discussing imaginary scenarios.
7. Writing short essays.
8. Speaking about the natural environment.
9. Describing communication system.
10. Describing position and movement- explaining rules.
11. Understanding technical instructions-Writing: writing instructions.
12. Speaking: describing things relatively-describing clothing.
13. Discussing safety issues (making recommendations) talking about electrical devices.
14. Describing controlling actions.
15. Writing a job application (Cover letter + Resume).

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl no	Name of the Equipment	Quantity
1.	Communication laboratory with sufficient computer systems	**30**
2.	Server	**1**
3.	Head phone	**30**
4.	Audio mixture	**1**
5.	Collar mike	**1**
6.	Television	**1**
7.	Speaker set with amplifier	**1**
8.	Power point projector and screen	**1**
9.	Cordless mike	**1**

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1 : Distinguish their technical competency through language skill.

CO2 : Predict context effectively in-group discussions held in a formal / semi-formal discussions.

CO3: Understanding candidates' key characteristics.

CO4: Finding personality traits by sharing and comparing thoughts and ability.

CO5: Understanding the value of ethics.(rules and regulations).

CO6: Construct emails and effective job applications**.**

U23CEP31	BUILDING PLANNING AND DRAWING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

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

1. Achieve skill sets to prepare computer aided engineering drawings
2. Understand the details of construction of different building elements.
3. Visualize the completed form of the building and the intricacies of construction based on the engineering drawings.

UNIT I

Drawing Basics: Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962.

Simple engineering drawings with CAD drawing tools : Lines, Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customizing toolbars, Working with multiple drawings.

UNIT II

Drawings Related to Different Building Elements:

Following drawings are to be prepared for the data given using CAD Software

1. Principles of planning, orientation and complete joinery details (Paneled and Glazed Doors and Windows)

2. Buildings with load bearing walls
3. Buildings with sloping roof
4. R.C.C. framed structures.
5. Industrial buildings – North light roof structures
6. Building Information Modelling

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 : The students will be able to draft the plan, elevation and sectional views of the buildings, industrial structures, and framed buildings using computer softwares.

TEXT BOOKS:

1. George Omura, "Mastering in AUTOCAD 2002", BPB Publications, 2002
2. Sikka V. B., A Course in Civil Engineering Drawing, 4thEdition, S.K. Kataria and Sons, 1998.

REFERENCE BOOKS:

1. Alf Yardwood, Introduction to Autocad 2008: 2D & 3D Design, Newnes, 2007.
2. Marimuthu V.M., Murugesan R. and Padmini S., "Civil Engineering Drawing-I", Pratheeba Publishers, 2008.
3. Shah.M.G., Kale. C.M. and Patki. S.Y., "Building Drawing with an Integrated Approach toBuilt Environment", Tata McGraw Hill Publishers Limited, 2004.
4. Sham tickoo, Autocad 2008: For Engineers & Designers, Dreamtech press, 2007
5. Verma.B.P., "Civil Engineering Drawing and House Planning", Khanna Publishers, 1989.

U23CET31	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

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

1.	To introduce the basic concepts of PDE for solving standard partial differential equations.
2.	To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
3.	To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
4.	To acquaint the student with Fourier transform techniques used in wide variety of situations
5.	To enable the students to study the Laplace transforms and some applications to solve the differential equations.

UNIT I	PARTIAL DIFFERENTIAL EQUATIONS	12

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Lagrange's linear equation – Solution of homogeneous linear partial differential equations of higher order with constant coefficients of both homogenous and non – homogenous type.

UNIT II	FOURIER SERIES	12

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

UNIT III	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	12

Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation — One dimensional equation of heat conduction — Steady state solution of two dimensional equation of heat conduction (Cartesian coordinates only).

UNIT IV	FOURIER TRANSFORMS	12

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

UNITV	LAPLACE TRANSFORMS	12

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to	
CO1 :	Understand how to solve the given standard partial differential equations.
CO2 :	Solve differential equations using Fourier series analysis which plays a vital role inengineering applications.
CO3:	Appreciate the physical significance of Fourier series techniques in solving One and two dimensional heat flow problems and one dimensional wave equations.
CO4:	Understand the mathematical principles on transforms would provide them the ability to formulate and solve some of the physical problems of engineering.
CO5:	Use the method of Laplace Transform to solve initial value problem for Linear differential equations with constant coefficients.

TEXT BOOKS:	
1.	Grewal B.S., "Higher Engineering Mathematics", 44thEdition, Khanna Publishers , New Delhi ,2018.
2.	Kreyszig E, "Advanced Engineering Mathematics", 10th Edition, John Wiley,New Delhi,India,2016.
REFERENCE BOOKS:	
1.	Andrews. L.C and Shivamoggi .B, "Integral Transforms for Engineers "SPIE Press,1999.
2.	Bali. N.P and Manish Goyal, "A Text book of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt. Ltd ,2015.
3.	James. G., "Advanced Modern Engineering Mathematics", 4th Edition, Pears on Education, New Delhi,2016.
4.	Narayanan. S.,Manicavachagom Pillay. T.K and Ramanaiah. G "Advanced Mathematics for Engineering Students",Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
5.	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd,NewDelhi,2018.
6.	Andrews. L.C and Shivamoggi .B, "Integral Transforms for Engineers "SPIE Press,1999.

U23CET31 **STRENGTH OF MATERIALS-I**

L	**T**	**P**	**C**
3	**0**	**0**	**3**

COURSE OBJECTIVES

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

1. To learn about the concept of stress, strain and deformation of solid and state of stress
2. To know the concepts of strain energy, principal stress and principal planes
3. To learn the bending moment, shear force and the corresponding stress distribution for different types of beams
4. To understand the theory of stresses in beams.
5. To understand the theory of torsion springs.

UNIT I SIMPLE STRESSES **9**

Simple Stresses and strains –Elastic constants –Volumetric strain-Relationship between elastic

constants-Stress Strain diagram for ductile and brittle materials-Analysis of axially loaded members-Composite Bars-Thermal Stresses.

UNIT II COMPLEX STRESSES 9

State of Stress in two dimensions-Stresses on inclined planes-Principal Stresses and Principal Planes-Maximum shear stress - Mohr's circle method. State of stress in three dimensions-Stress invariants –Determination of principal stresses and principal planes.

UNIT III SHEARING FORCE AND BENDING MOMENT 9

Types of loads, supports, beams – Concept of shearing force and bending moment-Relationship between intensity of load, Shearing Force and Bending moment-Shearing Force and Bending Moment Diagrams for Cantilever, simply supported and overhanging beams with concentrated load, uniformly distributed load, uniformly varying load and concentrated moment.

UNIT IV STRESSES IN BEAMS 9

Theory of simple bending-Assumptions and derivation of simple bending equation-Flexural rigidity-Bending and shearing stress distribution diagrams- Composite beams.

UNITV TORSION 9

Theory of Torsion- Assumptions and derivation of torsional equation-Power transmitted-Stresses and Deformations in Solid and Hollow Circular Shafts- Compound shaft- Combined bending and torsion of shafts- Shaft in series and parallel-Open and Closed coiled helical springs- laminated springs – Springs in series and parallel-Design of buffer springs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1 : Comprehend the state of stresses and strains in various structural components under all types of forces.

CO2 : Determine principal stresses and planes for an element in two and three dimensional state of stress.

CO3: Draw the Shearing force and bending moment diagrams for beams subjected to all the types of loading.

CO4: Calculate bending and shearing stresses of beam under flexure and shear**.**

CO5: Ideas of torsional stresses and how to evaluate it in circular sections and its applications in spring analysis.

CO6: Evaluvate material properties and its applications.

TEXT BOOKS:

1. Bansal R.K, “Strength of Materials”, Laxmi Publications, New Delhi, 2021.
2. Rajput R.K, “Strength of Materials”, S.Chand and Co, New Delhi,2014.

REFERENCE BOOKS:

1. Timoshenko.S.B. and Gere.J.M, “Mechanics of Materials”, Van Nos Reinbhold, New Delhi

2020.
2. Vazirani.V.N and Ratwani.M.M, “Analysis of Structures”, Vol I Khanna Publishers, New Delhi,2019.
3. Junnarkar.S.B. and Shah.H.J, “Mechanics of Structures”, Vol I, Charotar Publishing House, New Delhi 2020.
4. Singh. D.K., “ Strength of Materials”, Ane Books Pvt. Ltd., New Delhi, 2020
5. Basavarajaiah, B.S. and Mahadevappa, P., Strength of Materials, Universities Press, Hyderabad, 2020.
6. Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2020.

U23CET32	FLUIDS MECHANICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To understand the properties of fluids,fluid statics and kinematic problems such as finding particle paths and stream lines.
2. To understand the basic properties of the fluid, fluid kinematics, fluid dynamics and to analyze and appreciate the complexities involved in solving the fluid flow problems.
3. To use important concepts of continuity equation, bernoulli’s equation and turbulence, boundary layer and flow through pipes.
4. To understand the boundary layer concepts of fluids.
5. To study Dimensional Analysis – Rayleigh‟s method, Buckingham‟s Pi-theorem

UNIT I DEFINITIONS AND FLUID PROPERTIES 9

Definitions – Fluid and fluid mechanics – Dimensions and units – Fluid properties –Continuum Concept of system and control volume.

UNIT II FLUID STATICS AND KINEMATICS 9

Pascal‟s Law and Hydrostatic equation – Forces on plane and curved surfaces –Buoyancy – Meta centre – Pressure measurement –Fluid Kinematics -Stream, streak and path lines – Classification of flows – Continuity equation (one, two and three dimensional forms) – Stream and potential functions – flow nets – Velocity measurement (Pitot tube, current meter, Hot wire and hot film anemometer, float technique, Laser Doppler velocimetry).

UNIT III FLUID DYNAMICS 9

Euler and Bernoulli‟s equations – Application of Bernoulli‟s equation – Discharge measurement – Laminar flows through pipes and between plates – Hagen Poiseuille equation – Turbulent flow – Darcy – Weisbach formula – Moody diagram – Momentum Principle.

UNIT IV BOUNDARY LAYER AND FLOW THROUGH PIPES 9

Definition of boundary layer – Thickness and classification – Displacement and momentum thickness– Development of laminar and turbulent flows in circular pipes – Major and minor losses of flow in pipes – Pipes in series and in parallel – Pipe network. application of Boundry layer and flow through pipes.

UNITV SIMILITUDE AND MODEL STUDY 9

Dimensional Analysis – Rayleigh‟s method, Buckingham‟s Pi-theorem – Similitude and models studies – Scale effect and distorted models. Dimensionless parameters- application of dimensionless parameters.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1 : Understands the basic principles of fluid mechanics.

CO2 : Understands the concepts of statics and dynamics of fluid flow.

CO3: Develops skills in analyzing fluid flows through the proper use of modeling and the application of the basic fluid-flow principles.

CO4: Apply boundary layer concepts and flow through pipes major and minor losses.

CO5: Analyze the similitude and models.

CO6: Understand the characteristics of Uniform and Non Uniform flow of fluid.

TEXT BOOKS:

1. Jain.A.K.., "Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, 12 th Editions, 2016.
2. Modi, P.N. & Seth, S.M “Hydraulics and fluid Mechanics”, Standard book house, New Delhi, 2015.

REFERENCE BOOKS:

1. Bansal.R.K., “Fluid Mechanics and Hydraulic Machines”, Laxmi Publications Pvt. Ltd., New Delhi, 2013.
2. Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 2013.
3. Streeter, Victor, L. and Wylie, Benjamin E., “Fluid Mechanics”, McGraw-Hill Limited,1998.
4. Subramanya.K "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.
5. White, F.M., Fluid Mechanics, 8/e in SI units, McGraw-Hill, 2021.

		L	T	P	C
U23CET33	**SURVEYING AND LEVELLING**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

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

1. To measure the land area by chaining, compass and plane table.
2. To have the ability to apply knowledge of mathematics and engineering.
3. To understand the measurement techniques and equipment used in land surveying.
4. To know about the application of tacheometric surveying.
5. To relate the knowledge on Surveying to the new frontiers like Electronic Distance Measurement, Total Station, Global Positioning System, Photogrammetric surveying and Remote Sensing.

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING AND LEVELLING 9

Classifications and basic principles of surveying - Equipment and accessories for ranging and chaining - Methods of ranging -Compass - Types of Compass - Bearing - Types - True Bearing - Magnetic Bearing - 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.

UNIT II THEODOLITE AND TRIGNOMETRIC LEVELLING 9

Introduction- Classification of theodolite- Temporary and permanent adjustments –Measurements of horizontal and vertical angles- Theodolite traversing-Traversing computation-Balancing of traversing-Introduction to omitted measurements. Levelling: Heights and distances - Base of the object accessible and inaccessible.

UNIT III TACHEOMETRIC SURVEYING AND CONTOURS 9

Introduction-Instruments-Different systems of tachometric measurements- Tacheometer -Stadia Constants - Analytic Lens Tangential and Stadia Tacheometry surveying-Substense method: Vertical and horizontal measurements. Contour - Contouring - Characteristics of contours - Methods of contouring- Direct method-Indirect method- Contour gradient -Uses of contour plan and map- Measurements of area and volume.

UNIT IV CURVES AND TRIANGULATION 9

Curves-Classifications-Elements of curves-Designation of curves-Setting out of simple curves: Linear and instrument method.Triangulation- Classification-Basic systems-Operation-Signals and towers-Satellite station.

UNITV ADVANCED SURVEYING 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 - Task of control segment - Hand Held and Geodetic receivers - data processing - Traversing and triangulation. **Hydrographic Surveying** – Tides – MSL – Sounding

methods – Three point problem – Strength of fix –. Introduction about Drone surveying.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1 : Conduct linear and angular measurement survey with the help of chain, tape and compass.

CO2 : Determine the horizontal and vertical distance by traversing using theodolite and measure difference in elevation and produce reduced level of the given points.

CO3: Describe the methods of setting out curves in the field and to determine the area and volume of structures.

CO4: Handle total station instrument for making the horizontal and vertical measurements

CO5: Conduct the global positioning system for determining geographical location of the site.

CO6: Understand applications of basic to advanced surveying techniques.

TEXT BOOKS:

1. Kanetkar T.P, "Surveying and Levelling Vols. I and II", United Book Corporation, Pune, 2014.
2. Punmia B.C, "Surveying, Vol. I and II", Laxmi Publications, 2016.

REFERENCE BOOKS:

1. Arora K. R, "Surveying Vol. I and II", Standard Book House, 2015.
2. Basak N.N, "Surveying and Levelling", Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 2014.
3. Duggal S.K, "Surveying Vol. I and II", Tata McGraw Hill, New Delhi, 2013.
4. Kumar S., "Basics of Remote Sensing and GIS", Laxmi Publicat ion (P) Ltd, 2015.
5. Venkatramaiah, Text book of Surveying, University press, New Delhi, 2014

U23CET34	CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To understand the in gradients of concrete ,Hydration of cement test on cement and aggregate properties
2. To study the admixtures added in concrete and behaviour.
3. To study about the concrete design mix.
4. To stud the behavior of concrete at its fresh,hardened state and special concrete.
5. To study the behavior of special concrete.

UNIT I CONSTITUENT MATERIALS 9

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

UNIT II CHEMICAL AND MINERAL ADMIXTURES 9

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

UNIT III PROPORTIONING OF CONCRETE MIX 9

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

UNIT IV FRESH AND HARDENED PROPERTIES OF CONCRETE 9

Workability - Tests for workability of concrete - 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.

UNITV 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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1 : The various requirements of cement, aggregates and water for making concrete.
CO2 : The effect of admixtures on properties of concrete.
CO3: The concept and procedure of mix design as per IS method
CO4: The properties of concrete at fresh and hardened state
CO5: The importance and application of special concretes.
CO6: The materials, properties and its application were studied in detail.

TEXT BOOKS:

1. Santhakumar. A.R., “Concrete Technology”, Oxford University Press India, 2021.
2. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2016

REFERENCE BOOKS:

1. 1. Bhavikatti.S.S, “Concrete Technology”, I.K.International Publishing House Pvt. Ltd., New Delhi, 2015.

2. IS10262-2009 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998.
3. Gambhir, M.L; "Concrete Technology", 3 Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2013
4. Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
5. Kumar P Mehta., Paulo J M Monterio., "Concrete - Microstructure, Properties and Materials", McGraw Hill Education (India) Private Limited, New Delhi, 2016

U23CET35	ARTIFICIAL INTELLIGENCE IN CIVIL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To gain exposure to the latest algorithms, tools, techniques, and frameworks used in AI & ML to gain
2. hands-on learning in identifying, defining, designing, implementing & monitoring AI & ML projects apart from its use in solving boundary value problems.
3. To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
4. To acquaint the student with Fourier transform techniques used in wide variety of situations.
5. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I INTRODUCTION 9

Introduction to AI-Relationship between ML, DL and AI, machine learning applications for civil engineers, Deep learning applications for civil engineers, Machine learning Framework-Deep Learning Framework, Difference between ML and DL. The Tools and the Prerequisites-The Tools, Python Libraries and packages, Datasets – A Quick View.

UNIT II MACHINE LEARNING – THE FUNDAMENTALS 9

Introduction-Machine Learning Algorithms, Supervised Learning algorithms, Un-Supervised Learning algorithms, Reinforcement Learning, Evolutionary Approach, Linear Regression, Logistic Regression, Classification, SVM – Support Vector Machines, K – NN (K – Nearest Neighbour), Clustering – K-Means Clustering Classification, Clustering – Civil engineering domain case studies.

UNIT III THE DEEP LEARNING FRAMEWORK 9

Introduction, Artificial Neuron, Biological Neuron, Perceptron, how a Perceptron works? Activation Functions, Over fitting, Under fitting and Right fitting. Deep Learning Case Studies – Identification ofBrick types, Identification of building cracks.

UNIT IV CONVOLUTIONAL NEURAL NETWORKS 9

Bias/variance – A Quick Learning, Convolutional Neural Networks, how convolution works How zero padding works? How Max pooling works? The CNN Stack – Architecture, what is activation function CNN – Model Building – Step by Step. Case study: LeNET, AlexNet and VGG16 architectures.

UNITV ADVANCED CONCEPTS AND CASE STUDIES 9

CNN vs. RNN – A Quick Understanding, RNN vs. Feed forward Neural Networks – A Quick Understanding, Simple RNN, LSTM – Long Short-Term Memory, Gated Recurrent Unit, Autoencoders, Transfer Learning, Installation of Open VINO, Usage of Open VINO.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Apply the AI technique in Civil Engineering
CO2 : Understand the fundamental of machine learning
CO3: Use the application of deep learning in framework
CO4: Learn Fourier transform techniques.
CO5: Introduce the effective mathematical tools
CO6: Understand the techniques of AI and its application in Civil engineering.

TEXT BOOKS:

1. Samui pijush and Kothari dwarkadaspralhaddas Artificial Intelligence in Civil Engineering LAP Lambert Academic Publishing, 2012.
2. Paresh Chandra Deka A Primer on Machine Learning Applications in Civil Engineering Published by CRC Press 2019.

		L	T	P	C
U23CEP31	**MATERIAL TESTING LABORATORY**	**0**	**0**	**3**	**1.5**

COURSE OBJECTIVES

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

1. To find the youngs Modulus, Torsional Strength, Hardness and Tensile strength of given specimen.
2. To find stiffness of open coiled springs.
3. To find stiffness of closed coiled springs.
4. To study the deflection of a simply supported beam.
5. To verify the torsional formula, compare the torsional stiffness of solid and hollow shaft.

LIST OF EXPERIMENTS

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

5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring
10. Test on cement(Fineness Consistency, Soundness, Initial and Final)

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

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

COURSE OUTCOMES:

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

CO1: Evaluate Tensile and compressive strength of given specimen.

CO2 : Find stiffness of open and closed coiled springs.

CO3: Find the deflection of a simply supported beam.

CO4: Find the torsional formula, compare the torsional stiffness of solid and hollow shaft.

CO5: Calculate the intial and final setting of cement

CO6: Evaluate youngs Modulus, Torsional Strength, Hardnessof given specimen

U23CEP32 **SURVEYING LABORATORY** **L T P C**
0 0 4 2

COURSE OBJECTIVES

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

1. To study and calculate area using the Chain Traversing
2. To study and calculate area using the Compass Traversing

3. To estimate the levelling of ground surface
4. To study Plane Table Surveying – Radiation, intersection, Traverse, Resection Leveling
5. To calculate the Horizontal and Vertical Angle

LIST OF EXPERIMENTS

1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset
2. Setting out works – Foundation marking using tapes single Room and Double Room
3. Compass Traversing – Measuring Bearings & arriving included angles
4. Fly levelling using Dumpy level &Tilting level
5. Check levelling
6. Measurements of horizontal angles by reiteration and repetition and vertical angles
7. Determination of elevation of an object using single plane method when base is Accessible/ inaccessible.
8. Determination of Tacheometric Constants
9. Heights and distances by stadia Tacheometry
10. Heights and distances by Tangential Tacheometry
11. Traverse using Total station and Area of Traverse (Study)
12. Determination of distance and difference in elevation between two inaccessible points using Total station (Study)

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS		
Sl no	**Name of the Equipment**	**Quantity**
1.	Total Station	3 Nos
2.	Theodolites	Atleast 1 for every 5 students
3.	Dumpy level / Filling level	Atleast 1 for every 5 students
4.	Pocket stereoscope	1
5.	Ranging rods	1 for a set of 5 student
6.	Levelling staff	
7.	Cross staff	
8.	Chains	
9.	Tapes	
10.	Arrows	
11.	Prismatic Compass	10 nos
12.	Surveyor Compass	2 nos
13.	Survey grade or Hand held GPS	3 nos.

COURSE OUTCOMES:	
At the end ofthe course thestudentswouldbeableto	
CO1 :	use conventional surveying tools such as chain/tape, compass, plane table, level in

	the field of civil engineering applications such as structural plotting and highway profiling
CO2 :	apply the procedures involved in field work and to work as a surveying team
CO3:	plan a survey appropriately with the skill to understand the surroundings
CO4:	take accurate measurements, field booking, plotting and adjustment of errors can be understood
CO5:	plot traverses / sides of building and determine the location of points present on field on a piece of paper
CO6:	Locate the points and area traversing using Total Station.

U23CET41	STRENGTH OF MATERIALS-II	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

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

1. To analyze the column with different end conditions.
2. To study the different methods of finding deflection of beam.
3. To analyze the stress in thick and thick cylinders.
4. To calculate the theories of failure.
5. To analyze the plane members.

UNIT I COMPRESSION MEMBERS 9

Column: Types- Modes of failure-Buckling load-Factor of safety- Euler's theory- Different end conditions- Rankine's-Gordon formula. Axial and eccentric loads- Direct, bending and combined bending stress- Calculation of combined bending stress: Core section- Middle third and Middle fourth rule

UNIT II DEFLECTION OF DETERMINATE BEAMS 9

Governing differential equation-Elastic curve for various types of beams-Slope and deflection: Macaulay's method- Moment area method- Conjugate beam method.

UNIT III CYLINDERS 9

Thin cylinder: Circumferential and longitudinal stress- Shear stress- Volumetric strain. Thick cylinder: Lame's equation- Hoop and radial stress distribution- Compound cylinders.

UNIT IV PRINCIPAL STRESS AND THEORIES OF ELASTIC FAILURE 9

Two dimensional state of stress at a point-Normal and shear stresses: Analytical method. Theories of failure: Maximum principal stress theory- Maximum shear stress theory- Maximum principal strain theory- Strain energy theory- Maximum shear strain energy theory-Simple Problems.

UNITV ANALYSIS OF PLANE MEMBERS 9

Elements and types of a truss-Determinacy and stability- Analysis of statically determinate plane truss: Method of joints-Method of sections- Method of tension coefficient.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1 : Familiarize the behavior of column under axial and eccentric loads.

CO2 : Establish the slope and deflection in beams by using various methods.

CO3: Examine the problems related to thin and thick cylinders subjected to fluid pressure.

CO4: Understand the basic concepts of principle plane and stresses, theory of elasticity.

CO5: Determine the forces in plane truss members.

CO6: Analyse the behavior of beams, frames and trusses.

TEXT BOOKS:

1. Rajput R.K. "Strength of Materials", S.Chand and Co, New Delhi, 2014.
2. Bansal R.K, "Strength of Materials", Laxmi Publications, New Delhi, 2021.

REFERENCE BOOKS:

1. Basavarajiah and Mahadevapa, Strength of Materials, University press, Hyderabad, 2016
2. Chandramouli P.N, "Fundamentals of Strength of Materials", PHI Learning Private Limited, New Delhi, 2013.
3. Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2012.
4. Singh. D.K., " Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2016
5. Subramanian R, "Strength of Materials", Oxford Universit y Press, New Delhi, 2010.

U23CET42	SOIL MECHANICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To impart knowledge the properties of soil and to determine the behaviour soil under various conditions and loads
2. To explain the principles of Terzaghi's theory of primary consolidation, settlement in soils and associated properties.
3. To determine the shear stress and shear strength properties in soils, Mohr diagrams, and methods of finding the shear strength parameters of soils using direct shear test, unconfined compression test and tri-axial shear tests.
4. To adequate knowledge on mechanism of stress transfer in two-phase systems and stability analysis of slope.
5. To understand and determine stability of soil.

UNIT I SOIL CLASSIFICATION AND COMPACTION 9

Nature of soil – phase relationships – Soil description and classification for engineering purposes, their significance – BIS Classification system – Soil compaction – Theory,comparison of laboratory and field compaction methods – Factors influencing compaction behaviour of soils.

UNIT II SOIL WATER AND WATER FLOW 9

Soil water – static pressure in water – capillary stress – Permeability measurement in the laboratory and field – pumping in and pumping out tests – factors influencing permeability of soils – Seepage – introduction to flow net – Simple problems (sheet pile and wier).

UNIT III STRESS DISTRIBUTION AND SETTLEMENT 9

Effective stress concepts in soils – Stress distribution in soil media – Boussinesq theory – Use of Newmarks influence chart – Components of settlement — immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – computation of rate of settlement- log t and log t methods - Factors influencing settlement characteristics of soils.

UNIT IV SHEAR STRENGTH 9

Shear strength of cohesive and cohesion less soils – Mohr – Coulomb failure theory – Measurement of shear strength, direct shear – Triaxial compression, UCC and Vane shear tests – Cyclic loading – Pore pressure parameters– Factors influences shear strength of soil.

UNITV SLOPE STABILITY 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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1 : Classify the soil and assess the engineering properties, based on index properties.
CO2 : Understand the stress concepts in soils.
CO3: Learn and identify the settlement in soils.
CO4: Analyze the shear strength of soil.
CO5: Learn and identify the slope stability of soil.
CO6: Understand the properties and behaviour of different types of soil

TEXT BOOKS:

1. Gopal Ranjan, A S R Rao, "Basic and Applied Soil Mechanics" New Age InternationalPublication, 3rdEdition, 2020.
2. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16 thEdition, 2021.

REFERENCE BOOKS:

1. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 7th Edition, 2021(Reprint).
2. Braja M Das, "Principles of Geotechnical Engineering", Cengage Learning India Private Limited, 8th Edition, 2021.
3. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2018.
4. Palanikumar.M. "Soil Mechanics", Prentice Hall of India Pvt. Ltd, Learning Private Limited Delhi, 2021.
5. Venkatramaiah.C. "Geotechnical Engineering", New Age International Pvt. Ltd., New Delhi, 2021.

U23CET43	HYDRAULICS AND HYDRAULIC MACHINERY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To design open channel sections in a most economical fashion with minimum wetted perimeter and learn about critical flows
2. To study about uniform flows in open channel and longitudinal slopes in open channel
3. To develop an understanding of Characteristics of flow profiles and Hydraulic jump
4. To analyze the impact of jets and curved plates and classification of turbine.
5. To examine the classification of pumps and characteristics of pumps

UNIT I OPEN CHANNEL FLOW 9

Definition and differences between pipe flow and open channel flow - Types of Flow in channels - Properties of open channel - Velocity distribution in open channel — Determination of roughness coefficients – Manning‟s and Chezy‟s formula –Most economical sections – Wide open channel.

UNIT II UNIFORM FLOW 9

Uniform flow – Flow measurement by notches and weirs – Specific energy– Determination of normal depth and velocity - Critical flow and its computation – Channel Transition –Non erodible channels.

UNIT III VARIED FLOW 9

Dynamic equations of gradually varied flow – Assumptions – Characteristics of flow profiles – Draw down and back water curves – Profile determination – Graphical integration, direct step and standard step method – Flow through transitions – Hydraulic jump – Types – Energy dissipation – Surges.

UNIT IV TURBINES 9

Impact of jets on plane and curved plates - Classification of Turbines - Reaction turbines Francis turbine, Radial flow turbines, draft tube and Cavitation- Propeller and Kaplan turbines - Impulse turbines - Performance of Turbine - Runway Speed - Similarity laws.

UNITV PUMPS 9

Classification of Pumps - Centrifugal pump - Work done - minimum speed to start the pump – NPSH -multistage Pumps – Characteristics curve - reciprocating pump – negative slip - flow separation conditions - air vessels -indicator diagram and its variation – savings in work done - rotary pumps, Gear pump.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1 : Explain concepts of open channel flow, Channel transition and Identify economical Section.

CO2 : Compute the flow measurement and specific energy

CO3: Explain the rapidly varied channel-flow and dam flow profile characteristics

CO4: Illustrate the performance characteristics of various types of turbines

CO5: Examine the pumps for various engineering applications based on their performance Curves

CO6: Know about the flows in water storage structures.

TEXT BOOKS:

1. Bansal R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi, 2021.
2. Rajput R.K., "Fluid Mechanics and Hydraulic Machines", S. Chand Publishing Ltd, New Delhi, 2019.

REFERENCE BOOKS:

1. Modi P.N and Seth, "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi. 2020.
2. Jain.A.K., " Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, Twelfth Edition, 2020.
3. Rajesh Srivastava, "Flow through open channels", Oxford University Press, New Delhi, 2020.
4. Subramanya K, "Fluid Mechanics and Hydraulic Machines-Problems and Solutions", Tata McGraw Hill Educat ion, New Delhi, 2021.
5. VenTe Chow, "Open Channel Hydraulics", McGraw Hill, New York, 2009.

U23CET44	**WATER SUPPLY ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

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

1. To make the understudies familiar with sources and its interest of water.
2. To Study the basic characteristics of water and its determination.
3. To design various water treatment units.
4. Principles and design of water treatment.
5. To study difficulties in distributionand also waterdistribution design.

UNIT I SOURCES OF WATER **9**

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

UNIT II CONVEYANCE FROM THE SOURCE 9

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

UNIT III WATER TREATMENT 9

Objectives – Unit operations and processes – Principles, functions design and drawing of flash mixers, flocculators, sedimentation tanks and sand filters; Disinfection –THM; Iron and Manganese removal, Defluoridation - Residue Management – Corrosion Control; Construction, Operation and Maintenance aspects-Layout and Hydraulic Profile of water treatment plants.

UNIT IV ADVANCED WATER TREATMENT 9

Water softening - Desalination -demineralization – Adsorption -Membrane Systems Construction andoperation & Maintenance aspects – Recent advances.

UNITV WATER DISTRIBUTION AND SUPPLY TO BUILDINGS 9

Requirements of water distribution -Components -Service reservoirs -Functions and drawings Networkdesign -Economics -Computer applications -Analysis of distribution networks Appurtenances -operationand maintenance -Leak detection, Methods. Principles of design of water supply in buildings –House service connection -Fixtures and fittings -Systems of plumbing and drawings of types of plumbing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1 : An insight into the structure of drinking water supply systems, including water transport, treatment and distribution

CO2 : The knowledge in various unit operations and processes in water treatment

CO3: An ability to design the various functional units in water treatment

CO4: An understanding of water quality criteria and standards, and their relation to public health.

CO5: The ability to design and evaluate water supply project alternatives on basis of chosen criteria.

CO6: Understand the standards of water.

TEXT BOOKS:

1. Duggal K.N., “Elements of Environmental Engineering” S.Chand and Co. Ltd., New Delhi,2018
2. Garg, S.K., Environmental Engineering Vol. I, KhannaPublishers,New Delhi, 2015.

REFERENCE BOOKS:

1. Karia G.L., and Christian R.A, "Wastewater Treatment Concepts and Design Approach", Prentice
   Hall of India Pvt. Ltd., New Delhi. 3rd, Edition, 2017
2. Punmia, B.C.,Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi, 2014.
3. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government
   of India, New Delhi, 1999.
4. Gray N.F, "Water Technology", Elsevier India Pvt. Ltd., New Delhi, 2006.

U2CET45	HIGHWAY ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To know the History of road development in India and factors alignment.
2. To understand concept of Geometric design of roads and various aspects of traffic engineering.
3. To design the flexible and rigid pavements
4. To study the highway design, construction and maintenance of highways.
5. To understand the Highway Costs, Vehicle Operation Costs, Economic analysis

UNIT I HIGHWAY PLANNING AND ALIGNMENT 9

History of road development in India – Classification of highways – Institutions for Highway planning, design and construction at different levels – factors influencing highway alignment – Road ecology - Engineering surveys for alignment, objectives, conventional and modern methods.

UNIT II GEOMETRIC DESIGN OF HIGHWAYS 9

Typical cross sections of Urban and Rural roads — Cross sectional elements – Horizontal curves, super elevation, transition curves, widening of curves – Sight distances – Vertical curves, gradients, hairpin bends – Lateral and vertical clearance at underpasses – IRC standards-Road signs and safety. Urban utility services.

UNIT III DESIGN OF FLEXIBLE AND RIGID PAVEMENTS 9

Design principles – pavement components and their role - Design practice for flexible and rigid Pavements

UNIT IV HIGHWAY CONSTRUCTION AND MAINTENANCE 9

Highway construction materials, properties, testing methods – Construction practice of flexible and concrete pavements including modern materials and methods, Highway drainage – SpecialConsiderations for hilly roads; Evaluation and Maintenance of pavements.

UNITV HIGHWAY ECONOMICS AND FINANCE 9

Introduction, Highway User Benefits, Highway Costs, Vehicle Operation Costs, Economic analysis, Highway projects under Public-Private Sector Participation, Bidding process, Highway finance.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1 : Understand the concepts and standards adopted in Planning, Design and construction of Highways and its related infrastructures.

CO2 : Apply the knowledge of science and engineering fundamentals in designing the geometrics for an efficient Highway network and design concepts.

CO3: Designing various types of pavements to meet specified needs of safety, efficiency and long-time sustainability by adopting various design standards.

CO4: Select appropriate methods for construction, evaluation and maintenance of roadways.

CO5: Understand the bidding processes and types of highway projects and analyze the economic, financial aspects of the highway projects.

CO6: Learn about the Indian Road Congress Codal provisions

TEXT BOOKS:

1. Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", Nemchand Publishers
2. Subhash C Saxena, Textbook of Highway and Traffic Engineering. CBS Publishers, 2017.

REFERENCE BOOKS:

1. C.Venkatramaiah., Transportation Engineering-Highway Engineering, Universities Press`(India)Private Limited, Hyderabad,2015.
2. Indian Road Congress (IRC), Guidelines for the Design of Flexible Pavements, (Third Revision), IRC: 37-2012
3. Indian Road Congress (IRC), Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, (Third Revision), IRC: 58-2012
4. Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications, 8th edition Delhi, 2013.
5. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai, 2010

U23GET41	**ENVIRONMENTAL SCIENCES AND SUSTAINABILITY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

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

1. To finding and implementing scientific, technological, economic and political solutions to environmental problems
2. To study the interrelationship between living organism and environment.
3. To appreciate the importance of environment by assessing its impact on the human world envisions the surrounding environment, its functions and its value.
4. To study the dynamic processes and understand the features of the earth's interior and surface.
5. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ECO SYSTEMS AND BIODIVERSITY 9

Definition – concept of an ecosystem– structure and function of an ecosystem - Oxygen cycle and Nitrogen cycle –energy flow in the ecosystem – ecological succession- structure and function of the (a) forest ecosystem (b) grass and ecosystem (c) desert ecosystem (d) aquatic ecosystems. Introduction- definition, classification of India–value of biodiversity-India as a mega-diversity nation –hotspots of biodiversity– threats to biodiversity endangered and endemic species of India– conservation of biodiversity.

UNIT II ENVIRONMENTAL POLLUTION 9

Definition–causes, effects and control measures of: (a) Air pollution (b) Water pollution. (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management- disaster management: floods, earthquake, cyclone and landslides.

UNIT III NATURAL RESOURCES 9

Forest resources – deforestation - Water resources - dams - benefits and problems – Mineral resources -mineral resources – Food resources – Energy resources, Land resources – Role of an individual in conservation of natural resources.

UNIT IV GREEN CHEMISTRY 9

Introduction, Principles, Toxicity - Green chemistry in Plastics, Energy, sustainable development – Controlled environmental agriculture Avoidance of toxic fictional group - reduce the toxic chemicals -Advantage and disadvantages of protected cultivation- Green chemistry using the bio catalytic reactions -Fermentation and Bio transformations. Eco mark, Eco symbol, Green label.

UNITV SOCIAL ISSUES AND ENVIRONMENT 9

Human health Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment From unsustainable to sustainable development – water conservation, rain water harvesting, water shed management – resettlement and rehabilitation - Population growth, variation among nations – population explosion –family welfare programme human rights, consumerism – value education – HIV/AIDS –women and child welfare.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

CO2 : Public awareness of environmental is at infant stage.

CO3: Ignorance and incomplete knowledge has lead to misconceptions

CO4: Development and improvement in std. of living has lead to serious environmental disasters

CO5: Understand the social issues and environment like rehabilitation, population growth, women and child welfare

CO6:

TEXT BOOKS:

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd edition,Pearson Education (2004).
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, (2006).

REFERENCE BOOKS:

1. R.K.Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House,Mumbai, 2001.
3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan ,R, "Environmental Studies-From Crisis to Cure", Oxford University Press (2005).
5. Kaushik, A & Kaushik, CP, "Environmental Science and engineering", 3rd Edition, New Age International (P) Limited, New Delhi, 2009. (Module I)

		L	T	P	C
U23CEP41	**ENVIRONMENTAL ENGINEERING LABORATORY**	**0**	**0**	**3**	**1.5**

COURSE OBJECTIVES

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

1. To Study the water contamination

2. To study quality characteristics of portable and palatable water
3. To analyse the impact of contaminated water
4. To understand the importance of DO
5. To understand the sampling and preservation methods and significance of characterization of wastewater

LIST OF EXPERIMENTS

1. Determination of PH and turbidity in wastewater.
2. Determination of Hardness in wastewater.
3. Determination of Ammonia Nitrogen in wastewater
4. Determination of residual chlorine
5. Determination of Optimum Coagulant Dosage
6. Determination of suspended, volatile and fixed solids
7. Determination of dissolved oxygen
8. Determination of B.O.D. test
9. Determination of C.O.D .test
10. Introduction to Bacteriological Analysis (Demonstrationonly)

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	Oxygen analyzer	1
2.	Spectrophotometer	1
3.	Ion – selective electrode	1
4.	Sodium Potassium Analyzer – Flame Photometer	1
5.	Gas Chromatography	1
6.	Atomic absorption spectroscopy (Ni, Zn, Pb)	1
7.	Nephlo - turbidity meter	1
8.	BOD Analyser	1
9.	COD Analyser	1
10.	Jar Test Apparatus	1
11.	P^H meter	1
12.	Turbidity meter	1
13.	Conductivity meter	1
14.	BOD incubator	1
15.	Refrigerator	1
16.	Muffle furnace	1
`17.	Water bath	1

COURSE OUTCOMES:

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

CO1 : Characterize portable water and conduct treatability studies
CO2 : Characterize wastewater and conduct treatability studies
CO3: Understand the drinking water characteristics
CO4: Understand the importance of wastewater treatment
CO5: Study about impact of B.O.D and C.O.D
CO6: Study about the importance of physical characteristics of water.

		L	T	P	C
U23CEP42	**FLUID MECHANICS AND HYDRAULIC ENGINEERING LABORATORY**	**0**	**0**	**4**	**2**

COURSE OBJECTIVES

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

1. To study flow measurement using rotameter, venturimeter/Orifce meter
2. To calculate the Major and minor losses in pipes
3. To facilitate the understanding of the behaviour of Flow in Pipes, Pumps and Turbines
4. To estimate the characteristics value of turbine.
5. To calculate the metacentric height

LIST OF EXPERIMENTS

A. Flow Measurement

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

B. Losses in Pipes

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

C. Pumps

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

D. Turbines

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

E. Determination of Meta centric height

12. Determination of Metacentric height of floating bodies

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl no	Name of the Equipment	Quantity
1.	One set up of Rotometer	One set up

2.	One set up of Venturimeter/Orifice meter	One set up
3.	One Bernoulli's Experiment set up	One set up
4.	One set up of Centrifugal Pump	One set up
5.	One set up of Gear Pump	One set up
6.	One set up of Submersible pump	One set up
7.	One set up of Reciprocating Pump	One set up
8.	One set up of Pelton Wheel turbine	One set up
9.	One set up of Francis turbines/one set of kaplon turbine	One set up
10.	One set up of equipment for determination of Metacentric height of floating bodies	One set up
11.	One set up for determination of friction factor in pipes	One set up
12.	One set up for determination of minor losses.	One set up

COURSE OUTCOMES:

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

CO1 : Study flow measurement using rotameter, venturimeter / Orifce meter

CO2 : calculate the Major and minor losses in pipes

CO3: facilitate the understanding of the behaviour of Flow in Pipes, Pumps and Turbines

CO4: Estimate the characteristics value of turbine.

CO5: Calculate the metacentric height.

CO6: Understand the practical concepts of fluid flow.

U23CET51	STRUCTURAL ANALYSIS I	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To understand the concept of analysis of indeterminate structures by various classical methods
2. To calculate the beam deflection by slope deflection method.
3. To calculate the beam deflection by moment distribution method.
4. To analysis the different elements using flexibility method.
5. To analysis the different elements using stiffness method.

UNIT I VIRTUAL WORK AND STRAIN ENERGY 9

Support reactions - Internal forces in beams - Axial forces in trusses - Internal forces in frames application of method of virtual work (unit load method) and strain energy method for determination of deflections of statically determinate beams -pin-joined trusses and rigid frames -temperature effects - Lack of fit

UNIT II SLOPE DEFLECTION METHOD 9

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

UNIT III MOMENT DISTRIBUTION METHOD 9

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

UNIT IV FLEXIBLITY METHOD 9

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

UNIT V STIFFNESS METHOD 9

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1: Analyse the determinate structure by using virtual work method and strain energy method.

CO2: Analyse the continuous beams and rigid frames by slope deflectionmethod.

CO3: Analyse the continuous beams and rigid frames by moment distributionmethod.

CO4: Analyse the different types of elements using flexibility method.

CO5: Analyse the different types of elements using stiffness method.

CO6: Analyse the beams and trusses by various methods.

TEXT BOOKS:

1. BhavaiKatti, S.S, "Structural Analysis –Vol. 1 & Vol. 2", Vikas Publishing Pvt Ltd.,
2. Vaidyanadhan, R and Perumal, P, –"Structural Analysis Vol 1&Vol 2 Laxmi Publications Pvt. Ltd,New Delhi, 2015.

REFERENCE BOOKS:

1. Bhavikatti, S.S, Matrix Method of Structural Analysis, I. K. International Publishing House Pvt.Ltd.,New Delhi-4, 2014.
2. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, " Theory of structures", Laxmi Publications Pvt. Ltd., New Delhi, 2016
3. Reddy. C.S., "Basic Structural Analysis", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2013.
4. Thandavamoorthy T.S, "Structural Analysis", Oxford Universit y Press, New Delhi. 2011.
5. Vazrani.V.N and Ratwani, M.M, Analysis of Structures, Vol.II, Khanna Publishers, 2015.

U23CET52 FOUNDATION ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. To impart knowledge on common method of sub soil investigation and design of foundation.
2. To Analyze shallow and deep foundations
3. To Design types of footing such as raft
4. To Design the pile foundation
5. To Design the Retaining wall.

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

Scope and objectives-Methods of exploration-Depth of boring-Spacing of bore hole-Sampling techniques-Representative and undisturbed sampling-methods - Split spoon sampler, Thin wall sampler,Stationery piston sampler-Penetration tests (SPT and SCPT) - Bore log report- Selection of foundationbased on soil condition.

UNIT II SHALLOW FOUNDATION 9

Introduction-Location and depth of foundation-Codal provisions-Bearing capacity of shallow foundation on homogeneous deposits Terzaghi's formula and BIS formula- Bearing capacity from in-situ tests (SPT,SCPT and plate load) - Settlement -Total and differential settlement-Allowable settlements- Methods ofminimizing settlements.

UNIT III FOOTINGS AND RAFTS 9

Types of foundation- General design principles-proportioning of foundations-spread footings-combined footings-trapezoidal and strap footings-Raft foundation-contact pressure distribution.

UNIT IV PILE FOUNDATION 9

Types of piles and their function –Load carrying capacity of piles -static formula-dynamic formulae (Engineering news and Hileys)- Load carrying capacity from insitu tests (SPT and SCPT)-Negative skinfriction- Group capacity by different methods (Feld's rule, Converse-Labarre formula)-Settlement of pileand pile groups- pile load test (routine test only)-Under reamed piles.

UNITV RETAINING WALLS 9

Plastic equilibrium in soils-Active and passive states-Rankine's theory- Coulomb's wedge theory-Condition for critical failure plane Earth pressure on retaining walls of simple configurations-Rebhann'sandCulmann's graphical method-Pressure on the wall due to line load-Stability analysis of retainingwalls.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1 : Conduct sub surface investigation and select foundation based on soil condition.
CO2 : Estimate the bearing capacity of soil based on shear and settlement criteria.
CO3: Analyze the proportion of various shallow foundations.
CO4: Calculate the load carrying capacity of piles.
CO5: Determine the earth pressure of retaining wall.
CO6: Understand the application of foundation for different types of soil.

TEXT BOOKS:

1. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2014.
2. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16Edition 2017.

REFERENCE BOOKS:

1. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors,New Delhi, 7th Edition, 2017 (Reprint).
2. Brajam.das, principles of foundation Engineering, Thomson Asia pvt. Ltd, Singapore, 2016.
3. Das, B.M. "Principles of Foundation Engineering" 5 edition, Thompson Asia Pvt. Ltd., Singapore, 2003.
4. Shenbaga R kaniraj, Design aids in Soil mechanics and Foundation, Tata McGraw –Hill Education-2011.
5. Venkatramaiah, C, "Geotechnical Engineering", New Age International Publishers, New Delhi, 2017.

U23CET53 REINFORCED CONCRETE DESIGN

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. To Understand the stress strain behaviour of steel and concrete
2. To study the concept of working stress and limit state methods.
3. To design the Limit state Method for Bond, anchorage shear and torsion

4. To introduce the different types of attitudes related to design of basic structural elements such as
5. Slab, beam, column and footing which form part of any structural system with reference to Indian

UNIT I METHODS OF DESIGN OF CONCRETE STRUCTURES 9

Concept of Elastic method, ultimate load method and limit state method – Advantages of Limit State Method over other methods – Design codes and specification – Limit State philosophy as detailed in IScode – Design of beams and slabs by working stress method.

UNIT II LIMIT STATE DESIGN FOR FLEXURE 9

Analysis and design of singly and doubly reinforced rectangular and flanged beams - Analysis anddesign of one way, two way and continuous slabs subjected to uniformly distributed load for variousboundary conditions.

UNIT III LIMIT STATE DESIGN FOR BOND, ANCHORAGE SHEAR & TORSION 9

Behaviour of RC members in bond and Anchorage - Design requirements as per current codeBehaviour of RC beams in shear and torsion - Design of RC members for combined bending shear and torsion.

UNIT IV LIMIT STATE DESIGN OF COLUMNS 8

Types of columns – Braced and unbraced columns – Design of short Rectangular and circular columnsfor axial, uniaxial and biaxial bending.

UNITV LIMIT STATE DESIGN OF FOOTING 10

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1 : To understand conceptually the difference between Working stress method, Ultimate load theorymethod & Limit state Design method.

CO2 : To design the structural elements like RCC beam, slab, column, and footings by limit state Designmethod as per I.S.456-2000.

CO3: To design two way slab & one way continuous slabs

CO4: To design columns & footings for eccentric loads.

CO5: The student shall be in a position to design the basic elements of reinforced concrete structures.

CO6: Learn about the Indian Standard Codal Provisions for basic RC structural elements.

TEXT BOOKS:

1. Krishna Raju.N, "Design of Reinforced Concrete Structures", CBS Publishers & Distributors, New Delhi2010.
2. VargheseP.C, "Limit State Design of Reinforced Concrete", Prentice Hall of India Pvt. Ltd, New Delhi 2010.

REFERENCE BOOKS:

1. Ashok Kumar Jain, "Reinforced Concrete Limit State Design", Nem Chand Brothers, 2015.
2. Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.
3. IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000.
4. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete",Laxmi Publication Pvt. Ltd., New Delhi, 2007.
5. UnnikrishnaPillaiS,DevdasMenon, "Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd,New Delhi 2016.

U23CET54	RAILWAY AIRORT AND HARBOUR ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To learn about the railway engineering
2. To study the railway construction and maintenance.
3. To understand the airport planning
4. To design the airport.
5. To design the harbour.

UNIT I RAILWAY PLANNING 9

Significance of Road, Rail, Air and Water transports - Coordination of all modes to achievesustainability - Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, TrackStress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional andmodern methods- - Soil suitability analysis - Geometric design of railways, gradient, super elevation,widening of gauge on curves- Points and Crossings.

UNIT II RAILWAY CONSTRUCTION AND MAINTENANCE 9

Earthwork – Stabilization of track on poor soil –- Tunneling Methods, drainage and ventilation – calculation of Materials required for track laying - Construction and maintenance of tracks – Modernmethods of construction & maintenance - Railway stations and yards and passenger amenities- Urbanrail – Infrastructure for Metro, Mono and underground railways.

UNIT III AIRPORT PLANNING 9

Air transport characteristics-airport classification-airport planning: objectives, components, layout

characteristics, socio-economic characteristics of the Catchment area, criteria for airport site selectionand ICAO stipulations, Typical airport layouts, Case studies, Parking and circulation area.

UNIT IV AIRPORT DESIGN 9

Runway Design: Orientation, Wind Rose Diagram - Runway length - Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles – Elements ofTaxiway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markingsand lighting.

UNIT V HARBOR ENGINEERING 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

- **CO1 :** Understand the methods of route alignment and design elements in Railway Planning and constructions
- **CO2 :** Understand the Construction techniques and Maintenance of Track laying and Railway stations.
- **CO3 :** Gain an insight on the planning and site selection of Airport Planning and design.
- **CO4 :** Analyze and design the elements for orientation of runways and passenger facility systems.
- **CO5 :** Understand the various features in Harbours and Ports, their construction, coastal protection works and coastal Regulations to be adopted.
- **CO6:** Learn about the design of railway, Airport and Harbour.

TEXT BOOKS:

1. Saxena Subhash C, and Sat yapal Arora, “A Course in Railway Engineering”, Dhanpat Rai and Sons, Delhi, 2003
2. Khanna S K, Arora M G, and Jain S S, “Airport Planning and Design”, Nemchand and Brothers, Roorkee, 2012.
3. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi, 2013

REFERENCE BOOKS:

1. Rangwala, "Railway Engineering", Charotar Publishing House, 2013.
2. Rangwala, "Airport Engineering", Charotar Publishing House, 2013.

3. Rangwala, "Harbor Engineering", Charotar Publishing House, 2013.
4. Satish Chandra and Agarwal M.M, "Railway Engineering", 2 Editions, Oxford University Press, New Delhi, 2013.
5. Venkatramaiah. C., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels.,Universities Press (India) Private Limited, Hyderabad, 2015.

U23CET55 WASTE WATER ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. To study the characteristics and composition of sewage.
2. To study the characteristics and composition of sewage.
3. To study the standard disposal of sewage.
4. To Design the sludge treatment and disposal
5. To apply basic understanding of physical, chemical, and biological phenomena for successfuldesign, operation and maintenance of sewage treatment plants.

UNIT I PLANNING AND DESIGN OF SEWERAGE SYSTEM 9

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

UNIT II PRIMARY TREATMENT OF SEWAGE 9

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

UNIT III SECONDARY TREATMENT OF SEWAGE 9

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

UNIT IV DISPOSAL OF SEWAGE 9

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

UNIT V SLUDGE TREATMENT AND DISPOSAL 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1 : An ability to estimate sewage generation and design sewer system including sewage pumpingstations

CO2 : The required understanding on the characteristics and composition of sewage, self-purification ofstreams

CO3 : An ability to perform basic design of the unit operations and processes that are used in sewagetreatment

CO4 : Understand the standard methods for disposal of sewage.

CO5 : Gain knowledge on sludge treatment.

CO6: Understand the impact and importance of safe disposal of sludge.

TEXT BOOKS:

1. Duggal K.N., "Elements of Environmental Engineering" S.Chand and Co. Ltd., New Delhi, 2014.
2. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers,New Delhi, 2015.

REFERENCE BOOKS:

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

U23CEP51	GEOTECHNICAL ENGINEERING LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

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

1. To Study about the Index Properties of soil
2. To determine Density Index properties of soil
3. To calculate compaction characteristics of soil.
4. To determine the permeabilityof the soil.
5. To determine the direct shear, UCC and laboratory vane shear of the soil.

A. DETERMINATION OF INDEX PROPERTIES 22

1. Special gravity of soil solids
2. Grain size distribution – Sieve analysis
3. Grain size distribution Hydrometer analysis
4. Liquid limit and Plastic limit tests

5.	Shrinkage limit and Differential free swell test	
B.	**DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS**	8
6..	Field density Test	
7.	Determination of moisture – density relationship using standard Proctor compaction test.	
C.	**DETERMINATION OF ENGINEERING PROPERTIES**	30
8.	Permeability determination (constant head and falling head methods)	
9.	Direct shear test in cohesion-less soil	
10.	Unconfined compression test in cohesive soil	
11.	Laboratory vane Shear test in cohesive soil	

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl no	Name of the Equipment	Quantity
1.	Sieves	2 sets
2.	Hydrometer	2 sets
3.	Liquid and plastic limit apparatus	2 sets
4.	Shrinkage limit apparatus	3 sets
5.	Proctor compaction apparatus	2 sets
6.	UTM of minimum of 20KN capacity	1
7.	Direct shear apparatus	1
8.	Thermometer	2
9.	Field density measuring device	2
10.	Triaxial shear apparatus	1
11.	Three gang consolidation test device	1

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto do

CO1 :	Determine index properties
CO2 :	Evaluate the Density Index properties of soil
CO3:	Calculate the engineering properties of soil.
CO4:	Determine the compaction value of the soil
CO5:	Understand shear strength, compressibility and permeability by conducting appropriate tests
CO6:	Evaluate the strength of different soils.

		L	T	P	C
U23CEP52	**CONCRETE AND HIGHWAY ENGINEERING LABORATORY**	**0**	**0**	**3**	**1.5**

COURSE OBJECTIVES

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

1. To learn about test on fresh concrete
2. To Learn about Hardened concrete.
3. To understand the test on aggregate.
4. To study the test on Bitumen
5. To characterize various pavement materials.

LIST OF EXPERIMENTS

A. TESTS ON FRESH CONCRETE

1. Slump cone test
2. Flow table
3. Compaction factor
4. Vee bee test.

B. TESTS ON HARDENED CONCRETE

5. Compressive strength - Cube & Cylinder
6. Flexure test
7. Modulus of Elasticity

C. TESTS ON AGGREGATES

8. Specific Gravity
9. Gradation of Aggregate
10. Crushing Strength
11. Abrasion Value
12. Impact Value
13. Water Absorption
14. Flakiness and Elongation Indices

D. TESTS ON BITUMEN

15. Penetration
16. Softening Point
17. Ductility
18. Flash and fire points.
19. Viscosity

E. TESTS ON BITUMINOUS MIXES

21. Determination of Binder Content
22. Marshall Stability and Flow value
23. Density

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl no	Name of the Equipment	Quantity
1.	Concrete cube moulds	6
2.	Concrete cylinder moulds	3
3.	Concrete Prism moulds	3

4.	Sieves 1 set	1 set
5.	Concrete Mixer	1
6.	Slump cone	3
7.	Flow table	1
8.	Vibrator	1
9.	Trovels and planers	1 set
10.	UTM – 400 kN capacity	1
11.	Vee Bee Consistometer	1
12.	Aggregate impact testing machine	1
13.	CBR Apparatus	1
14.	Blains Apparatus	1
15.	Los - Angeles abrasion testing machine	1
16.	Marshall Stability Apparatus	1

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1 : learn about test on fresh concrete

CO2 : Learn about Hardened concrete.

CO3: Understand the test on aggregate.

CO4: Study the test on Bitumen

CO5: Student knows the techniques to characterize various pavement materials through relevant tests.

CO6: Learn and make the concrete based on Indian Standards.

U23CET61	STRUCTURAL ANALYSIS II	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To understand the concept of analysis of indeterminate structures by various influence line method
2. To analysis the different types of arches.
3. To analysis the different types of space and cable structures.
4. To design the member using plastic analysis.
5. To understand the analysing concepts of finite element.

UNIT I INFLUENCE LINES FOR DETERMINATE STRUCTURES 9

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

UNIT II ARCHES 9

Types of Arches - Analysis of three hinged and two hinged arches – Parabolic and circular arches – Three and two hinged arches for calculating horizontal thrust, radial shear and BM at any section

UNIT III SPACE AND CABLE STRUCTURES 9

Analysis of Space trusses using method of tension coefficients – Beams curved in plan Suspension cables – suspension bridges with two and three hinged stiffening girders

UNIT IV 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 V FINITE ELEMENT METHOD 9

Introduction – Discretisation of a structure – Displacement functions – Truss element – Beam element – Plane stress and plane strain - Triangular elements

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Analyse the determinate structure by using virtual work method and strain energy method

CO2 : Analyse the continuous beams and rigid frames (indeterminate structures) by slope deflectionmethod

CO3: Analyse the continuous beams and rigid frames (indeterminate structures) by moment distributionmethod

CO4: Analyse the different types of arches.

CO5: Calculate plastic analysis with different members

CO6: Analyse the concrete and steel structural elements by different methods.

TEXT BOOKS:

1. BhavaiKatti, S.S, "Structural Analysis –Vol. 1 & Vol. 2", Vikas Publishing Pvt Ltd.,
2. Vaidyanadhan, R and Perumal, P, –"Structural Analysis Vol 1&Vol 2 Laxmi Publications

Pvt. Ltd,New Delhi, 2015.

REFERENCE BOOKS:

1. Bhavikatti, S.S, Matrix Method of Structural Analysis, I. K. International Publishing House Pvt.Ltd.,New Delhi-4, 2014.
2. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, " Theory of structures", Laxmi Publications Pvt. Ltd., New Delhi, 2016
3. Reddy. C.S., "Basic Structural Analysis", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2013.
4. Thandavamoorthy T.S, "Structural Analysis", Oxford Universit y Press, New Delhi. 2011.
5. Vazrani.V.N and Ratwani, M.M, Analysis of Structures, Vol.II, Khanna Publishers, 2015.

U23CET62	DESIGN OF STEEL TRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. Gain Knowledge on the of limit state design of steel structures and the design of connections.
2. Be familiar with the design concepts of steel structural members subjected to tension.
3. Understand the design concepts of the structural steel members subjected to compression.
4. Be familiar with the design concepts of structural members subjected to bending .
5. Be acquainted with the design concepts of the components of industrial structures.

UNIT I SECTIONS AND JOINTS 9

Types of steel structures – Properties of rolled steel sections and Light gauge steel sections – Allowable Stresses as per IS code - Riveted and bolted connections – Failures of joints – Single and multiple riveted lap and butt joints under axial and eccentric loading – Strength of fillet and butt welded joints – Design of riveted and welded joints.

UNIT II TENSION MEMBERS 9

Types of sections – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag.

UNIT III COMPRESSION MEMBERS 9

Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of laced and battened type columns – Design of column bases – Gusseted base.

UNIT IV BEAMS 9

Design of laterally supported and unsupported beams – Built up beams – Beams subjected to uniaxial and biaxial bending – Design of plate girders - Intermediate and bearing stiffeners – Flange

and web splices.

UNIT V ROOF TRUSSES AND INDUSTRIAL STRUCTURES 9

Roof trusses – Roof and side coverings – Design of purlin and elements of truss; end bearing – Design of gantry girder.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Apply the IS code practice for the design of steel structural elements, analyses and design tension members.
CO2 : Design tension members and tension splice.
CO3: Design compression members and base plates.
CO4: Design various types of flexural members.
CO5: Design various members of roof truss.
CO6: Design the steel elements for residential and industrial structures.

TEXT BOOKS:

1. Bhavikatti S.S, "Design of Steel Structures", I.K. International Publishing House Pvt. Ltd, New Delhi, 2010
2. Duggal S.K, "Design of Steel Structures", Tata McGraw-Hill Education, 2009

REFERENCE BOOKS:

1. Gambhir M.L, "Fundamentals of Structural Steel Design", McGraw Hill Educat ion India Pvt. Ltd, 2013
2. Jayagopal L.S, and Tensing, "Design of Steel Structures" Vikas Publishing House Pvt. Ltd, India, 2016.
3. Negi L.S, "Design of Steel Structures", Tata McGraw Hill Publishing Pvt Ltd, New Delhi, 2007.
4. Shiyekar M.R, "Limit State Design in Structural Steel", Prent ice Hall of India Pvt. Ltd, 2013.
5. Subramanian N, "Design of Steel Structures", Oxford Universit y Press, New Delhi 2008

U23CET63 ADVANCED REINFORCED CONCRETE DESIGN

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. To understand the design concept of various structures and detailing of reinforcements
2. To design the water tank underground as well above the ground level.
3. To design the Stair case, flat slab and principles of mat foundation and box culvert
4. To analyse the yield line theory and collapse load.
5. To design the brick masonry wall or column with point load and eccentric load

UNIT I RETAINING WALLS 9

Design of Cantilever and Counterfort Retaining walls.

UNIT II WATER TANKS 9

Design of rectangular and circular water tanks both below and above ground level - Design of

circular slab.

UNIT III STAIRCASE AND FLAT SLABS 9

Design of staircases (Ordinary and Dog logged) – Design of flat slabs – Principles of design of mat foundation, box culvert and road bridges.

UNIT IV YIELD LINE THEORY 9

Assumptions - Characteristics of yield line - Determination of collapse load / plastic moment Application of virtual work method - square, rectangular, circular and triangular slabs – Design problems

UNIT V BRICK MASONRY 9

Introduction, Classification of walls, Lateral supports and stability, effective height of wall and columns, effective length of walls, design loads, load dispersion, permissible stresses, design of axially and eccentrically loaded brick walls

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Deign the retaining walls with details of structural drawing
CO2 : Apply the concepts of liquid retaining structures
CO3: Design the staircase, flat slab, mat foundation and box culvert
CO4: Analyse square, rectangular and triangular slabs using yield line theory.
CO5: Design the brick masonry structure like columns and wall
CO6: Know about different detailing diagrams for advanced concrete structures.

TEXT BOOKS:

1. Krishna Raju N, "Design of Reinforced Concrete Structures", CBS Publishers & Distributors, New Delhi2010.
2. Unni krishna Pillai S,Devdas Menon, "Reinforced Concrete Design", Tata Mc Graw-Hill Publishing Company Ltd,New Delhi 2016.

REFERENCE BOOKS:

1. Ashok Kumar Jain, "Reinforced Concrete Limit State Design", Nem Chand Brothers, 2015.
2. Gambhir M.L, "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Pvt. Ltd, New Delhi 2012.
3. SinhaS.N, "Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd, New Delhi 2014.
4. Subramanian. N., "Design of Reinforced Concrete Structures", Oxford University, New Delhi, 2013.
5. Varghese P.C,"Limit State Design of Reinforced Concrete", Prentice Hall of India Pvt. Ltd, New Delhi 2010.

U23CET64 CONSTRUCTION PLANNING AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. To make the students to learn about planning of construction projects
2. To understand the concepts of scheduling procedures and techniques.
3. To indentify the cost and monitoring the budgets in construction projects.

4. To indentify quality control problems in construction projects.
5. To create the awareness about decision making tools in organizations

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 durationsCrashing 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 the students would be able to

CO1 : Understand basic concepts of construction planning.

CO2 : Schedule the construction activities.

CO3 : Forecast and control the cost in a construction.

CO4 : Understand the quality control and safety during construction.

CO5 : Organize information in Centralized database Management systems.

CO6 : Making the decisions in different construction related organization.

TEXT BOOKS:

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

REFERENCE BOOKS:

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.
4. Halpin,D.W., “Financial and Cost Concepts for Construction Management”, John Wiley and Sons, New York, 1985

U23CEP61	COMPUTER AIDED ANALYSIS AND DESIGN LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES

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

1. To design and draw RCC cantilever and counter fort type
2. To design and draw RCC Tee beam bridge
3. To Design and Draw RCC Circular and Rectangular water tank
4. To design and draw the Plate Girder bridges and connections
5. To design and draw hemispherical steel tank.

LIST OF EXPERIMENTS

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

TOTAL: 30 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl No	Name of the Equipment	Quantity
1.	Models of Structures	1 each
2.	Computers Pentium IV	30 Nos
3.	Analysis and Design Software - Minimum 5 use License	1 N0

COURSE OUTCOMES:

At the end ofthe course the students would be able to

CO1 : Design and draw RCC cantilever and counterfort type

CO2 : Design and draw RCC Tee beam bridge
CO3: Design and Draw RCC Circular and Rectangular water tank
CO4: Design and draw the Plate Girder bridges and connections
CO5: Design and draw hemispherical steel tank.
CO6: Draw the RCC and Steel Structural elements by using Software tool.

REFERENCES:

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

		L	T	P	C
U23HSP61	**Professional Communication**	**0**	**0**	**3**	**1.5**

COURSE OBJECTIVES

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

1. To Enhance the Employability and Career Skills of students
2. To Orient the students towards grooming as a professional
3. To Make them Employable Graduates
4. To Develop their confidence and help them attend interviews successfully.
5. To Strengthen their prospects of success in competitive examinations

LIST OF EXPERIMENTS

1. Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs
2. Self -Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations
3. Introduction to Group Discussion— Participating in group discussions – understanding group dynamics- brainstorming the topic -– questioning and clarifying –GD strategies-activities to improve GD skills
4. Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews
5. International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Verbal Ability.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end ofthe course the students would be able to

CO1 : Make effective presentations

CO2 : Participate confidently in Group Discussions.

CO3: Attend job interviews and be successful in them.

CO4: Develop adequate Soft Skills required for the workplace

CO5: Learn IELTS and TOEFL

Recommended Software

1. Globearena
2. Win English

REFERENCES:

1. Peter, Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw Hill. 2012. Print.
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Robert M Sherfield and et al. **"Developing Soft Skills"** 4th edition, New Delhi: Pearson Education, 2009..
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. Roberts, Rachael, Joanne Gakonga, and Andrew Preshous (2004) IELTS Foundation: Study Skills. Oxford: Macmillan Education

U23CET71	ESTIMATING AND QUANTITY SURVEYING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To study the importance of preparing the types of estimates
2. To calculate the rate analysis of different work
3. To estimate the buildings and retaining walls
4. To estimate some special structures
5. To calculate the valuation of the buildings and bill preparations

UNIT I PROCEDURE OF ESTIMATING QUANTITIES 9

Introduction – Estimate – Types of Estimates – Units of measurements – Methods of building estimate – calculation of quantities of earth work, stone masonry, brick masonry, plastering, cement concrete, R.C.C, PCC Doors, Windows, Flooring, White Washing, colour washing and painting Nourishing for load bearing structures and framed structures, Case Studies.

UNIT II RATE ANALYSIS 9

Data – Types of Data – Scheduled of rates – lead statement – Theoretical materials – Requirement calculations - Analysis of Rates for cement concrete, R.C.C., brick masonry, Stone masonry, Hollow block masonry, Plastering, Painting, Flooring, Road works, Sanitary Works, Water supply works and Electrical works. Case Studies.

UNIT III COST ESTIMATE OF BUILDINGS 9

Estimation of the cost of residential buildings by load bearing structures and framed structures - Estimation of Roofs – R.C.C. slab roof, GI sheet roof, Tiled Roof, Roof Truss. Estimation of R.C.C. works – Beam, T-beam and Slab, Column, Foundation, Stair case, Retaining wall etc, Case Studies.

UNIT IV ESTIMATE OF OTHER STRUCTURES 9

Estimation Of Roads – Earth Work, Pitching Of Slopes, Hill Roads - Estimation Of R.C.C. Slab Culvert, Pier, Pipe Culvert, R.C.C. T-Beam Bridge - Estimation Of Water Supply And Sanitary Works Like Septic Tank, Soak Pit, Manhole, Sewer line, Case Studies. .

UNIT V SPECIFICATIONS AND VALUATION 9

Specifications – Objectives – Types Of Specifications – Principles Of Specification – Writing – Typical Specifications – Tenders – E-Tendering, Contracts – Types Of Contracts – Arbitration And Legal Requirements - Valuation – Market Value – Book Value – Scrap Value – Salvage Value – Annuity – Capitalized Values – Sinking Fund – Depreciation – Valuation Of A Building – Rent Fixation – Mortgage – Lease – Cash Flow And Cost Control. Case Studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Estimate the quantities required for building works using the drawings.
CO2 : Carry out the analysis of rates
CO3: Prepare the cost estimate for various buildings
CO4: Prepare the estimate of civil engineering structures other than buildings
CO5: Prepare the report on the basis of specifications and valuation of the existing buildings
CO6: Understand the importance of estimating and preparing the reports for structural building.

TEXT BOOKS:

1. Dutta, B.N., Estimating And Costing, S Dutta and Co., Lucknow 2016.
2. Rangawala,S.C., Estimating And Costing, Charotar Anand Publications, 2006.

REFERENCE BOOKS:

1. B.S.Patil, 'Civil Engineering Contracts and Estimates', University Press, 2006
2. D.N. Banerjee, 'Principles and Practices of Valuation', V Edition, Eastern Law House, 1998.
3. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD
4. Kohli, D.D.And Kohli R.C., A Text Book On Estimating, Costing And Accounts, S.Chand And Co, New Delhi, 2004.
5. Tamil Nadu Transparencies in Tenders Act, 1998

U23CET72	PRE-STRESSED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To introduce the need for prestressing in a structure.
2. To understand about the effect of prestressing for flexural elements.
3. To understand about the effect of prestressing for compression members.
4. To design a prestressed concrete structural elements in composite construction.
5. To introduce the students about the effect of shear behaviour of structural elements

UNIT I INTRODUCTION – THEORY AND BEHAVIOUR 9

Basic concepts – Advantages – Materials required – Systems and methods of pre-stressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – losses of prestress.

UNIT II DESIGN FLEXURE 9

Flexural strength – Simplified procedures as per codes – strain compatibility method – Basic concepts in selection of cross section for bending – Effect of tendon profile on deflections –Factors influencing deflections – Calculation of deflections – Short term and long term deflections

UNIT III DESIGN OF COMPRESSION MEMBER AND END BLOCK 9

Design of compression members (Axial and Bending) – Design of tension member - Stress distribution in end block, Design of anchorage zone reinforcement – Limit state design criteria – partial pre-stressing –Applications

UNIT IV COMPOSITE CONSTRUCTION 9

Analysis for stresses – Estimate for deflections – Flexural and shear strength of composite members.

UNIT V DESIGN OF WATER TANKS AND MISCELLANEOUS STRUCTURES 9

Design of pre-stressed concrete tanks – Poles and sleepers –design of pre-stressed concrete pipes and sleepers

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Describe the basic properties of pre-stressed concrete constituents and various losses.

CO2 : Apply the provisions of IS 1343-1984 to determine the flexural strength of concrete members and also evaluate the deflection in beams

CO3: Analyze and design the end blocks of prestress concrete members.

CO4: Interpret the behavior of composite constructions for propped and unpropped conditions

CO5: Analyze and design of pre-stressed concrete water tanks and pipes.

CO6: Explain the methods, types and advantages of pre stressing concrete.

TEXT BOOKS:

1. Krishna Raju N., Pre-stressed concrete, Tata McGraw Hill Company, New Delhi2012.
2. Mallic S.K. and Gupta A.P., Pre-stressed concrete, Oxford and IBH publishing Co. Pvt.Ltd.2007.

REFERENCE BOOKS:

1. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2013
2. IS 3370- Part 4 (2008) Indian standard Code of practice for concrete structures for the storage of liquid- Design tables, code of practice, bureau of Indian standards, new Delhi.
3. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
4. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2002.
5. Ramaswamy G.S., Modern pre-stressed concrete design, Arnold Heinimen, New Delhi,2010

		L	T	P	C
U23CET73	**STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

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

1. Introduce about principles of vibration in structures.
2. Introduce dynamic loading and the dynamic performance of the multi storey structures.
3. Knowing the Elements of seismology.
4. The detailed study on the performance of structures under earthquake loading.
5. Methods of analysing the structures under earthquake loading.

UNIT I THEORY OF VIBRATIONS **9**

Difference between static loading and dynamic loading – Degree of freedom – idealisation of structure as single degree of freedom system – Formulation of Equations of motion of SDOF system - D'Alemberts principles – effect of damping – free and forced vibration of damped and

undamped structures – Response to harmonic and periodic forces.

UNIT II MULTIPLE DEGREE OF FREEDOM SYSTEM 9

Two degree of freedom system – modes of vibrations – formulation of equations of motion of multi degree of freedom (MDOF) system - Eigen values and Eigen vectors – Response to free and forced vibrations - damped and undamped MDOF system – Modal superposition methods.

UNIT III ELEMENTS OF SEISMOLOGY 9

Elements of Engineering Seismology - Causes of Earthquake – Plate Tectonic theory – Elastic rebound Theory – Characteristic of earthquake – Estimation of earthquake parameters Magnitude and intensity of earthquakes – Spectral Acceleration.

UNIT IV RESPONSE OF STRUCTURES TO EARTHQUAKE 9

Effect of earthquake on different type of structures – Behaviour of Reinforced Cement Concrete, Steel and Prestressed Concrete Structure under earthquake loading – Pinching effect – Bouchinger Effects – Evaluation of earthquake forces as per IS:1893 – 2002 - Response Spectra – Lessons learnt from past earthquakes.

UNIT V DESIGN METHODOLOGY 9

Causes of damage – Planning considerations / Architectural concepts as per IS:4326 – 1993 – Guidelines for Earthquake resistant design – Earthquake resistant design for masonry and Reinforced Cement Concrete buildings – Later load analysis – Design and detailing as per IS:13920 – 1993.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Knowledge to the principles of vibration in structures.
CO2 : Analyse structures subjected to dynamic loading in structures.
CO3 : Know about the elements of seismology.
CO4 : Analyze the concepts of Response of Structures to Earthquake
CO5 : Know about the methodology to design a earthquake resistant structures.
CO6 : Design the structures for seismic loading as per code provisions.

TEXT BOOKS:

1. Chopra, A.K., "Dynamics of Structures – Theory and Applications to Earthquake Engineering", 4thEdition, Pearson Education, 2011.
2. Agarwal.P and Shrikhande.M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2011.

REFERENCE BOOKS:

1. Biggs, J.M., "Introduction to Structural Dynamics", McGraw Hill Book Co., New York, 1964
2. Dowrick, D.J., "Earthquake Resistant Design", John Wiley & Sons, London, 2009
3. Paz, M. and Leigh.W. "Structural Dynamics – Theory & Computation", 4 Edition, CBS Publishers & istributors, Shahdara, Delhi, 2006.

U23CEP71	INDUSTRIALTRAINING (4 Weeks During VI Semester – Summer	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

To train 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.

COURSE CONTENT

The students will individually undertake training in reputed civil engineering companies for duration of four weeks during the summer vacation of sixth semester. At the end of the training, a report on the work done and lessons learnt will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff members

COURSE OUTCOMES:

At the end ofthe course the students would be able to

CO The intricacies of implementation text book knowledge into practice the concepts of developments and implementation of new techniques

U23CEP72	DESIGN PROJECT	L	T	P	C
		3	0	0	1

COURSE OBJECTIVES

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

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

EVALUATION PROCEDURE

The method of evaluation will be as follows:

1.	Internal Marks (Decided by conducting 3 reviews by the guide appointed by the Institution)	20marks
2.	Evaluation of Project Report (Evaluated by the external examiner appointed the University). Every student belonging to the same group gets the same mark)	30marks
3.	Viva voce examination (Evaluated by the internal examiner appointed by the HOD with the approval of HOD, external examiner appointed by the University and Guide of the course – with equal Weightage)	50marks
	TOTAL	:100 marks

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

On completion of the design project students will have a better experience in designing various design problems related to Civil Engineering.

U23CEP81	PROJECTWORK II	L	T	P	C
		0	0	4	6

COURSE OBJECTIVES

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

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

STRATEGY:

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

TOTAL 300 PERIODS

COURSE OUTCOMES:

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

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

CO1 : Identify civil engineering problems reviewing available literature.

CO2 : Identify appropriate techniques to analyze complex civil engineering problems.

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

U23CEV11	HYDROLOGY AND WATER RESOURCES ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To introduce the student to the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources.
2. To apply runoff calculation of rain water
3. To calculate flood Drought, Flood Estimation, Frequency analysis nad flood control
4. To apply reservoirs storage, area capacity, storage estimation, sedimentation
5. To gain knowledge about groundwater and management

UNIT I PRECIPITATION AND ABSTRACTIONS 10

Hydrological cycle- Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges-Spatial analysis of rainfall data using Thiessen and Isohyetal methods-Interception - Evaporation. Horton‟s equation, pan evaporation measurements and evaporation suppression - Infiltration-Horton‟s equation - double ring infiltrometer, infiltration indices.

UNIT II RUNOFF 8

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical - Strange‟s table and SCS methods – Stage discharge relationships- flow measurements- Hydrograph – Unit Hydrograph – IUH.

UNIT III FLOOD AND DROUGHT 9

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts- Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP).

UNIT IV RESERVOIRS 8

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve.

UNITV GROUNDWATER AND MANAGEMENT 10

Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1 : Understand of the key drivers on water resources, hydrological processes and their integrated behaviour in catchments.

CO2 : Construct and apply a range of hydrological models to surface water and groundwater problems including Hydrograph, Flood/Drought management, artificial recharge.

CO3: Conduct Spatial analysis of rainfall data

CO4: Understand the concept and methods of ground water management.

CO5: Design water storage reservoirs.

CO6 Analyse Artificial recharge rural and urban areas.

TEXT BOOKS:

1. Sivasubramaniyan, K. Water Management, SIMRES Publication, Chennai, 2011
2. Jayarami Reddy .P. "Hydrology", Tata McGraw Hill, 2008.
3. Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw HilInternational Book Company, 1995.
4. Chambers R., Managing canal irrigation, Oxford IBM publishing Co. Pvt. Ltd., New Delhi,

1998.
5. Uphoff. N., Improving International Irrigation management with Farmer Participation – Getting the process Right – Studies in water Policy and management, New West - View press, Boulder and London, 1986.

REFERENCE BOOKS:

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

U23CEV12	GROUNDWATER ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To understand the principles of Groundwater governing Equations, Characteristics of different aquifers and techniques of groundwater model development and management.
2. To understand well hydraulics and well losses
3. To mathematical model for ground water management
4. To analyse the ground water quality.
5. To Calculate Aquifer Storage and Recovery.

UNIT I HYDROGEOLOGICAL PARAMETERS 9

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

UNIT II WELL HYDRAULICS 9

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

UNIT III GROUNDWATER MANAGEMENT 9

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

UNIT IV GROUNDWATER QUALITY 9

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

UNITV GROUNDWATER CONSERVATION 9

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

and remediation schemes.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1 : Define the groundwater system basic, types of aquifers, aquifer parameters, movement and its potential for confined and unconfined aquifers.

CO2 : Apply the knowledge of groundwater flow in steady and unsteady flow characteristics of well hydraulics.

CO3: Explain the concept of groundwater model development and data base management for groundwater management.

CO4: Describe the importance of artificial recharge and groundwater quality concepts.

CO5: Apply the creative and innovative technique on conservation of groundwater.

CO6: Understand Contamination source inventory and remediation schemes.

TEXT BOOKS:

1. 1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi,2010.
2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York,2000.

REFERENCE BOOKS:

1. Fitts R Charles, "Groundwater Science". Elsevier, Academic Press,2002.
2. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998
3. Chahar BR, Groundwater hydrology, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2015.
4. RastogiA.K. , Numerical Groundwater Hydrology,2011

U23CEV13	WATER RESOURCES SYSTEMS ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To introduce the concept of Mathematical approaches for managing the water resources system and apply to operate a water resource system optimally.
2. Gain about the knowledge of hydrology is prerequisite for the irrigation engineering and also for design of hydraulic structure.
3. To impart the knowledge of various irrigation techniques, requirements of the crops.
4. To learn about distribution systems for canal irrigation, design of unlined and lined irrigation canals design sediment problems associated with canal.
5. To impart the knowledge of hydrology that deals with the occurrence, distribution, movement and properties of water on the earth.

UNIT I SYSTEM APPROACH 9

Definition, classification, and characteristics of systems - Philosophy of modelling – Goals and Objectives – Basics of system analysis concept – steps in systems engineering

UNIT II LINEAR PROGRAMMING 9

Introduction to Operation research - Linear programming Problem Formulation-graphical solution Simplex method –Sensitivity analysis - application to operation of single purpose reservoir

UNIT III DYNAMIC PROGRAMMING 9

ellman's optimality criteria, problem formulation and solutions – Water Allocation for three state (user), Forward and Backward Recursion techniques in Dynamic Programming - Shortest pipe line route problem - Application to reservoirs capacity expansion

UNIT IV SIMULATION 9

Basic principles and concepts – Monte Carlo techniques – Model development – Inputs and outputs – Single and multipurpose reservoir simulation models – Deterministic simulation – Rule Curve development for reservoir

UNITV ADVANCED OPTIMIZATION TECHNIQUES 9

Integer and parametric linear programming – Goal programming types – Applications to reservoir release optimization – application of evolutionary algorithms like Genetic algorithm, Particle swarm, Simulated Annealing to reservoir release optimization

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Define the economic aspects and analysis of water resources systems for comprehensive and integrated planning of a water resources project.

CO2 : Apply the concept of linear programming for optimisation of water resources problems.

CO3: Explain the concept of dynamic programming and apply in water resource system.

CO4: Develop the simulation model based on deterministic and stochastic simulation for reservoir operating policy.

CO5: Apply advance optimisation techniques like goal programming, heuristic algorithm in the field of water resources planning and management.

CO6: Analyse Integer and parametric linear programming.

TEXT BOOKS:

1. Vedula, S., and Majumdar, P.P. Water Resources Systems – Modeling Techniques and Analysis Tata McGraw Hill, New Delhi, Fifth reprint,2010.
2. Bhave PR, Water Resources Systems, Narosa Publishers,2011

REFERENCE BOOKS:

1. Gupta, P.K., and Man Mohan, "Problems in Operations Research", (Methods and Solutions), Sultan Chand and Sons, New Delhi,1995.
2. Chaturvedi, M.C., "Water Resources Systems Planning and Management", Tata McGraw Hill, New Delhi,1997.
3. Taha, H.A., "Operations Research", McMillan Publication Co., New York,1995
4. Hiller, F.S., and Liebermann, G.J., "Operations Research", CBS Publications and Distributions, New Delhi,1992

U23CEV14	**WATERSHED CONSERVATION AND MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

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

1. To provide the technical and sociological understanding of a watershed.

2. To provide a comprehensive discourse on the engineering practices of watershed management for realizing the higher benefits.
3 To Preserve water harvesting and conservation
4 To calculate the applications of Remote Sensing and Geographical Information System.
5 To analyse watershed Management.

UNIT I WATERSHED CONCEPTS 9

Watershed – Definition, Need and Elements – Principles - Influencing Factors: Geology – Soil – Morphological Characteristics – Topo sheet - Delineation – Codification – Prioritization Watershed Atlas.

UNIT II SOIL CONSERVATION MEASURES 9

Types of Erosion – Water and Wind Erosion: Causes, Factors, Effects and Management – Soil Conservation Measures: Agronomical and Mechanical – Design of Terraces and Bunds - Estimation of Soil Loss – USLE Equation - Sedimentation.

UNIT III WATER HARVESTING AND CONSERVATION 9

Yield from a Catchment - Traditional Water Harvesting Techniques – Micro-Catchments - Design of Small Water Harvesting Structures: Farm Ponds, Percolation Tanks, Check dams, Grassed Waterways

UNIT IV GIS FOR WATERSHED MANAGEMENT 9

Applications of Remote Sensing and Geographical Information System - Role of Decision Support System – Conceptual Models and Case Studies.

UNITV WATERSHED MANAGEMENT 9

Project Proposal Formulation - Watershed Development Plan – Entry Point Activities – Watershed Economics - Agroforestry – Grassland Management – Wasteland Management – Watershed Approach in Government Programmes – People's Participation – Evaluation of Watershed Management Programmes – Integrated Watershed Management – Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1 : Recognize and Interpret the morphological features of a watershed.
CO2 : State, design and sketch the soil conservation structures.
CO3: Describe the micro catchment and apply the concepts to design the small water harvesting structures.
CO4: Illustrate the application of modern tools and technology in the management of watershed.
CO5: Classify the management activities and to develop an integrated watershed development.
CO6: Understand GIS For Watershed Management.

TEXT BOOKS:

1. Ghanashyam Das, Hydrology and Soil Conservation Engineering, Prentice Hall of India Private Limited, New Delhi, Second Edition, 2009.
2. Suresh, R. Soil and Water Conservation Engineering, Standard Publishers and Distributors

Private Limited, New Delhi, 2020.

REFERENCES:

1. Glenn O Schwab. etal, Soil and Water Conservation engineering, Wiley India Private Limited,2009.
2. Heathcote, I. W. Integrated Watershed Management: Principles and Practice. John Wiley and Sons, Inc., New York, Second Edition 2009.
3. John G. Lyon, GIS for Water Resources and Watershed Management, CRC Press, 2002
4. Vijay P. Singh, Donald K. Frevert, Watershed Models, CRC Press, 2005.
5. Vir Singh, Raj, Watershed Planning and Management, Bio- Green Publisher, 2016.

U23CEV15	INTEGRATED WATER RESOURCES MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To understand the concepts and principles of IWRM, which is inclusive of the economics, public-private partnership, water & health, water & food security and legal & regulatory settings.
2. To analyse Economic view of water issues and Economic characteristics of water good and services
3. To learn coordinated development and management of water, land and related resources
4. To maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.
5. To learn how the potential for extreme hydrologic events

UNIT I CONTEXT FOR IWRM 9

Water as a global issue: Key challenges – Definition of IWRM within the broader context of development – Key elements of IWRM - Principles – Paradigm shift in water management - Complexity of the IWRM process – UN World Water Assessment - SDGs

UNIT II WATER ECONOMICS 9

Economic view of water issues: Economic characteristics of water good and services – Non-market monetary valuation – Water economic instruments – Private sector involvement in water resources management: PPP objectives, PPP models, PPP processes, PPP experiences through case studies.

UNIT III LEGAL AND REGULATORYSETTINGS 9

Basic notion of law and governance: Principles of International and National law in the area of water management - Understanding UN law on non-navigable uses of International water courses - International law for groundwater management – World Water Forums – Global Water Partnerships - Development of IWRM in line with legal and regulatory framework: Case Studies

UNIT IV WATER AND HEALTH WITHIN THE IWRM CONTEXT 9

Links between water and health: Options to include water management interventions for health – Health protection and promotion in the context of IWRM – Global burden of Diseases - Health impact assessment of water resources development projects – Case studies.

UNITV AGRICULTURE IN THE CONCEPT OF IWRM 9

Water for food production: ‘blue’ versus ‘green’ water debate – Water foot print - Virtual water

trade for achieving global water and food security - Climate Smart Agriculture - Current water pricing policy– Scope to relook pricing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.

CO2 : Select the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.

CO3: Apply law and governance in the context of IWRM.

CO4: Discuss the linkages between water-health; develop a HIA framework.

CO5: Analyse how the virtual water concept pave way to alternate policy options.

CO6: Understand the water resources development in India and wastewater reuse.

TEXT BOOKS:

1. Cech Thomas V., Principles of water resources: history, development, management and policy. John Wiley and Sons Inc., New York. Fourth Edition 2018.
2. Mollinga.P. etal "Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006.

REFERENCE BOOKS:

1. Technical Advisory Committee, Dublin principles for water as reflected in comparative assessment of institutional and legal arrangements for Integrated Water Resources Management, Technical Advisory Committee Background Paper No: 3. Global water partnership, Stockholm, Sweden. 1999.
2. Technical Advisory Committee, Integrated Water Resources management, Technical Advisory Committee Background Paper No: 4. Global water partnership, Stockholm, Sweden. 2002
3. Technical Advisory Committee, Effective Water Governance". Technical Advisory Committee Background Paper No: 7. Global water partnership, Stockholm, Sweden, 2003.
4. Tony Allan, Virtual Water: Tackling the Threat to Our Planet's Most Precious Resource, I. B.Taurus, 2011.
5. Convention on the Law of the Non-navigational Uses of International Watercourses. https://legal.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf.

		L	T	P	C
U23CEV16	**URBAN WATER INFRASTRUCTURE**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

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

1. To impart knowledge and skills relevant to water management in the context of urbanization and relate engineering principles to water supply.
2. To calculate storm water and wastewater management, along with related regulations and best management practices from around the world.

3 To calculate urban hydrological cycle.
4 To Design stromwater drainage system
5 To analyses private sector participation, urban service delivery, customer satisfaction, financial resource management.

UNIT I URBAN ECOSYSTEM 9

Cities as Ecological system – hybrid ecosystem – Resilience in urban ecosystem. Human components of Ecosystem – Urban pattern and Ecosystem function. Population and Community dynamics, functions of Urban Ecosystem.

UNIT II URBAN HYDROLOGY 9

The urban hydrological cycle – Function – Human induced changes in urban watershed – Hydrological calculation – Runoff – Infiltration – hydrograph

UNIT III URBAN STORM WATERMANAGEMENT 9

Design of Drainage System – Roadway Drainage Analysis – Types of inlet – inlet design – Design of storm drain - Storm water management regulations - structural storm management systems – Newer trends in storm water management (Green infrastructure) – installation – operation and maintenance.

UNIT IV WATER CONSERVATION AND REUSE 9

Trends in supply and demand – indoor conservation – outdoor conservation – water reuse – Rainwater harvesting – public education.

UNIT V WATER GOVERNANCE 9

Challenges in water sector - Institutional setting, Supply Management, Demand Management, Waste water management – Private sector participation, urban service delivery, customer satisfaction, financial resource management – case studies of best practices in cities across the world

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Explain various functional elements of urban ecosystem.
CO2 : Calculate urban runoff, compute supply and demand of water, draw hydrograph.
CO3: Compare advantages of Newer techniques of green infrastructure and illustrate benefits.
CO4: Assess the Operation and Maintenance needs of urban water systems.
CO5: Propose best management practices for Indian context.
CO6: To regulate water conveyance through private sector

TEXT BOOKS:

1. Anand Chiplunkar, K Seetharam and CheonKheong (ed) (2012), "Good Practices in urban water management" ADB, National University Singapore.
2. Marina Alberti (2008), "Advances in Urban Ecology", SpringeR
3. Mohammad Karamouz, Ali Moridi, Sara Nazif (2010), Urban Water Engineering and Management, 1st Edition, CRC Press
4. Monzur A. Imteaz , (2019), Urban Water Resources, CRC Press

REFERENCES:

1. HormozPazwash (2016), "Urban storm water management", CRC Press
2. Larry W. Mays, (2004), Urban Stormwater Management Tools, McGraw-Hill Companies
3. J Parkinson, O Mark (2005) Urban Stormwater Management in Developing Countries, IWA Publishing

U23CEV17	WATER QUALITY AND MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To understand the fundamentals of mathematical models and their importance in water quality modelling.
2. To impart the skills to use water quality modelling software for surface and groundwater quality modelling.
3. To conservation of mass, momentum and energy balance, governing equation.
4. To analysis water quality modelling of streams, lakes and estuaries.
5. To calculate Groundwater contamination, restoration and management.

UNIT I MODELLING INSIGHTS 9

Engineers and Mathematical models-Water quality models – historical development - different types of models-- steps in model development - importance of model building.- calibration and verification of models- finite element, finite difference and finite volume methods

UNIT II POLLUTION TRANSPORT 9

Transport phenomena – advection, diffusion, dispersion- contamination transport in surface and subsurface water - Simple transport models –steady state and time variable solutions- conservation of mass, momentum and energy balance, governing equation for contaminant fate and transport

UNIT III SURFACE WATER QUALITY MODELLING 9

Water quality modeling of streams, lakes and estuaries – water quality– model sensitivity – assessing model performance; Models for dissolved oxygen, pathogens and COD, BOD-Streeter Phelp's model for point and distributed sources – modified streeter Phelp's equations.

UNIT IV GROUNDWATER QUALITY MODELLING 9

Groundwater flow and mass transport of solutes – groundwater quality modelling using numerical methods – Parameters, Input-output stresses, Initial and Boundary conditions- degradation of organic compounds in subsurface – Model calibration : steady state and unsteady state – sensitivity analysis – Model validation –seawater intrusion – basic concepts and modelling.

UNITV WATER QUALITY MANAGEMENT MODELS 9

Exposure to surface water and groundwater quality modelling software's – MIKE 21, WASP, QUAL2E and MODFLOW – demonstration – case studies – Modeling multilayer groundwater flow system – Artificial recharge feasibility through modeling – Groundwater contamination, restoration and management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Know about the principles of water quality modelling.

CO2 : Understand the pollutant transport phenomena in surface and groundwater.

CO3: Apply the knowledge of surface water quality modelling to predict the water quality of rivers, lakes and estuary.

CO4: Predict the groundwater contamination transport.

CO5: Predict water quality of surface and sub surface water using numerical solution.

CO6: Calculate Artificial recharge feasibility through modelling.

REFERENCE BOOKS:

1. Steven C. Chapra, "Surface Water Quality Modelling", Tata McGraw-Hill Companies, Inc., New Delhi2018.
2. Water Quality Modelling for Rivers and Streams" Authors: Benedini, Marcello, Tsakiris, George, Springer Netherlands2017.
3. Hydrodynamics and Water Quality**:** Modelling Rivers, Lakes, and Estuaries", Zhen-Gang Ji, John Wiley & Sons,2018
4. Modelling Groundwater Flow and Contaminant Transport By Jacob Bear, A. H.-D. Cheng, Springer Science & Business Media,2010.
5. Mathematical Modelling of Groundwater Pollution" Ne-Zheng Sun, Alexander Sun, Springer New York, 2012

U23CEV21	ROAD SAFETY SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. Helps in identifying the reasons for road accidents and scientific Investigation. Provides knowledge on safety audit and its methodology
2. To acquire knowledge and understanding of the road environment.
3. To inculcate decision making and behavioral skills necessary to survive in the road environment.
4. To impart knowledge and understanding of the causes and consequences of accidents.
5. To understand roles and responsibilities in ensuring road safety.

UNIT I DESCRIPTION OF PROBLEMS 9

Causes of accidents – Human factors – Vehicles – Road and its condition – Environmental Studies

UNIT II ACCIDENT ANALYSIS TECHNIQUES 9

Collision Diagram – Preparation, Spatial Analysis of Accidents – Methods and GIS in Accident Analysis -Black Spot, Black Route and Area Identification

UNIT III BEFORE AND AFTER STUDIES 9

Accident Prediction Models – Development – Empirical Bayees Approach – Before and After Evaluation – Case Studies

UNIT IV SAFETY AUDIT 9

Need for Safety Audit – Concept and Elements of Safety Audit – Safety Audit for existing roads – Legal requirements – Provisions of Motor Vehicle Act and role of NGO‟s in prevention of accidents.

UNITV ACCIDENT STUDIES AND INVESTIGATION 9

Accident data – Identification of Accident Prone Location – Prioritisation – Investigation – Problems and Remedies

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : The students would have gained knowledge on different aspects of road safety audit and its methodology

CO2 : Generate awareness about number of people dying every year in road accidents, traffic rules and characteristics of accident

CO3: Gain information and knowledge about people responsible for accidents and their duties

CO4: Understand the importance of multidisciplinary approach to planning for traffic safety and rehabilitation

CO5: Acquire a certificate of coordination/ participation in compulsory events based on the topic under study

CO6: Knowledge and understanding of the causes and consequences of accidents.

TEXT BOOKS:

1. Khanna.S.K. Arora.M.G and Jain.S.S, Airport Planning and Design, Nemachand and Bros, Roorkee,1994
2. Robert Honjeff and Francis X.Mckelvey, "Planning and Design of Airports", McGraw Hill,

New York,1996
3. Robert F. Baker, "Hand Book of Highway Engineering", Van Nonstrant Keinhold Company, New York, 1975

REFERENCE BOOKS:

1. Ministry of Surface Transport, "Accident Investigation and Prevention Manual for Highway Engineers in India, Government of India, 2001

2. Robert F.Baker, "The Highway Risk Problem – Policy Issues in Highway Safety", John Wiley and Sons.

U23CEV22	TRAFFIC ENGINEERING AND MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To give an overview of Traffic engineering, various surveys to be conducted, traffic Regulation, management and traffic safety
2. To have an overall knowledge of the traffic components and assess the traffic characteristics and related problems
3. To develop a strong knowledge base of traffic planning and its management in any transportation area.
4. To provide knowledge of traffic control devices and its techniques in transportation
5. To provide knowledge of cost – effective traffic management techniques

UNIT I TRAFFIC SURVEYS AND ANALYSES 9

Traffic characteristics: Human, vehicular, and Pavement Characteristics, Problems- presentation of traffic volume data, Annual Average Daily Traffic, Average Daily Traffic, Design hourly traffic volume; Speed- spot speed, presentation of spot speed data, speed and delay studies, methods of conducting spot-speed studies and Speed and Delay studies; Problems Origin and Destination – methods of conducting the survey and presentation of data; parking surveys, presentation of data and analyses, determination of parking demand; Accident studies and analyses; Different problems

UNIT II TRAFFIC FLOW AND ROADWAY CAPACITY 9

Traffic Flow Characteristics – Basic traffic manoeuvres, Traffic stream flow characteristics, SpeedFlow-Density Relations; Passenger Car Units – Mixed traffic flow and related issues – Concept of PCU value- Factors affecting PCU values- Recommended PCU values for different conditions;Capacity and Level of Service – Factors affecting practical capacity – Design Service Volumes

UNIT III COST – EFFECTIVE TRAFFIC MANAGEMENT TECHNIQUES 9

Traffic System Management: Regulatory Techniques- one way street, Reversible Street, Reversible lane, Turning moment restrictions, closing streets; Traffic Control Devices – Traffic Signs – Road Markings, Traffic Signals, Miscellaneous traffic control devices; Traffic Segregation – Vehicle segregation, Pedestrian segregation, Traffic signals design; Bus Priority Techniques – Priority manoeuvres – With-flow bus lane and contra-flow bus lane; Self- Enforcing Techniques- Demand

Management Techniques (TDM) Road pricing, parking control, Tolls, Staggering of office/educational institution hours.

UNIT IV DESIGN OF ROAD INTERSECTIONS 9

Importance and Classification; Intersections at-grade – uncontrolled, channelised; Rotary intersections (problems)- Signalised intersections (problems)- Grade Separated Intersections – merits and demerits, types, pattern of intersections with different types of interchanges- Capacity, Concept diagrams.

UNITV DESIGN OF PARKING AND PEDESTRIAN FACILITIES AND CYCLE TRACKS 9

Parking: Need for parking studies and its ill effects- Parking Standards for different land uses, different types of parking - Conceptual plans for different types of parking; **Pedestrians:** Importance,
Barriers, Behaviour, Pedestrian facilities – Principles of planning, Level of Service (LoS), Design standards.; **Cycle Tracks:** Principles of design, Design criteria, Design standards for Rural Expressways.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Apply the knowledge of science and engineering fundamentals in conducting traffic surveys, analyze the problems and relating it with standards.

CO2 : Understand the principles of traffic flow characteristics and their relationships.

CO3: Understand various traffic management measures in addressing the demand Pricing and ITS applications.

CO4: Designing various types of control and regulatory measures to meet an efficient traffic network.

CO5: Understand various type of facilities and plan for Non Motorised Transport.

CO6: Analyse various traffic control measures and design traffic engineering facilities.

TEXT BOOKS:

1. Kadiyali. L.R. Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2019.
2. Khanna .K and Justo C.E.G. and Veeraragavan, A Highway Engineering, Nem Chand Bros., Roorkee, Revised 10th Edition, 2014.
3. Srinivasa Kumar, "Introduction to Traffic Engineering", Universities Press, 2018
4. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHI Learning Pvt. Ltd., 2011.
5. Papacosta.P.S and Prevedouros.P.D, " Transportation Engineering and Planning, third edition, 2015

REFERENCE BOOKS:

1. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
2. Khanna S. K, and others, Highway Engineering, Nam Chand & Bros, Roorkee, 2014, Pages 177 – 308.
3. C. JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
4. Taylor MAP and Young W, Traffic Analysis – New Technology and New Solutions, Hargreen

Publishing Company , 1998.
5. Salter. R.I and Hounsell N.B, Highway Traffic Analysis and design, Macmillan Press Ltd.1996.
6. Roger P.Roess, William R.Mcshane and Elena S.Prassas, Traffic Engineering-Second Edition, Prentice Hall Publishers,, Upper Saddle River, New Jersey 1998

U23CEV23	URBAN PLANNING AND DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To enable students to have the knowledge on planning process and to introduce to the students about the regulations and laws related to Urban Planning.
2. To relate knowledge and action through critical study of urban and regional planning theories
3. To teach urban and regional planning as a unique body of knowledge and experience
4. To impart knowledge on three areas land Use & Real Estate Development, Health & Social Planning, and Environmental Services
5. To teach Problems due to multiple laws, rules and institutions

UNIT I INTRODUCTION 9

Definition of Human settlement, Urban area, Town, City, Metropolitan City, Megalopolis, Urbanisation, Urbanism, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Urban Agglomeration, Census definition of urban settlements, Classification of urban areas –Positive and negative impacts of urbanisation, - Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

UNIT II PLANNING PROCESS AND THEORIES 9

Principles of Planning –Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Draft Plans, Evaluation, Final Plan. Planning Theories - Garden City Concept, Geddesian Triad by Patrick Geddes, Modernism Concept by Le-Corbusier, Radbun Concept, Neighbourhoods, Theories of Ekistics, Bid-rent Theory by William Alonso, Green Belt Concept

UNIT III DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION 9

Types of plans – Regional Plan, Master Plan, Structure Plan, Detailed Development Plan, New Town/ Satellite town- Development Plan, urban nodes, Smart City Plan -Scope and Content of Regional Plan (RP), Master Plan (MP), and the Detailed Development Plan (DDP), Methodologies for the preparation of the RP, MP, and the DDP – Case Studies.

UNIT IV PLAN IMPLEMENTATION 9

Planning Standards, Project Formulation and evaluation; Project Report preparation and presentation; Legal, Financial and Institutional constraints – Problems due to multiple laws, rules and institutions; Financing of Urban Development Projects; Urban planning agencies and their functions in the plan formulation and implementation.

UNITV URBAN AND REGIONAL PLANNING LEGISLATIONS, 9

REGULATIONS AND DESIGNS

Town and Country Planning, Local Bodies and Land Acquisition Acts, Development and Building Rules, Site analyses, Layouts and Buildings Design.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Understand the basic issues and meaning of terminologies in urban planning

CO2 : Understand the different types of theories of urban planning and city development.

CO3: Understand the different types of plan, their strategies and their preparation process.

CO4: Comprehend the planning standards, evaluate the constraints and the financial mechanism

CO5: Knowledge on various town and country planning acts and their functions.

CO6: Overview and understanding of the History of Town Planning Politics and policy making in modern cities and to assess modern and contemporary theories of Town and Country Planning.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Tamil Nadu Town and Country Planning Act 1971, and Rules made thereunder, Government of Tamil Nadu, Chennai
2. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005
3. Chennai City Municipal Corporation Act, 1919 and Tamil Nadu District Municipalities Act, 1920
4. The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013
5. The Tamil Nadu Combined Development and Building Rules, 2019
6. Urban & Regional Development Plans Formulation & Implementation (URDPFI) Guidelines, Vol
   I & II, Jan 2015, Govt of India, Ministry of Urban Development
7. http:/.moud.gov.in

U23CEV24 **SMART CITIES** **L T P C**

3 0 0 3

COURSE OBJECTIVES

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

1. To help the leaners to understand the concepts of smart city and to introduce the students

about application of technologies in smart cities

2. To understand management of city loaning and traffic and traffic related problems
3. To teach about intelligent Emergency Services and intelligent Disaster Forecasting and Management,
4. To impart knowledge of various technologies in smart cities
5. To help them to understand the project management and cost forcasting and risk managment

UNIT I INTRODUCTION 9

Urbanisation, need of focused development, role of Authorities, Smart city, Opportunity and Challenges- Smart infrastructures for city- Smart Cities Mission

UNIT II SMART PHYSICAL INFRASTRUCTURE 9

Infrastructure development in Smart Cities - Physical Infrastructure, Land Use - Compact/mixed-usedevelopment, Transit oriented development (TOD); Smart City Management-Transportation Unifiedgovernance structure (UMTA). Smart public transportation, Smart parking, Intelligent traffic management, Detour management; Low emission vehicles, Electric Mobility -Environmental projects etc

UNIT III SUSTAINABILITY AND SMART PLANNING 9

Relationship Between Sustainability and Smart planning - Place making project guidelines Surveillance, Smart Street Lighting, Intelligent Emergency Services, Intelligent Disaster Forecasting and Management, GIS-based Spatial Decision Support Systems, Smart Communication Services;

UNIT IV APPLICATION OF TECHNOLOGIES IN SMART CITIES 9

Role of Technologies in Smart Cities - Integrated Command and Control Center (ICCC), Data Analytics, Data driven strategies implementation in smart cities

UNITV SMART CITIES PROJECT MANAGEMENT 9

Need for project management, Philosophy and concepts; Project phasing and stages; Project organizational structuring: Planning and Scheduling: Project cost analysis; Procurement and Contracting: PPP: Project Monitoring and Evaluation: Risk Management; Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Understand the basics of Urbanisation and the role of smart cities.
CO2 : Gain knowledge on implementation of smart physical infrastructure.
CO3: Understand the role of smart planning for sustainable development.
CO4: Comprehend the knowledge of Technologies in Smart City planning
CO5: Reviewing the case studies of smart city projects
CO6: Ability of project cost analysis

REFERENCESBOOKS:

1. 1.P Sharma , “Sustainable Smart cities in India, Challenges and Future Perspectives”, Springer
Link, 2017

2. Sameer Sharma,"Smart Cities Unbounded- Ideas and Practice of Smart Cities in India", Bloomsbury India, 2018.
3. Binti Singh, ManojParmar, "Smart City in India Urban Laboratory, Paradigm or Trajectory? Routledge India,2019
4. https://smartcities.gov.in/guidelines#block-habikon-content
5. https://smartnet.niua.org/learn/library

U23CEV25	INTELLIGENT TRANSPORTATION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To learn the fundamentals of ITS.
2. To study the data collection in ITS functional areas
3. To have knowledge of traffic management
4. To impart about transportation planning
5. To teach about application of ITS in various fields of logistics

UNIT I INTRODUCTION TO ITS 9

Fundamentals of ITS: Definition of ITS, Challenges in ITS Development-Purpose of ITS Deployment-Benefits of ITS- Overview of application of ITS in Transportation Planning

UNIT II DATA COLLECTION THROUGH ITS 9

Sensors & its application in traffic data collection - Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques – vehicle Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, RFID, video data collection,Internet of Things (IOT)

UNIT III ITS IN TRAFFIC MANAGEMENT 9

ITS User Needs and Services and Functional areas –Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveller Information systems (ATIS), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS)- Autonomous Vehicles- Autonomous Intersections

UNIT IV ITS IN TRANSPORTATION PLANNING 9

ITS and safety, ITS and security- Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportationnetwork operations – public transportation applications- Weight –in Motion

UNITV ITS APPLICATION IN LOGISTICS 9

Commercial vehicle operations and intermodal freight-Fleet Management- IT application in freight logistics-E commerce

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Understand the fundamentals of ITS and its benefits.

CO2 : Gain knowledge on data collection using sensors and its applications.
CO3: Acquainted with the knowledge of ITS in Traffic Management
CO4: Application of ITS in Transportation Planning
CO5: Able to gain knowledge on application of ITS in Logistics
CO6: Have capabilities to identify and solve transportation problems within the context of ITS applications

TEXT BOOKS:

1. R. Srinivasa Kumar,"Intelligent Transportation Systems", Universities Press P Ltd, Telangana, 2022.
2. Mollinga.P. etal "Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006.

REFERENCE BOOKS:

1. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US,2001.
2. Henry F.Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill,1992.
3. TurbanE.,"Decision Support and Export Systems Management Support Systems", Maxwell Macmillan,1998.
4. Sitausu S. Mittra, "Decision Support Systems–Tools and Techniques", John Wiley, New York,1986.
5. Cycle W.Halsapple and Andrew B.Winston, "Decision Support Systems–Theory and Application", Springer Verlog, New York, 1987
6. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

U23CEV26 PAVEMENT ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. Student gains knowledge on various IRC guidelines for designing rigid and flexible pavements.
2. Further, the student will be in a position to assess quality and serviceability conditions of roads
3. To be able to learn about characterization of material and design factors of pavement.
4. To able to analyze the stresses and design the flexible and rigid pavement
5. To be able to study different types of pavement construction procedures

UNIT I PAVEMENT MATERIALS AND SUBGRADE ANALYSIS 9

Introduction – Pavement as layered structure – Pavement types -rigid and flexible-Subgrade analysis- Stress and deflections in pavements- Pavement Materials and Testing- Modified Binders.

UNIT II DESIGN OF FLEXIBLE PAVEMENTS 9

Flexible pavement design – Advantages and disadvantages -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 PAVEMENT CONSTRUCTION, EVALUATION AND MAINTENANCE **9**

Construction Techniques practice of flexible and concrete pavement 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).

UNITV STABILIZATION OF PAVEMENTS **9**

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Get knowledge about types of rigid and flexible pavements.
CO2 : Able to design of rigid pavements
CO3: Able to design of flexible pavements.
CO4: Determine the causes of distress in rigid and flexible pavements.
CO5: Understand stabilization of pavements, testing and field control.
CO6: Comprehend the concept of strengthening of existing pavements and pavement management system

TEXT BOOKS:

1. Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, "Highway Engineering", New Chand andBrothers, Revised 10th Edition,2014.
2. Kadiyali, L.R., "Principles and Practice of Highway Engineering", Khannatech. Publications,New Delhi,2015.

REFERENCE BOOKS:

1. Yoder, R.J. and Witchak M.W. "Principles of Pavement Design", John Wiley2000.
2. Guidelines for the Design of Flexible Pavements, IRC-37–2012, The Indian roads Congress, NewDelhi.
3. Guideline for the Design of Rigid Pavements for Highways, IRC 58-2018, The Indian Road Congress, NewDelhi

U23CEV27 TRANSPORTATION PLANNING PROCESS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. To impart knowledge in the rudiments and stages in Transportation Planning Process
2. Student will understand and apply basic concepts and methods of urban transportation planning in the
3. Student will learn methods of designing, conducting and administering surveys to provide the data required for transportation planning
4. In addition students will understand and be able to apply travel demand molding, project

development and financing, regulations and policies, environmental related issues

5. Land use and contemporary issues in transportation planning

UNIT I TRANSPORTATION PLANNING PROCESS 9

Importance of transportation planning, Integration of Land Use and Transport; Systems Approach to Transport Planning; Four Steps in the Transport Planning Process; Travel Demand Modelling Approach; Traffic Analyses Zones – internal and external; Various Transportation Surveys for the collection of data – methodology, analyses of data and presentation of results.

UNIT II TRIP GENERATION STAGE 9

Definition and importance; Trip Production and Attraction, Types of trips; Factors governing trip generation: population related data, land and building use, socio-economic, Trip generation models: Types, Assumptions made, Multiple Linear Regression, category analysis- merits and de-merits of the model, verification, calibration and validation of the model.

UNIT III TRIP DISTRIBUTION STAGE 9

Definition and objective; Data collection, analyses and presentation of trip matrix table, Desire Line Diagram, Development of Gravity, growth factor methods for Trip Distribution, Calibration of gravity model and its validation.

UNIT IV MODAL SPLIT STAGE 9

Factors influencing mode choice - Household characteristics; Zonal Characteristics; Network characteristics - Modal split: pre distribution or post distribution - Mode wise trip matrix and modal split analyses- Overview of Probit and Logit model

UNITV TRAFFIC ASSIGNMENT STAGE 9

Meaning and objective; General principles; Assignment Techniques- all-or-nothing assignments, multiple route assignment, capacity restraint, diversion curves, Trip assignment route selection; Mode-wise trip matrices; element of transportation network, nodes and links, speed flow curves, minimum path trees

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Understand the principles of the transportation planning process and methods of data collection.

CO2 : Acquainted with the trip production, trip attraction models and calibration.

CO3: Able to understand trip distribution models and its application.

CO4: Gain knowledge on the mode choice behaviour and mode split models.

CO5: Understated selected emerging contemporary transportation issues and their impact on the society.

CO6: Impact of the transportation project on the land use

TEXT BOOKS:

1. Kadiyali. L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2019.
2. C.S. Papacostas and P.D. Prevedouros, Transportation Engineering and Planning, Prentice
3. Michael J.Bruton, Introduction to Transportation Planning, Hutchinson, London, 1995.

REFERENCE BOOKS:

1. J D Ortuzar and L G Willumnsen. Modeling Transport. John Wiley and Sons, New York,

2011.
2. John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1990.
3. C. JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
4. Juan de Dios Ort zar and Luis G. Willumsen, Modelling Transport, John Wiley & Sons 2001
5. Chennai Comprehensive Traffic Study, Chennai Metropolitan Development Authority, 2007.
6. James H.Banks, Introduction to Transportation Engineering, Tata McGraw Hill Education Pvt Ltd, 2010

U23CEV31	CLIMATE CHANGE ADAPTATION AND MITIGATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To impart knowledge on the global warming, the impact of climate change on society and the adaptation and mitigation measures to the students
2. Provide a rationale for climate change mitigation and propose actions in key sectors.
3. Identify the main streams of climate change
4. Outline basic elements of planning processes to deliver climate change action
5. Comprehensive analysis of all the components of the climate system - atmosphere, ocean, ice sheets, geosphere and of all the interactions between them will be dealt with in detail.

UNIT I INTRODUCTION 09

Atmosphere – weather and Climate - climate parameters – Temperature, Rainfall, Humidity, Wind – Global ocean circulation – El Nino and its effect - Carbon cycle

UNIT II ELEMENTS RELATED TO CLIMATE CHANGE 07

Greenhouse gases - Total carbon dioxide emissions by energy sector – industrial, commercial, transportation, residential – Impacts – air quality, hydrology, green space - Causes of global and regional climate change – Changes in patterns of temperature, precipitation and sea level rise – Greenhouse effect

UNIT III IMPACTS OF CLIMATE CHANGE 10

Effects of Climate Changes on living things – health effects, malnutrition, human migration, socioeconomic impacts- tourism, industry and business, vulnerability assessment- infrastructure, population and sector – Agriculture, forestry, human health, coastal areas

UNIT IV MITIGATING CLIMATE CHANGE 09

IPCC Technical Guidelines for Assessing Climate Change Impact and Adaptation -Identifying adaption options – designing and implementing adaption measures – surface albedo environment-reflective roofing and reflective paving – enhancement of evapotranspiration - tree planting programme – green roofing strategies – energy conservation in buildings – energy efficiencies – carbon sequestration.

UNITV ALTERNATE FUELS AND RENEWABLE ENERGY 10

Energy source – coal, natural gas – wind energy, hydropower, solar energy, nuclear energy, geothermal energy – biofuels – Energy policies for a cool future - Energy Audit.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : an insight into carbon cycle, physical basis of the natural greenhouse effect, including the meaning of the term radiative forcing, climate change, global

warming and measures to adapt and to mitigate the impacts of climate change

CO2 : understanding on the growing scientific consensus established through the IPCC as well as the complexities and uncertainties

CO3: ability to plan climate change mitigation and adaptation projects including the use of alternate fuels and renewable energy

CO4: Gain in-depth knowledge on climate models

CO5: Post process the model outputs for climate impact assessment, know about adaptation strategies

CO6: Examine and critique policy issues related to climate change based on their scientific knowledge gained in the course.

TEXT BOOKS:

1. Ruddiman W.F, freeman W.H. and Company, "Earth‟s Climate Past and Future", 2001
2. Velma. I. Grover "Global Warming and Climate" Change. Vol I an II. Science Publishers, 2005.

REFERENCE BOOKS:

1. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007
2. IPCC Fourth Assessment Report, Cambridge University Press, Cambridge, UK, 2007
3. Thomas E, Lovejoy and Lee Hannah "Climate Change and Biodiversity", TERI Publishers, 2005
4. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

		L	T	P	C
U23CEV32	**AIR AND NOISE POLLUTION CONTROL ENGINEERING**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

1. To impart knowledge on the sources, effects and control techniques of air pollutants and noise pollution.
2. to know about source inventory and control mechanism
3. Minimization of the noise and noise pollution including technical measures, Codes, regulations, directives and standards about noise pollution.
4, An ability to design and conduct experiments, as well as to analyze and interpret data
5, To know sources and control measures of noise and air pollution

UNIT I GENERAL **09**

Atmosphere as a place of disposal of pollutants – Air Pollution – Definition - Air Pollution and Global Climate - Units of measurements of pollutants - Air quality criteria - emission standards - National ambient air quality standards - Air pollution indices - Air quality management in India.

UNIT II SOURCES, CLASSIFICATION AND EFFECTS **09**

Sources and classification of air pollutants - Man made - Natural sources - Type of air pollutants - Pollution due to automobiles - Analysis of air pollutants - Chemical, Instrumental and biological methods.Air pollution and its effects on human beings, plants and animals - Economic effects of air pollution - Effect of air pollution on meteorological conditions - Changes on the Meso scale, Micro scale and Macro scale.

UNIT III SAMPLING, METEOROLOGY AND AIR QUALITY MODELLING 09

Sampling and measurement of particulate and gaseous pollutants - Ambient air sampling - Stack sampling. Environmental factors - Meteorology - temperature lapse rate and stability – Adiabatic lapse rate - Wind Rose - Inversion – Wind velocity and turbulence - Plume behavior - Dispersion of air pollutants- Air Quality Modeling

UNIT IV AIR POLLUTION CONTROL MEASURES 09

Control - Source correction methods - Control equipments - Particulate control methods – Bag house filter - Settling chamber - cyclone separators - inertial devices - Electrostatic precipitator - scrubbers - Control of gaseous emissions - Absorption - Absorption equipments - adsorption and combustion devices (Theory and working of equipments only).

UNITV NOISE POLLUTION AND ITS CONTROL 09

Sources of noise – Units and Measurements of Noise - Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise – General Control Measures – Effects of noise pollution – auditory effects, non-auditory effects. Noise Menace– Prevention and Control of Noise Pollution – Control of noise at source, control of transmission, protection of exposed person - Control of other types of Noise Sound Absorbent

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Understand various types and sources of air pollution and its effects
CO2 : Know the dispersion of air pollutants and their modeling
CO3: Know about the principles and design of control of particulate pollutants
CO4: Understand the principles and design of control of gaseous pollutant
CO5: Know the sources, effects and control of vehicular, indoor air and noise pollution
CO6: An ability to identify, formulate, and solve engineering problems

TEXT BOOKS:

1. C. S. Rao, “Environmental Pollution Control Engineering”, Wiley Eastern Limited, 2006.
2. 2. M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 2017

REFERENCE BOOKS:

1. Noel De Nevers, "Air pollution control Engineering", McGraw Hill International Edition, McGraw Hill Inc, New Delhi, 2000.
2. Air Pollution act, India, 1987
3. Peterson and E.Gross Jr., “Hand Book of Noise Measurement”, 7th Edition, 1974
4. Mukherjee, "Environmental Pollution and Health Hazards", causes and effects, 1986

5. Antony Milne, “Noise Pollution: Impact and Counter Measures”, David & Charles PLC, 1979.

U23CEV33	ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To expose the students to the need, methodology, documentation and usefulness of environmental impact assessment and to develop the skill to prepare environmental management plan.
2. To provide knowledge related to the broad field of environmental risk assessment, important processes that control contaminant transport and tools that can be used in predicting and managing human health risks.
3. To expose various impacts in family level
4. To provide assessment of environmental impacts
5. To provide knowledge about various industrial activities

UNIT I INTRODUCTION 09

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 09

Matrices – networks – checklists – cost benefit analysis – analysis of alternatives – expert systems in EIA. Prediction tools for EIA – mathematical modelling for impact prediction – assessment of impacts – air – water – soil – noise – biological — cumulative impact assessment

UNIT III SOCIO-ECONOMIC IMPACT ASSESSMENT 09

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 09

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

assessment

UNITV CASE STUDIES 09

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 the students would be able to

CO1 : Apply the principle of limit state design for concrete pipe design
CO2 : Do structural design of Water tanks
CO3: Design the water treatment plant Structures.
CO4: Design the components of wastewater treatment plant structures.
CO5: Apply the knowledge of structural design to various environmental engineering structures.
CO6: They gain the ability about handling different chemical and industrial waste

TEXT BOOKS:

1. Canter, L.W., "Environmental Impact Assessment", McGraw Hill, New York. 1996
2. Lawrence, D.P., "Environmental Impact Assessment – Practical solutions to recurrent problems", Wiley-Interscience, New Jersey. 2003

REFERENCE BOOKS:

1. World Bank –Source book on EIA
2. Cutter, S.L., "Environmental Risk and Hazards", Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
3. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff “Risk Assessment and Management Handbook”, McGraw Hill Inc., New York,1996.
4. K. V. Raghavan and A A. Khan, "Methodologies in Hazard Identification and Risk Assessment", Manual by CLRI, 1990.
5. Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification, Assessment and Control, 4th Edition, Butterworth Heineman, 2012.

U23CEV34 INDUSTRIAL WASTEWATER MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. To impart knowledge on the concept and application of Industrial pollution prevention,.

2. Understand principles of various processes applicable to industrial wastewater treatment
3. Identify the best applicable technologies for wastewater treatment from the perspective of yield production.
4. To provide knowledge about cleaner technologies, industrial wastewater treatment and residue management
5. To expose various charaterstics of waste

UNIT I INTRODUCTION 08

Industrial scenario in India– Industrial activity and Environment - Uses of Water by industry – Sources and types of industrial wastewater – Nature and Origin of Pollutants - Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater – Industrial waste survey – Industrial wastewater monitoring and sampling – generation rates, characterization and variables –Toxicity of industrial effluents and Bioassay tests – Major issues on water quality management.

UNIT II INDUSTRIAL POLLUTION PREVENTION &WASTE MINIMISATION 08

Prevention vis a vis Control of Industrial Pollution – Benefits and Barriers – Waste management Hierarchy - Source reduction techniques – Periodic Waste Minimisation Assessments – Evaluation of Pollution Prevention Options – Cost benefit analysis – Pay-back period – Implementing & Promoting Pollution Prevention Programs in Industries.

UNIT III INDUSTRIAL WASTEWATER TREATMENT 10

Flow and Load Equalisation – Solids Separation – Removal of Fats, Oil & Grease- Neutralisation-Removal of Inorganic Constituents – Precipitation, Heavy metal removal, Nitrogen &Phosphorousremoval, Ion exchange, Adsorption, Membrane Filtration, Electro dialysis & Evaporation –Removal of Organic Constituents – Biological treatment Processes, Chemical OxidationProcesses, Advanced Oxidation processes – Treatability Studies.

UNIT IV WASTEWATER REUSE AND RESIDUAL MANAGEMENT 09

Individual and Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse Industrial reuse , Present status and issues - Disposal on water and land – Residuals of industrialwastewater treatment – Quantification and characteristics of Sludge – Thickening, digestion,conditioning, dewatering and disposal of sludge – Management of ROrejects.

UNIT V CASE STUDIES 10

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Sugar and Distilleries

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: Explain the source and types of industrial wastewater and their environmental impacts and choose the regulatory laws pertaining to environmental protection
CO2: Identify industrial wastewater pollution and implement pollution prevention, waste minimization in industries
CO3: Apply knowledge and skills to design industrial wastewater treatment schemes
CO4: Audit and analyze environmental performance of industries to internal, external client, regulatory bodies and design water reuse management techniques
CO5: Conduct research to develop effective management systems for industrial wastewater
CO6: Ability of waste treatment flow sheet of textiles

TEXT BOOKS

1 "Industrial wastewater management, T reatment& disposal, Water Environment" Federation Alexandria Virginia, Third Edition, 2008.
2 Lawrance K. Wang, Yung Tse Hung, Howard H.Lo and Constantine Yapijakis "handlook of Industrial and Hazardous waste Treatment", Second Edition, 2004.

REFERENCES:

1 Metcalf & Eddy, Inc., George Tchobanoglous, Franklin L. Burton and H. David Stensel, Wastewater engineering, treatment and reuse, Fourth Edition, McGraw-Hill, 2017
2 Nelson Leonard Nemerow, " industrial waste Treatment", Elsevier, 2007.
3 Wesley Eckenfelder W., " Industrial Water Pollution Control", Second Edition, Mc Graw Hill, 2000.
4 Paul L. Bishop, Pollution Prevention: - Fundamentals and Practice", Mc-Graw Hill International, Boston, 2000.
5 Waste water Treatment for pollution control and reuse by Soli. J. Arceivala, Shyam. R. Asolekar, Tata McGraw Hill, 2007

U23CEV35 **SOLID AND HAZARDOUS WASTE MANAGEMENT** **L T P C**
2 0 2 3

COURSE OBJECTIVES

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

1. To impart knowledge and skills relevant to minimization of solid and hazardous wastes
2. To expose knowledge storage, collection, transport, recycling, processing and disposal of solid and hazardous wastes
3. To provide the related regulations, engineering principles, design criteria, methods and equipment.
4.
5.

UNIT I WASTE CLASSIFICATION AND REGULATORY REQUIREMENTS 09

Sources and types of solid and hazardous wastes - need for solid and hazardous waste management – salient features of latest Indian legislations on management and handling of solid wastes, hazardous wastes, biomedical wastes, electronic wastes, construction and demolition wastes, plastics and discarded lead acid batteries – elements of integrated waste management and roles of

stakeholders - seven elements and seven step approach to integrated solid waste management planning.

UNIT II WASTE CHARACTERIZATION SOURCE REDUCTION AND RECYCLING 09

Waste sampling and characterization plan - waste generation rates and variation – physical composition, chemical and biological properties – hazardous characteristics – ignitability, corrosivity and TCLP tests –source reduction, segregation and onsite storage of wastes – waste exchange - extended producer responsibility - recycling of plastics, C&D wastes and E wastes.

UNIT III WASTE COLLECTION TRANSPORT AND MATERIAL RECOVERY 09

Door to door collection of segregated solid wastes - analysis of hauled container and stationery container collection systems - compatibility, storage, labeling and handling of hazardous wastes – principles and design of transfer and transport facilities - hazardous waste transport and manifests - mechanical processing and material separation technologies – Size reduction – size separation - density separation - magenetic separation – compaction – principles and design of material recovery facilities – physico chemical treatment of hazardous wastes - solidification and stabilization – case studies on waste collection and material recovery

UNIT IV BIOLOGICAL AND THERMAL PROCESSING OF WASTES 09

Biological and thermos-chemical conversion technologies – composting – biomethanation – incineration – pyrolysis- plasma arc gasification –principles and design of biological and thermal treatment facilities - MSW processes to energy with high-value products and specialty By-products - operation of facilities and environmental controls - treatment of biomedical wastes – case studies and emerging waste processing technologies.

UNIT V WASTE DISPOSAL 09

Sanitary and secure landfills - components and configuration– site selection - liner and cover systems - geo synthetic clay liners and geo membranes - design of sanitary landfills and secure landfills- leachate collection, treatment and landfill gas management – landfill construction and operational controls - landfill closure and environmental monitoring – landfill bioreactors – rehabilitation of open dumps and biomining of dumpsites-remediation of contaminated sites- Case studies

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

- **CO1**: Explain the various functional elements of solid and hazardous waste management including the associated legal, health, safety, and cultural issues as well as responsibilities of different stakeholders
- **CO2**: Apply the knowledge of science and engineering fundamentals to characterize different types of solid and hazardous wastes.
- **CO3**: Design of systems and processes to meet specified needs of waste minimization,

storage, collection, transport, recycling, processing and disposal.

CO4: Select appropriate methods for processing and disposal of solid and hazardous wastes, taking into account the impact of the solutions in a sustainability context

CO5: Conduct research pertinent to solid and hazardous waste management and communicate effectively to different stakeholders as well as engage in independent lifelong learning

CO6: Assess the factors affecting variation and assess performance of waste treatment and disposal systems

TEXT BOOKS

1 George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Waste Management, Mc-Graw Hill India, First edition, 2015.

2 CPHEEO, "Manual on Municipal Solid waste management,Vol I, II and III, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi, 2016.

REFERENCES:

1 William A. Worrell, P. AarneVesilind, Christian Ludwig, Solid Waste Engineering – A Global erspective, 3rd Edition, Cengage Learning, 2017.

2 Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and "Environmental Resources Management, Hazardous waste Management", Mc-Graw Hill International edition, New York,2010.

3 John Pitchtel,Waste Management Practices, CRC Press,Taylor and Francis Group,2014.

4 Gary C. Young, Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons, Wiley, 2010

5 Cherry P M, Solid and Hazardous Waste Management, CBS publishers and distributors Pvt Ltd, 2018.

U23CEV36 **ENVIRONMENTAL POLICY AND LEGISLATIONS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. The course will analyze the legislative and judicial responses to environmental problems and the administrative system of environment related laws such as air, water, land, and hazardous substances etc. Environment advocacy and approaches for using litigation in environment protection will receive special attention

2.
3.
4.
5.

UNIT I **INTRODUCTION TO ENVIRONMENTAL LEGISLATIONS AND INTERNATIONAL SCENARIO** **09**

Significance of Environmental Law -International Environmental Law -Development of International Environmental Law -Source and General principals of International Environmental Law –General rights and obligations of States -General Issues of the international law related to environmental protection -Stockholm Declaration-Rio Declaration on Environment and Development-Basel Convention on the Control of Trans boundary Movement of Hazardous Wastes and their disposal- Convention of Biological Diversity-U.N Frame Work Convention on Climate Change-Montreal Protocol on Substances that deplete Ozone Layer-Kyoto Protocol**.**

UNIT II INDIAN CONSTITUTIONS AND ENVIRONMENTAL PROTECTION 09

Indian Constitution and Environmental Protection -Constitutional provisions concerning Environment Articles 14,15,(2) (b) 19 (e),21,31,32,38,39,42,47, 48-A,49,51,51-A: Indian Environmental Policy 2006 Administrative machinery for pollution control Common Law & Criminal Law Nuisance, Negligence, Strict liability and Absolute liability, Provisions of IPC relating to environmental problems (public nuisance u/s 268 and others (Sections 269,270,277,284,285,286,425 to 440) Section 133 of Cr.P.C.

UNIT III REMEDIES FOR ENVIRONMENTAL POLLUTION 09

Common Law Remedies/Remedies under Law of Tort – Penal Remedies – Indian Penal Code and Code of Criminal Procedure – Remedies under Constitutional Law – Writs – Public Interest Litigation - Public Liability Insurance Act, 1991 – The National Green Tribunal Act 2010

UNIT IV MAJOR INDIAN LEGISLATIONS 09

Water Act (1974) Air Act (1981) Environmental Protection Act (1986) Major Notifications, The Municipal solid Wastes (Management and Handling) Rules 2000-Bio Medical Wastes (Management and Handling) Rules 1998- Hazardous Wastes (Management and Handling Rules 1989- Environment Impact Assessment Notifications- Coastal Regulation Zone Notification- Public Hearing Notifications

UNIT V ENVIRONMENT AND DEVELOPMENT CASE LAWS 09

Meaning and concept of development - Its impact on environment; conflict between environment and development, Concept of Sustainable Development., Polluter Pay Principle, Precautionary Principle, Public Trust Doctrine. Landmark Judgments - Olium gas leakage case, Rural Litigation and Entitlement Kendra, Dehradun, (1985) Supp SCC 487) Vellore Citizen Welfare Forum v. Union of India, (1996) 5SCC 647) Ganga Pollution case (1988) I SCC) S. Jagannath v. UOI (1997) SCC867) Vellore Citizens welfare forum case M.C. Mehta V. Kamalnath (1997) I SCC 388)

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: Understand origins and sources of environmental laws, and understand how and by whom environmental laws are made and interpreted

CO2: Understand the key principles of, and actors within, environmental laws
CO3: Understand the National Environmental Policy and Various Legislations enacted in line with Policy
CO4: Critically analyze environmental laws within various contexts and to evaluate laws against procedural and substantive criteria.
CO5: Understand and the Legal system operating in India and will be in a position to prepare compliance reports for getting environmental clearance.
CO6: Understand conflict between development and environmental

TEXT BOOKS

1 Leelakrishnan P., Environmental Law in India, Butterworths,1998
2 ShanthakumarS. , Environmental Law – An Introduction, Butterworths,2004

REFERENCES:

1 Leelakrishnan P., Environmental Case Book, Lexis Nexis, 2000
2 Shyam Diwan and Armin Rosencranz, Enviromental Law and Policy in India, Oxford, 2001

U23CEV37 ENVIRONMENTAL HEALTH AND SAFETY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. To educate overview of EHS in industries and related Indian regulations, types of Health hazards, effect, assessment and control methods and EHS Management System
2. To analyse occupational health and hygiene
3. To observe Safety at Construction sites
4. To Hazard and Risk Management Techniques
5. Study Elements of Environmental Health and Safety Management Policy and implementation

UNIT I INTRODUCTION **09**

Need for developing Environment, Health and Safety systems in work places- International initiatives, National Policy and Legislations on EHS in India - Regulations and Codes of Practice - Role of trade union safety representatives - Ergonomics.

UNIT II OCCUPATIONAL HEALTH AND HYGIENE **10**

Definition of occupational health and hygiene - Categories of health hazards – Exposure pathways and human responses–Exposure Assessment-occupational exposure limits - Hierarchy of control measures - Role of personal protective equipment and the selection criteria

UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS **11**

Features of Satisfactory and Safe design of work premises – good housekeeping - lighting and color,Ventilation and Heat Control, Noise, Chemical and Radiation Safety – Electrical Safety – Fire Safety– Safety at Construction sites, ETP – Machine guarding – Process Safety, Working at different levels

UNIT IV HAZARDS AND RISK MANAGEMENT 08

Safety appraisal – Job Safety Analysis-Control techniques – plant safety inspection – Accident investigation - Analysis and Reporting – Hazard and Risk Management Techniques –Onsite and Offsite emergency Plans. Employee Participation- Education and Training- Case Studies

UNIT V ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT 07

Concept of Environmental Health and Safety Management – Elements of Environmental Health and Safety Management Policy and implementation and review – ISO 45001-Strucure and Clauses-Case Studies

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

- **CO1**: Need for EHS in industries and related Indian regulations
- **CO2**: Various types of Health hazards, effect, assessment and control methods
- **CO3**: Various safety systems in working environments
- **CO4**: The methodology for preparation of Emergency Plans and Accident investigation.
- **CO5**: EHS Management System and its elements
- **CO6:** Hazard and Risk Management Techniques

TEXT BOOKS

1 Environmental and Health and Safety Management by Nicholas P.Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995

2 Fundamentals of Industrial Safety and Health by Dr.K.U.Mistry, Siddharth Prakashan, 2012

REFERENCES:

1 Industrial Health and Safety Acts and Amendments, by Ministry of Labour and Employment, Government of India

2 The Facility Manager's Guide to Environmental Health and Safety by Brian Gallant, Government Inst Publ., 2007.

3 Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services, 2005.

U23CEV41 PREFABRICATED STRUCTURES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To introduce the basic concepts of prefabrication
2. To acquire the knowledge of prefabrication components and systems
3. To understand the design principles in prefabrication
4. To perceive the types of joints and connections in structural members
5. To impart knowledge about the structural stability.

UNIT I INTRODUCTION 09

Need for prefabrication -Advantages and limitations – Principles of prefabrication – Modular coordination – Standarization– Loads and load combinations– Materials – Production – Transportation – Erection.

UNIT II PREFABRICATED COMPONENTS AND SYSTEMS 07

Behaviour and types of structural components– roof and floor slabs – Walls panels - Shear walls - Beams - Columns – skeletal system- portal frame system-Large panel systems- block system

UNIT III DESIGN PRINCIPLES 10

Design philosophy- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems- Design for stripping , stacking ,transportation and erection of elements

UNIT IV JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS 09

Types of Joints – based on action of forces - compression joints - shear joints - tension joints - based on function - construction joints , contraction joints, expansion joints. Design of expansion joints -Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation.

UNITV DESIGN FOR ABNORMAL LOADS 10

Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse -case study.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Understand concepts about principles of prefabrication, production, transportation, erection.

CO2 : Acquire knowledge about panel systems, slabs, beams, shear walls and columns used in precast construction.

CO3: Acquire knowledge about design of cross section, joint flexibility.
CO4: Acquire knowledge about joints and connection in precast construction.
CO5: Acquire knowledge about structural stability..
CO6: To know abnormal loads which are hazardous to the prefabricated structures

TEXT BOOKS:

1. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers, USA,1991.
2. Lewitt,M. " Precast Concrete- Materials, Manufacture, Properties And Usage ,CRC Press, 2019

REFERENCE BOOKS:

1. Alfred Steinle, Hubert Bachmann, Mathias Tillmann, Philip Thrift . "Precast Concrete Structures", Ernst & Sohn, Berlin, 2019.
2. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
3. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.
4. " Precast concrete connection details", Structural Design manual, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.

U23CEV42 **CONSTRUCTION EQUIPMENT AND MACHINERY** **L T P C**
3 0 0 3

COURSE OBJECTIVES

1. To train the students in field of construction equipment and machineries so as to have a first hand knowledge of practical problems in carrying out engineering tasks. To develop skills in facing and solving the field problems using construction equipment like bull dozer, concrete mixer, cranes and scraper etc.,

UNIT I **CONSTRUCTION EQUIPMENT SELECTION** **09**

Identification – Planning of equipment – Selection of Equipment - Equipment Management in Projects - Maintenance Management – Equipment cost – Operating cost – Cost Control of Equipment - Depreciation Analysis – Replacement of Equipment- Replacement Analysis - Safety Management.

UNIT II **EQUIPMENT FOR EARTHWORK** **09**

. Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders – Dozer, Excavators, Rippers, Loaders, trucks and hauling equipment, Compacting Equipment, Finishing equipment.

UNIT III **OTHER CONSTRUCTION EQUIPMENTS** **09**

Equipment for Dredging, Trenching, Drag line and clamshells, Tunneling – Equipment for Drilling and Blasting - Pile driving Equipment - Erection Equipment - Crane, Mobile crane - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Equipment for Demolition.

UNIT IV **ASPHALT AND CONCRETING EQUIPMENTS** **09**

Aggregate production- Different Crushers – Feeders - Screening Equipment - Handling Equipment -

Batching and Mixing Equipment - Pumping Equipment – Ready mix concrete equipment, Concrete pouring equipment. Asphalt Plant, Asphalt Pavers, Asphalt compacting Equipment.

UNITV **MATERIALS HANDLING EQUIPMENT** **09**

Forklifts and related equipment - Portable Material Bins – Material Handling Conveyors – Material Handling Cranes- Industrial Trucks.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Develop knowledge on planning of equipment and selection of equipment

CO2 : Explain the knowledge on fundamentals of earth work operations, earth moving operations and types of earth work equipment

CO3: Develop the knowledge on special construction equipments

CO4: Apply the knowledge on asphalt and concrete plants

CO5: Apply the knowledge and select the proper materials handling equipment

CO6: Perform the proper selection, application, utilization, and productivity of heavy equipment

TEXT BOOKS:

1. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, DhanpatRai and Sons, 2010.
2. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 2008

REFERENCE BOOKS:

1. Peurifoy, R.L., Schexnayder, C. and AviadShapira., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 2010.
2. Granberg G.,Popescu M Construction Equipment and Management for Engineers Estimators and Owners, Taylor and Francis Publishers, New York, 200
3. Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 2001
4. Mukherjee, "Environmental Pollution and Health Hazards", causes and effects, 1986
5. Antony Milne, “Noise Pollution: Impact and Counter Measures”, David & Charles PLC, 1979.

U23CEV43	**SUSTAINABLE CONSTRUCTION AND LEAN CONSTRUCTION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

1. To impart knowledge about sustainable construction and to understand the concepts of sustainable materials, energy calculations, green buildings and environmental effects.

UNIT I **INTRODUCTION & MATERIALS USED IN SUSTAINABLE CONSTRUCTION** **09**

Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. - CO2 contribution from cement and other construction materials - Recycled and manufactured aggregate - Role of QC and durability - Life cycle and sustainability.

UNIT II ENERGY CALCULATIONS 09

Components of embodied energy - calculation of embodied energy for construction materials - Energy concept and primary energy - Embodied energy via-a-vis operational energy in conditioned building - Life Cycle energy use.

UNIT III GREEN BUILDINGS 09

Control of energy use in building – National Building Code (NBC), ECBC code, codes in neighboring tropical countries - OTTV concepts and calculations – Features of LEED and TERI – Griha ratings - Role of insulation and thermal properties of construction materials - influence of moisture content and modeling -Performance ratings of green buildings - Zero energy building'

UNIT IV CORE CONCEPTS IN LEAN 09

Introduction to the Course; Lean Overview; Need for Productivity Measurement and improvement; Productivity Measurement System (PMS).

UNITV LEAN CONSTRUCTION TOOLS AND TECHNIQUES 09

Sampling/ Work Sampling; Survey/ Foreman delay survey; Value Stream/ Process Mapping– 5S , Collaborative Planning System (CPS)/ Last Planner™ System (LPS) – Big Room Approach, IT/BIM and Lean, How to Start Practicing Lean Tools in Project Site.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- **CO1 :** Describe the various sustainable materials used in construction.
- **CO2 :** Explain the method of estimating the amount of energy required for building.
- **CO3:** Describe the features of LEED, TERI and GRIHA ratings of buildings.
- **CO4:** Explain the core concepts of lean construction tools and techniques and their importance in achieving better productivity.
- **CO5:** Apply lean tools & techniques to achieve sustainability in construction projects.
- **CO6:** Identify the driving factors behind Lean Construction and Lean Construction practices implemented on projects

TEXT BOOKS:

1. Charles J Kibert, Sustainable Construction : Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.

REFERENCE BOOKS:

1. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
2. Ballard, G., Tommelein, I., Koskela, L. and Howell, G., Lean construction tools and

techniques, 2002.
3. Salem, O., Solomon, J., Genaidy, A. and Luegring, M., Site implementation and Assessment of Lean Construction Techniques, Lean Construction Journal, 2005.

U23CEV44 **DIGITALIZED CONSTRUCTION LAB** **L T P C**
0 0 6 3

COURSE OBJECTIVES

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

1. To train the students in field of digitalization of construction. Students can be trained in the latest softwares relevant to construction industry

LIST OF EXPERIMENTS:

To implement the digital knowledge in construction (use relevant softwares)

1. Introduction and understanding of Primavera project planner for construction
2. Using Primavera project planner, update the schedule of the project of a construction project.
3. Introduction and understanding of MS Project for a construction project
4. Using MS project, schedule the construction project planning
5. Introduction to BIM in construction projects
6. Development of BIM for small construction project
7. Progress the work flows in construction project using BIM

TOTAL : 90 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: To understand the importance of latest softwares in a construction industry.
CO2: To plan a construction project using Primer vera
CO3: To plan a construction project using MS project
CO4: To develop a BIM information model
CO5: To analyse the bid management and its
CO6: To evaluate effectiveness using bid management software

U23CEV45 **CONSTRUCTION MANAGEMENT AND SAFETY** **L T P C**
2 0 2 3

COURSE OBJECTIVES

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

1. To study and understand the formulation, costing of construction projects, scheduling and various safety concepts and its requirements applied to construction projects.
2. well-versed with the latest safety and health regulations and the Indian Standards applicable to the construction industry.
3. To plan, assess, analyze and manage the hazardous construction project sites
4. Design safety and emergency response plans
5. Design an effective company safety culture manual

UNIT I GENERAL OVERVIEW AND PROJECT ORGANIZATION 06

Introduction - Interdisciplinary nature of modern construction projects – execution of project – evaluation of bits – resource management.

UNIT II ESTIMATION OF PROJECT COST & ECONOMICS 06

Estimating quantities – description of items – estimation of project cost – running account bills – decision making in construction projects – depreciation of construction equipment – case study.

UNIT III PLANNING AND SCHEDULING 06

Introduction – project scheduling – uncertainties in duration of activities using PERT – Project monitoring and control system – resource levelling and allocation – crashing of network.

UNIT IV SAFETY DURING CONSTRUCTION 06

Basic terminology in safety - types of injuries - safety pyramid - Accident patterns - Planning for safety budget, safety culture - Introduction to OSHA regulations - Site safety programs - Job hazard analysis, accident investigation & accident indices-violation, penalty.

UNIT V SAFE OPERATING PROCEDURES 06

Safety during alteration, demolition works – Earthwork, steel construction, temporary structures, masonry & concrete construction, cutting & welding - Construction equipment, materials handling-disposal & hand tools - Other hazards – fire, confined spaces, electrical safety.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: Perform formulations of projects.
CO2: Analyze project costing.
CO3: Identify and estimate the activity in the construction.
CO4: Develop the knowledge on accidents and their causes.
CO5: To plan safety and emergency response
CO6: Plan, assess, analyze and manage the construction project sites.

TEXT BOOKS

1 Albert Lester, Project Management, Planning and Control, 7th Edition, Butterworth-Heinemann, USA , 2017.

2 Patrick X.W. Zou ,Riza YosiaSunindijo, Strategic Safety Management in Construction and Engineering John Wiley & Sons, Ltd 2015.

REFERENCES:

1 Barcus, S.W. and Wilkinson.J.W., Hand Book of Management Consulting Services, McGraw Hill, New York, 1986.

2 Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan India Ltd., 1992

U23CEV46 **ADVANCED CONSTRUCTION TECHNIQUES** **L T P C**

3 0 0 3

COURSE OBJECTIVES

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

1. To study and understand the latest construction techniques applied to engineering construction for sub structure, super structure, special structures, rehabilitation and strengthening techniques and demolition techniques.
2. Create awareness about construction practices for sub structure of heavy structures under various conditions.
3. Relate recent advancement in heavy construction.
4. Impart knowledge of construction of tall structures.
5. Study process of demolition and safety measures.

UNIT I SUB STRUCTURE CONSTRUCTION 09

Construction Methodology - Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - Piling techniques - Driving well and caisson - sinking cofferdam - cable anchoring and grouting - Driving diaphragm walls, Sheet piles - Laying operations for built up offshore system - Shoring for deep cutting - Large reservoir construction - well points - Dewatering for underground open excavation.

UNIT II SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS 09

Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in-situ prestressing in high rise structures, Post tensioning of slab- aerial transporting – Handling and erecting lightweight components on tall structures.

UNIT III CONSTRUCTION OF SPECIAL STRUCTURES 09

Erection of lattice towers - Rigging of transmission line structures – Construction sequence in

cooling towers, Silos, chimney, sky scrapers - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks.

UNIT IV REHABILITATION AND STRENGTHENING TECHNIQUES 09

Seismic retrofitting - Strengthening of beams - Strengthening of columns - Strengthening of slab - Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation – Micro piling and underpinning for strengthening floor and shallow profile - Sub grade water proofing, Soil Stabilization techniques.

UNIT V DEMOLITION 09

Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: Understand the modern construction techniques used in the sub structure construction.
CO2: Demonstrate knowledge and understanding of the principles and concepts relevant to super structure construction for buildings
CO3: Understand the concepts used in the construction of special structures
CO4: Knowledge on Various strengthening and repair methods for different cases.
CO5: Identify the suitable demolition technique for demolishing a building.
C06: Employ recent advancement in construction techniques.

TEXT BOOKS

1 Jerry Irvine, Advanced Construction Techniques, CA Rocket, 1984
2 Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 1992.

REFERENCES:

1 Peter H.Emmons, “Concrete repair and maintenance illustrated”, Galgotia Publications Pvt. Ltd., 2001.Press, 2008.
2 Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 1995.
3 Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University, New Delhi, 2008.

U23CEV47 **ENERGY EFFICIENT BUILDINGS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

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

1. To provide an understanding of the concept of energy consumption in buildings and design an energy efficient building
2. To equip the participants with fundamental understanding, Knowledge and Skills
3. To contribute in the practice of Energy Efficient Buildings in Cities and Move towards related UNSDGs.
4. To get an technical, legal, financial and practical aspects of energy efficiency in buildings
5. Overall assessment where outdoor environment, building and technical systems are seen in connection with energy supply, energy use and indoor environment.

UNIT I INTRODUCTION **09**

Climate adapted and climate rejecting buildings – Heat Transfer – Measuring Conduction – Thermal Storage – Measurement of Radiation – The Greenhouse Effect – Convection – Measuring latent and
sensible heat – Psychrometry Chart – Thermal Comfort – Microclimate, Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Path Diagrams – Sun Protection – Types of Shading Devices – Design responses to energy conservation strategies.

UNIT II PASSIVE SOLAR HEATING AND COOLING **09**

General Principles of passive Solar Heating – Key Design Elements – Sunspace – Direct gain – Trombe Walls, Water Walls – Convective Air loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Principles – Case studies – Courtyards – Roof Ponds– Cool Pools – Predicting ventilation in buildings – Window Ventilation Calculations – Room Organization Strategies for Cross and Stack Ventilation – Radiation – Evaporation and dehumidification – Wind Catchers – Mass Effect – Zoning – Load Control – Air Filtration and odor removal.

UNIT III DAYLIGHTING AND ELECTRICAL LIGHTING **09**

Materials, components and details – Insulation – Optical materials – Radiant Barriers – Glazing materials – Glazing Spectral Response – Day lighting – Sources and concepts –Building Design Strategies – Case Studies – Daylight apertures – Light Shelves – Codal requirements – Day lighting design – Electric Lighting – Light Distribution – Electric Lighting control for day lighted buildings – Switching controls – Coefficient of utilization – Electric Task Lighting – Electric Light Zones – Power Adjustment Factors.

UNIT IV HEAT CONTROL AND VENTILATION **09**

Hourly Solar radiation – Heat insulation – Terminology – Requirements – Heat transmission through building sections – Thermal performance of Building sections – Orientation of buildings – Building characteristics for various climates – Thermal Design of buildings – Influence of Design Parameters –Mechanical controls – Examples. Ventilation – Requirements – Minimum standards

for ventilation –Ventilation Design – Energy Conservation in Ventilating systems – Design for Natural Ventilation –Calculation of probable indoor wind speed.

UNIT V DESIGN FOR CLIMATIC ZONES 09

Energy efficiency – An Overview of Design Concepts and Architectural Interventions – Embodied Energy – Low Embodied Energy Materials – Passive Downdraft Evaporative Cooling – Design of Energy Efficient Buildings for Various Zones – Cold and cloudy – Cold and sunny – Composite – Hot and dry – Moderate – Warm and humid – Case studies of residences, office buildings and other buildings in each zones – Commonly used software packages in energy efficient building analysis and design - Energy Audit – Certification

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

- **CO1**: Explain environmental energy supplies on buildings
- **CO2**: Explain the passives ol arheating,cooling system
- **CO3**: Discuss the various aspects of day-lighting and electrical lighting in abuilding
- **CO4**: Predict and design building ventilation and heat control for indoor comfort
- **CO5**: Design a building for climatic zone and apply simulation programs of buildings to perform energy calculations
- **CO6:** Technical installations for heating, cooling, ventilation, domestic hot water, lighting, heat recovery

TEXT BOOKS

1 Residential Energy: Cost Savings and Comfort for Existing Buildings by John Krigger and Chris Dorsi, Published by Saturn Resource Management, 2013.

2 Handbook on Functional Requirements of Buildings Part 1 to 4 SP : 41 (S and T) 1995

REFERENCES:

1 Energy Conservation Building Code, cau of Energy Efficiency, New Delhi, 2018.

2 Brown, G.Z. and DeKay, M., Sun, Wind and Light - Architectural Design Strategies, John Wiley and Sons Inc,3rd Edition, 2014

3 Majumdar, M (Ed), Energy - Efficient Buildings in India, Tata Energy Research Institute, Ministry of Non-Conventional Energy Sources, 2009.

U23CEV51	CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

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

UNIT I INTRODUCTION AND CODES 09

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

UNIT II LOADS ACTING ON STRUCTURES 07

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

UNIT III MODELLING OF BASIC STRUCTURAL ELEMENTS 10

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

UNIT IV DESIGN OF STRUCTURAL ELEMENTS 09

Design of Beams- flexural reinforcement, shear reinforcement, Design of flat slabs- FlexuralReinforcement, shear reinforcement, Design of 2-way continuous slabs.

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

UNITV DETAILING OF STRUCTURAL ELEMENTS 10

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Plan a layout of a structure

CO2 : Calculate loads using IS codes and various computational tools
CO3: Analyse the structure for various loads and load combination according to the relevant IS codes
CO4: Design and Analysis of structures using computer software/tools
CO5: Prepare the complete structural drawings using computer software
CO6: Discuss fire and seismic resistance of concrete structures.

TEXT BOOKS:

1. Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., 2009. 105
2. Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.

REFERENCE BOOKS:

1. Krishnaraju.N" Design of Reinforced Concrete Structurres ", CBS Publishers & Distributors Pvt. Ltd., New Delhi.
2. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002.
3. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete",Laxmi Publication Pvt. Ltd., New Delhi, 2007.

U23CEV52	STEEL STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To acquire hands on experience in design and preparation of structural drawings for steel structures like industrial buildings, steel framed buildings using structural design software and detailed drawing softwares
2. To introduce the students to design of light gauge steel structures

UNIT I DESIGN ASPECTS AND LOADS ON A STEEL BUILDING 09

Inputs for the design of a steel building - Design basis report, covering Site Data, geometrical, functional and structural requirements for its end usage - material specifications - Methods of designing a steel building. Calculating the various loads acting on a steel building - Vertical & Lateral loads - Effects of each loads separately and in combination – Dead, superimposed dead, live, temperature, MEP service loads - Lateral loads due to Wind and Seismic effects

UNIT II SELECTION OF LOAD RESISTING SYSTEM AND MODELLING OF STRUCTURE 09

Studying the layout plans of the structure - Selection of load resisting systems - Load flow in each system - Satisfying Stability and strength of the structure - Vertical and Lateral load resisting systems- Analysis and design of Sway and non-sway frames - Manual and Computer aided modelling, analysis and design - Geometric and structural parameters of the structure - Loading the structure -Interpretation of the results of the software – Analysis and Design of a multi-storeyed

building.

UNIT III DESIGN OF VARIOUS ELEMENTS OF A STEEL BUILDIN 09

Manual and Software aided design – Beams, columns, floors, bracings, purlins/girts and facades, base plates and anchor bolts – Various loads, different conditions of supports, exposure, and purpose of use - Design of Connections between the members – bolted and welded, moment and shear connections

UNIT IV DESIGN OF AN INDUSTRIAL BUILDING 09

Functional requirements - Serviceability Requirements - Structural Configurations - Selection of sections as per requirements - Configuration of the elements, connectivity - Analysis and design of different types of trusses — Design of Gantry Girders – Design of gable frames – Design of steel columns for combined loading - Analysis and design of industrial buildings - Study of General assembly drawings - Fabrication processes - Fabrication, logistics & erection – Sequence of erection- Inspection of a completed structure.

UNITV DESIGN OF LIGHT GAUGE STEEL STRUCTURES 09

Philosophy of design of light gauge steel members, Direct Strength Method (DSM) ,Effective width method (EWM) – Concept of buckling, local buckling and post-buckling strength - Analysis and design of Compression members– Analysis and design of flexural members, Lateral buckling of beams, Shear Lag, Flange Curling – Design of wall panels

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Plan the layout of the structure and calculate the loads of the steel structure.
CO2 : Select a load resisting system, model the structure and interpret the results
CO3: Design the various elements of a steel buildings
CO4: Design a typical industrial building
CO5: Design the various elements of a cold –formed steel buildings
CO6: Analyze **&** design the plate and gantry girder

TEXT BOOKS:

1. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016
2. Negi L.S. “Design of steel structures” McGraw Hill Co., New Delhi, 2014
3. Duggal S.K., Design of Steel Structures, Tata McGraw Hill, Publishing Co. Ltd., New Delhi, 2010

REFERENCE BOOKS:

1. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India Pvt Limited, 2013
2. Jack C. McCormac and Stephen F Csernak, Structural Steel Design, Pearson Education Limited, 2013.
3. Sarwar Alam Raz, Structural Design in Steel, New Age International Publishers, 2014
4. Gaylord E H, Gaylord N C and Stallmeyer J E, “Design of Steel Structures”, 3edition, McGraw Hill Publications, 1992.
5. Salmon, Johnson &Malhas,” Steel Structures: Design and Behavior, 4th Edition, Harper Collins College Publisher, 1996
6. Bhavikatti S.S, Design of Steel Structures, Ik International Publishing House, New Delhi, 2017.

7. Wie Wen Yu, Design of Cold Formed Steel Structures, McGraw Hill Book Company, 1996

U23CEV53	REHABILITATION/HERITAGE RESTORATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To acquire the knowledge on quality of concrete, durability aspects, causes of deterioration,
2. To promote conservation, restoration, rehabilitation, and renovation;
3. To manage alterations, development, redevelopment, construction, and demolition in order to retain the heritage value of the area
4. Assessment of distressed structures
5. Repairing of structures, Restoration of Heritage structures and demolition procedures

UNIT I MAINTENANCE AND REPAIR STRATIGES 09

Maintenance, Repair and Rehabilitation - Facets of Maintenance - Importance of MaintenanVarious aspects of Inspection - Assessment procedure for evaluating a damaged structure - cauof deterioration.

UNIT II STRENGTH AND DURABILITY OF CONCRETE 09

Quality assurance for concrete – Strength and Durability of concrete - Cracks, different types, causes-Effects due to climate, temperature, Sustained elevated Temperature, Corrosion –

UNIT III SPECIAL CONCRETES 09

Polymer concrete - Sulphur infiltrated concrete - Fibre reinforced concrete - High strength concrete-High performance concrete - Self compacting concrete - Geopolymer concrete - Concrete made withindustrial wastes.

UNIT IV TESTING TECHNIQUES AND PROTECTION METHODS 09

Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodicprotection.

UNITV STRENGTHENING, REPAIR, REHABILITATION AND RESTORATION OF STRUCTURES 09

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage and earthquake - Restoration of Heritage structures- Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Know the importance of inspection and maintenance.
CO2 : Study the Impacts of cracks, corrosion and climate on structures.
CO3: Know about various special concretes
CO4: Understand the testing techniques and various protection measures
CO5: Know the Repair of structures and Restoration of Heritage structures
CO6: To find assessment procedure for evaluation

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.
2. Hand Book on "Repair and Rehabilitation of RCC Buildings" – Director General works CPWD ,Govt of India , New Delhi – 2002
3. P.C.Varghese, Maintenance Repair and Rehabilitation & Minor works of building, Prentice Hall India Pvt Ltd 2014.
4. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth-Heinemann, Elsevier, New Delhi 2012

U23CEV54	DYNAMICS AND EARTHQUAKE RESISTANT STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. To understand the behaviour of structures under dynamic, earthquake loading and desithe structures as earthquake resistant as per codal provisions.
2. To provide a coherent development to the students for the courses in sector of earthquake engineering design of buildings according to earthquake design philosophy.
3. To present the foundations of many basic engineering concepts related earthquake
4. Engineering To give an experience in the implementation of engineering concepts which are applied
5. In field of earthquake engineering To involve the application of scientific and technological principles of planning, analysis

UNIT I INTRODUCTION TO DYNAMICS 09

Dynamics - Degree of freedom – Free and forced vibration - Idealization of structure as SingleDegree of Freedom (SDOF) and Multi degree of freedom (MDOF) system – D'Alemberts Principles- Formulation of equation of motion for SDOF system and MDOF system –- Evaluation of natural frequencies and modes - Effect of damping.

UNIT II SEISMOLOGY 09

Elements of Engineering Seismology – Seismic hazard - Earthquake phenomenon – Seismotectonics – Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters – Soil Structure Interaction – Liquefaction of soil - Seismic zone map – Response spectra.

UNIT III EARTHQUAKE EFFECTS ON STRUCTURES 09

Inertia force on structures – load transfer path – Effect of architectural features on behavior of structures – Hysteretic Behaviour of RCC, steel and prestressed concrete - Pinching Effect – Bouchinger Effects - Energy dissipation - P-delta effect - storey drift - Behavior of brick masonry, stone masonry and reinforced concrete structures under past earthquakes – typical failures - Causes of damage –- Lessons learnt from past earthquakes.

UNIT IV EARTHQUAKE LOAD ANALYSIS 09

Design spectra – Codal provision – Different methods of earthquake analysis –- Analysis of structureby Equivalent static method – Analysis of structure by Response spectrum method – Introduction totime-history method of analysis

UNIT V EARTHQUAKE RESISTANT DESIGN 09

Philosophy of earthquake resistant design - Planning considerations and Architectural concepts - Design and detailing as per codal provisions - Design and detailing of typical flexural member and column member, Ductile detailing of beam-column joints and footing – Concept and principle of shearwall - Introduction to performance based seismic design - Seismic isolation principles and methods.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

- **CO1**: Develop the equations of motion for SDOF and MDOF system and to evaluate the natural frequencies and mode shapes.
- **CO2**: Explain the elements of engineering seismology, characteristics of earthquake and seismic instrumentation.
- **CO3**: Explain the behavior of various types of structures under earthquake
- **CO4**: Determine the forces in a structure due to earthquake
- **CO5**: Design earthquake resistant building structures
- **CO6:** The students will learn to understand the theoretical and practical aspects of earthquake• engineering along with the planning and design aspects.

TEXT BOOKS

1 Mario Paz, Structural Dynamics – Theory and Computations, Fifth Edition 2nd printing, CBS publishers, 2006.

2 Agarwal.P and Shrikhande.M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2011.

REFERENCES:

1 Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.

2 Minoru Wakabayashi, Design of Earthquake Resistant Buildings, Mc Graw – Hill Book Company, 1986.

3 Anil K Chopra, Dynamics of structures – Theory and applications to Earthquake

Engineering,Prentice Hall Inc., 2007.
4 Moorthy.C.V.R., Earthquake Tips, NICEE, IIT Kanpur,2002.
5

U23CEV55	INTRODUCTION TO FINITE ELEMENT METHOD	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

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

1. To develop a thorough understanding of the finite element analysis techniques with an abilityto effectively use the tools of the analysis for solving practical problems arising in CivilEngineering.
2. To learn basic principles of finite element analysis procedure.
3. To learn the theory and characteristics of finite elements that represent engineering structures.
4. To learn and apply finite element solutions to structural, thermal, dynamic problem
5. To develop the knowledge and skills needed to effectively evaluate finite element analyses.

UNIT I INTRODUCTION 09

Historical Background – Mathematical Modeling of field problems in Engineering –Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT II STIFFNESS MATRIX FORMULATION 09

Introduction to Discrete and Continua elements – Discrete Elements - Direct stiffness method - Special characteristics of stiffness matrix - Assemblage of elements – Boundary condition & reaction- 2D – truss element - 2D - beam element - Analysis of framed Structures - Basic steps in finiteelement analysis - Differential equilibrium equations - strain displacement relation - linear constitutiverelation - Numerical methods in finite element analysis- Gauss elimination method.

UNIT III ONE DIMENSIONAL PROBLEMS 09

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher orderElements – Continua Elements - Displacement models - convergence requirements. Natural coordinate systems - Shape function. Interpolation function. Linear and quadratic elements - Lagrange & Serendipity elements. Strain displacement matrix - element stiffness matrix and nodal load vector. Natural frequencies of longitudinal vibration and mode shapes.

UNIT IV TWO DIMENSIONAL PROBLEMS 09

Two dimensional isoparametric elements - Four noded quadrilateral elements - triangular elements. Computation of stiffness matrix for isoparametric elements - numerical integration (Gauss quadrature) Convergence criteria for isoparametric elements.

UNIT V ANALYSIS OF PLATES 09

Introduction to Plate Bending Problems - displacement functions – Analysis of Thin Plate – Analysisof Thick Plate - Analysis of Skew Plate, Finite Element Analysis of Shell, plane stress and planestrain analysis, Example problem using any general-purpose finite element software

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: To understand the basics of finite element formulation.
CO2: To formulate the stiffness matrix for beam, truss and framed structures.
CO3: To apply finite element formulations to solve one-dimensional problems.
CO4: To apply finite element method to solve two dimensional problems.
CO5: To apply finite element method to analyze plate bending problems.
CO6: To Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.

TEXT BOOKS

1 Rao, S.S., "The Finite Element Method in Engineering", 6th Edition, ButterworthHeinemann, 2018.
2 Reddy,J.N. "Introduction to the Finite Element Method", 4thEdition, Tata McGrawHill,2018.

REFERENCES:

1 Krishnamoorthy, C. S, Finite Element Analysis - Theory and Programming, McGraw - Hill, 1995.
2 David Hutton, Fundamentals of Finite Element Analysis, Tata McGraw Hill Publishing Company Limited, New Delhi, 2005.
3 G.R. Liu and S.S.Quek, Finite Element Method: A Practical Course, Butterworth-Heinemann; 1st edition (21 February 2003)
4 Chennakesava R. Alavala Finite Element Methods: Basic Concepts and Applications, Prentice Hall Inc., 2010.
5 R. T. Chandrupatla and A. D. Belegundu, Introduction to Finite Elements in Engineering, PHI Learning Pvt Ltd, New Delhi, 1997.
6. S. S. Bhavikatti, Finite Element Analysis, New Age Publishers, 2007.

U23CEV56 **BRIDGE ENGINEERING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. The main aim of this course is to enable students to choose the appropriate bridge type for a given project
2. To analyses and design the main components of the chosen bridge
3. The course also provides students with fundamental knowledge in a wide range of state-of-the-art practices, including code specifications, in bridge engineering

4. Completion of this course, students should have learned the analysis of bridge superstructures, foundations, bearings and deck joints.
5. Students should have learned the design of bridge's and other superstructures

UNIT I INTRODUCTION **09**

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 **09**

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 **09**

Design of Truss Bridges – Design of Plate girder bridges.

UNIT IV DESIGN OF RC AND PSC BRIDGES **09**

Design of slab bridges – T beam bridges – PSC bridges

UNIT V SUBSTRUCTURE, BEARINGS AND EXPANSION JOINTS, PARAPETS AND RAILINGS **09**

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:

On completion of the course the student will be able to

CO1: Identify loads on bridges and selection of type of bridge for the site condition
CO2: Analyze the super structure by various methods.
CO3: Design the trussed bridge and plate girder bridges
CO4: Design reinforced concrete slab and T beam bridges and prestressed concrete bridges
CO5: Design of bridge superstructures, foundations, bearings and deck joints
CO6: Analyses and design the main components of the chosen bridge

TEXT BOOKS

1 Johnson Victor D., “Essentials of Bridge Engineering”, Oxford and IBH Publishing Co., New Delhi, 2009

2 Jagadeesh. T.R. and Jayaram. M.A., "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2013

REFERENCES:

1 Phatak D.R., “Bridge Engineering”, Satya Prakashan, New Delhi, 1990.

2 Ponnuswamy S., “Bridge Engineering”, Tata McGraw-Hill, New Delhi, 1996.

3 Rajagopalan. N. “Bridge Superstructure”, Alpha Science International, 2006

U23CEV57 **TALL BUILDINGS** **L T P C**

3 0 0 3

COURSE OBJECTIVES

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

1. The design aspects and analysis methodologies of tall buildings will be introduced.
2. The stability analysis of tall buildings is another important objective of this course
3. To learn analysis and design of buildings for wind loads
4. To study design criteria for tall structures.
5. To familiarize the students about stability analysis of tall structures.
6. To study behaviour of various structural systems under wind loads

UNIT I DESIGN CRITERIA AND MATERIALS 09

Development of High Rise Structures - General Planning Considerations - Design philosophies - Materials used for Construction - High Strength Concrete - High Performance Concrete - Self Compacting Concrete - Glass - High Strength Steel

UNIT II LOADING 10

Gravity Loading - Dead Load - Live Load - Live load reduction technique - Impact Load - Construction Load - Sequential Loading. Lateral Loading - Wind load - Earthquake Load. Combination of Loads

UNIT III BEHAVIOUR OF VARIOUS STRUCTURAL SYSTEMS 11

Factors affecting growth, Height and Structural form. High rise behaviour of Various structural systems - Rigid frames, braced frames, Infilled frames, shear walls, coupled shear walls, wallframes, tubular structures, cores, outrigger - braced and hybrid mega systems.

UNIT IV ANALYSIS AND DESIGN 08

Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of buildings as total structural system considering overall integrity and major subsystem interaction, Analysis for member forces, drift and twist, computerised general three dimensional analysis.

UNIT V STABILITY OF TALL BUILDINGS 07

Overall buckling analysis of frames, wall-frames, Approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first-order and P-Delta analysis, Translational,

Torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: At the end of this course the student should have an understanding on the behaviour of tall buildings subjected to lateral building. The students should have knowledge about the rudimentary principles of designing tall buildings as per the existing codes.

CO2: To analyze and Design tall buildings.

CO3: To understand behaviour of various structural systems under different loading conditions.

CO4: To design towers, chimneys and shear walls.

CO5: To check stability of tall structures against buckling, Torsion

CO6: To apply all types loads on tall buildings according IS code

TEXT BOOKS

1 Bryan Stafford Smith, Alex coull, “Tall Building Structures, Analysis and Design”, John Wiley and Sons, Inc., 1991.

2 Taranath B.S., “Structural Analysis and Design of Tall Buildings”, McGraw Hill, 2011

REFERENCES:

1 Lin.T.Y, StotesBurry.D, “Structural Concepts and systems for Architects and Engineers”, John Wiley, 1988.

2 Lynn S.Beedle, “Advances in Tall Buildings”, CBS Publishers and Distributors, Delhi, 1986

3 Wolfgang Schueller "High Rise Building Structures", John Wiley and Sons, New York 1977..

U23CEV61 GEOENVIRONMENTAL ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. The student acquires the knowledge on the Geotechnical related Problems
2. To get an idea about soil contamination, safe disposal of waste
3. To know about different techniques to protecting environment.
4. To know soil waste stabilization, solidificationof soils,

5. To analyse various cause and ill effects of soil waste

UNIT I SOIL – WASTE INTERACTION 09

Role of Geo-environmental Engineering – sources, generation and classification of wastes – causes and consequences of soil pollution – case studies in soil failure -factors influencing soilpollutant interaction – modification of index, chemical and engineering properties – physical and physiochemical
mechanisms.

UNIT II CONTAMINANT TRANSPORT AND SITE CHARACTERISATION 09

Transport of contaminant in subsurface – advection, diffusion, dispersion – chemical process – biological process, sorption, desorption, precipitation, dissolution, oxidation, complexation, ion exchange, Volatization, biodegradation – characterization of contaminated sites – soil and rock data – hydrological and chemical data – analysis and evaluation.

UNIT III WASTE CONTAINMENT AND REMEDIATION OF CONTAMINATED SITES 09

In-situ containment – vertical and horizontal barrier – surface cover – ground water pumping systemon subsurface drain – soil remediation – Soil Vapour extraction, soil waste stabilization, solidificationof soils, electrokinetic remediation, soil heating, vitrification, bio remediation, Phyto-remediation –ground water remediation – pump and treat , In-situ flushing, permeable reacting barrier, In-situ airsparging.

UNIT IV LANDFILLS AND SURFACE IMPOUNDMENTS 09

system – Source and characteristics of waste - site selection for landfills – components of landfills – liner soil, geomembrane, geosynthetic clay, geo-composite liner system – leachate collection – final cover design – monitoring landfill - Environmental laws and regulations.

UNIT V STABILISATION OF WASTE 09

Evaluation of waste materials – flyash, municipal sludge, plastics, scrap tire, blast furnace slag, construction waste, wood waste and their physical, chemical and biological characteristics – potentialreuse – utilization of waste and soil stabilization.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

- **CO1**: Understand the various causes and consequences of waste interaction with soil and their modification
- **CO2**: Understand the various mechanism of transport of contaminants into the subsurface and characterization of contaminated sites and their risk analysis.
- **CO3**: Understand on how to decontaminate the site so as to reuse the site for human settlement
- **CO4**: Understand how to safely dispose the waste through different containment process.
- **CO5**: Expose on how to convert the waste into a resource material through soil waste stabilization techniques with or without chemical stabilization.

CO6 Students can get an ability to solve soil related problems and waste disposal

TEXT BOOKS

1 Daniel B.E, Geotechnical Practice for waste disposal, Chapman & Hall, London, 1993.

2 Hari D. Sharma and Krishna R.Reddy, Geo-Environmental Engineering – John Wiley and SonsINC, USA, 2004.

3. Wentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore, 1989.

4. Westlake, K., Landfill Waste pollution and Control, Albion Publishing Ltd., England, 1995.

REFERENCES:

1 Proceedings of the International symposium of Environmental Geotechnology (Vol.I and II) Environmental Publishing Company, 1986 and 1989.

2 Ott, W.R., Environmental Indices, Theory and Practice, Ann Arbor, 1978.

3 Fried, J.J., Ground Water Pollution, Elsevier, 1975.

4. ASTM Special Tech. Publication 874, Hydraulic Barrier in Soil and Rock, 1985.

5. Lagrega, M.d., Buckingham, P.L., and Evans, J.C., Hazardous Waste Management, McGraw Hill, Inc. Singapore, 1994.

U23CEV62 GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. Toknow various problems associated with soil deposits
2. To study various methods to evaluate soil deposits
3. To taught different techniquesto improve the characteristics ofdifficult soils
4. To taught design techniques required to implement various ground improvementmethods.
5. To know various methods to stabilize loosen soil

UNIT I HYDRAULIC MODIFICATIONS 09

Scope and necessity of ground improvement in Geotechnical engineering basic concepts. Drainage– Ground Water lowering by well points, deep wells, vacuum and electro-osmotic methods.Stabilization by thermal and freezing techniques - Applications.

UNIT II MECHANICAL MODIFICATIONS 09

Insitu compaction of granular and cohesive soils, Shallow and Deep compaction methods – Sand piles – Concept, design, factors influencing compaction. Blasting and dynamic consolidation design and relative merits of various methods – Soil liquefaction mitigation methods.

UNIT III PHYSICAL MODIFICATION 09

Preloading with sand drains, fabric drains, wick drains – theories of sand drain - Stone column with and without encased, lime stone – functions – methods of installation – design, estimation of load carrying capacity and settlement. Root piles and soil nailing – methods of installation – Design and Applications.

UNIT IV MODIFICATION BY INCLUSIONS 09

Reinforcement – Principles and basic mechanism of reinforced earth, simple design: Synthetic and natural fiber based Geotextiles and their applications. Filtration, drainage, separation, erosion control.

UNIT V CHEMICAL MODIFICATION 09

Grouting – Types of grout – Suspension and solution grouts – Basic requirements of grout. Groutingequipment – injection methods – jet grouting – grout monitoring – Electro – Chemical stabilization –Stabilization with cement, lime - Stabilization of expansive clays.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

- **CO1**: Identify and evaluate the deficiencies in the deposits of the given project area and improve its characteristics by hydraulic modifications
- **CO2**: Improve the ground characteristics by mechanical modifications using various method and design the system
- **CO3**: Improve the ground characteristics by physical modifications using various method and design the system
- **CO4**: Improve the characteristics of soils by various reinforcement techniques and design
- **CO5**: Analyse the ground and decide the suitable chemical method for improving its characteristics
- **CO6** Implement the various modification methods to improve the soil stability

TEXT BOOKS

1 Pappala, A.J.,Huang,J., Han, J., and Hoyos, L.R., Ground Improvement and Geosynthetics; Geotechnical special publication No.207, Geo Institute, ASCE, 2010

2 Cox, B.R., and Grifiths S.C., Practical Recommendation for Evaluation and mitigation of Soil Liquefaction in Arkansas, (Project Report), 2010.

3. Day, R.W., Foundation Engineering Handbook, McGraw – Hill Companies, Inc. 2006.

4. Rowe, R.K., Geotechnical and Geo-environmental Engineering Handbook, Kluwer Academic Publishers, 2001.

5. Das, B.M., Principles of Foundation Engineering, Fourth Edition, PWS Publishing, 1999.

6. Moseley, M.P., Ground Treatment, Blackie Academic and Professionals, 1998.

REFERENCES:

1 Koerner, R.M., Designing with Geosynthetics, Third Edition, Prentice Hall 1997.

2 Hehn, R.W., Practical Guide to Grouting of Underground Structures, ASCE, 1996.

3 Jewell, R.A., Soil Reinforcement with Geotextiles, CIRIA, London, 1996.

4. Koerner, R.M. and Welsh, J.P., Construction and Geotechnical Engineering using Synthetic Fabrics, John Wiley, 1990.

5. Han,J., Principles and Practice of Ground Improvement, John Wiley and Sons, New Jersey, Canada 2015.

6. Jones, J.E.P., Earth Reinforcement and Soil Structure, Butterworths, 1985.

7. Manfred R. Hausmann, Engineering Principles of Ground Modifications, McGraw-Hill Publishing Company, New York

U23CEV63 SOIL DYNAMICS AND MACHINE FOUNDATIONS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. To design different types of machine foundations based on the dynamic properties of soils And to get an exposure on vibration isolation techniques.
2. To understand the basic and engineering behavior of soil
3. To Understand basic properties of soil
4. To know different laboratory methods for determination of basic properties of soil.
5. To know how to find design machine foundation using various methods

UNIT I THEORY OF VIBRATION 09

Introduction – Nature of dynamic loads – Basic definitions – Simple harmonic motion – Fundamentalsof vibration – Single degree and multi degree of freedom systems – Free vibrations of spring – Masssystems – Forced vibrations – Resonance – Viscous damping – Principles of vibrations measuringsystems – Effect of transient and pulsating loads.

UNIT II DYNAMIC SOIL PROPERTIES 10

Dynamic stress-strain characteristics – Principles of measuring dynamic properties – Laboratory techniques – Field tests – Block vibration test – Factors affecting dynamic properties – Typical values. Mechanism of liquefaction – Influencing factors – Evaluation of liquefaction potential – Analysis from SPT test – Dynamic bearing capacity – Dynamic earth pressure.

UNIT III MACHINE FOUNDATIONS 11

Introduction – Types of machine foundations – General requirements for design of machinefoundations – Design approach for machine foundation – Vibration analysis – Elastic Half-Spacetheory – Mass-spring-dashpot model – Permissible amplitudes – Permissible bearing pressures.

UNIT IV DESIGN OF MACHINE FOUNDATION 08

Evaluation of design parameters – Types of Machines and foundations – General requirements – their importance – Analysis and design of block type and framed type machine foundations – Modesof vibration of a rigid foundation – Foundations for reciprocating machines, impact machines, Two –Cylinder vertical compressor, Double-acting steam hammer – Codalrecommendations–Empricalapproach – Barken's method – Bulb of pressure concept – Pauw's analogy – Vibration table studies.

UNIT V VIBRATION ISOLATION 07

Vibration isolation – Types of isolation – Transmissibility – Passive and active isolation – Methods ofisolation – Use of springs and damping materials – Properties of isolating materials – Vibration control of existing machine foundation.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: Acquire knowledge to apply theories of vibration to solve dynamic soil problems.
CO2: Evaluate the dynamic properties of soil using laboratory and field tests.
CO3: Acquire basic knowledge about machine foundations and design various types of machine foundation.
CO4: To know and capable of selecting the types of vibration isolation materials.
CO5: To apply vibration isolation techniques for various field problems.
CO6: Get an clear knowledge about the properties and various methods for foundation using machine

REFERENCES:

1. KameswaraRao, N.S.V., Dynamics soil tests and applications, Wheeler Publishing, New Delhi, 2000.
2. Prakash, S and Puri, V.K., Foundations for machines, McGraw Hill, 1987.
3. Moore, P.J.,Analysis and Design of Foundations for Vibrations, Oxford and IBH, 1985.
4. Vaidyanathan, C.V., and Srinivasalu, P., Handbook of Machine Foundations, McGraw Hill, 1995..
5. Arya, S., O'Nelt; S., Design of Structures and Foundations for Vibrating Machines, Prentice Hall, 1981.
6. Major, A., Vibration Analysis and Design of Foundations for Machines and Turbines, Vol. I. II and III Budapest, 1964.
7. Barkan, D.D., Dynamics of Basis of Foundation, McGraw Hill, 1974.
8. Swami Saran, Soil Dynamics and Machine Foundation, Galgotia publications Pvt. Ltd. New Delhi 2010.
9. Das B.M., Principles of Soil Dynamics, McGraw Hill, 1992.
10. Krammer S.L., Geotechnical Earthquake Engineering, Prentice Hall, International series, Pearson Education (Singapore) Pvt Ltd, 2004.
11. KameswaraRao, Vibration Analysis and Foundation Dynamics, Wheeler Publishing, New Delhi, 1998

U23CEV64 **ROCK MECHANICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

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

1. Students are expected to classify, understand stress-strain characteristics, failure criteria, and influence of in-situ stress in the stability of various structures and various technique to improve the in-situ strength of rocks
2. To understand of the mechanical behavior of rock materials,
3. To know about the rock discontinuities and rock masses.
4. To be able to analyze and to determine mechanical and engineering properties of rocks for engineering applications
5. To develop an understanding of the engineering properties of rocks, geological and engineering .

UNIT I CLASSIFICATION OF ROCKS 09

Types of Rocks - Index properties and classification of rock masses, competent and incompetent rock - value of RMR and ratings in field estimations.

UNIT II STRENGTH CRITERIA OF ROCKS 09

Behaviour of rock under hydrostatic compression and deviatric loading - Modes of rock failure planes of weakness and joint characteristics - joint testing, Mohr - Coulomb failure criterion and tension cut-off. Hoek and Brown Strength criteria for rocks with discontinuity sets.

UNIT III INSITU STRESSES IN ROCKS 09

In-situ stresses and their measurements, Hydraulic fracturing, flat jack, over coring and under coring methods - stress around underground excavations – Design aspects of openings in rocks.

UNIT IV SLOPE STABILITY AND BEARING CAPACITY OF ROCKS 09

Rock slopes - role of discontinuities in slop failure, slope analysis and factor of safety - remedial measures for critical slopes – Bearing capacity of foundations on rocks.

UNIT V ROCK STABILIZATION 09

Stabilization of rocks-rock support and rock reinforcement-active and passive supports-ground response curve-support reaction curve-reinforcement of fractured and joined rocks-Shotcreting-bolting-anchoring-installation methods.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

- **CO1**: Classify the Rock mass and rate the quality of rock for tunnelling and foundations works and suggest the safer length of tunnelling and stand-up time.
- **CO2**: Apply the knowledge of engineering and understand the stress – strain characteristics and failure criteria of rock and apply them to arrive at the shear strength parameters of rocks to be used for the design of structures resting on rock and also for the design of underground excavation in rocks.
- **CO3**: Apply the knowledge of engineering and assess the influence of in-situ stress in the stability of various underground excavations and also acquire the knowledge of design of opening in rocks
- **CO4**: Apply the knowledge on rock mechanics and analyze the stability of rock slopes and arrive at the bearing capacity of shallow and deep foundations resting on rocks considering the presence of joints. design the foundations resting on rocks.
- **CO5**: Improve the in-situ strength of rocks by various methods such as rock reinforcement and rock support. Able to select suitable support system considering the interaction between rock and support. Also capable of executing the same in the field.
- **CO6:** Able to carry-out suitable foundation for the structure resting on rock.

REFERENCES:

1 Goodman, R.E., Introduction to rock mechanics, John Willey and Sons, 1989.

2 Hudson, A. and Harrison, P., Engineering Rock mechanics – An introduction to the principles, Pergamon publications, 1997.
3 Hoek, E and Bray, J., Rock slope Engineering, Institute of Mining and Metallurgy, U.K. 1981.
4 Hoek, E and Brown, E.T., Underground Excavations in Rock, Institute of Mining and Metallurgy, U.K. 1981.
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5 Obvert, L. and Duvall, W., Rock Mechanics and the Design of structures in Rock, John Wiley, 1967.
6 Bazant, Z.P., Mechanics of Geomaterials Rocks, Concrete and Soil, John Wiley and Sons, Chichester, 1985.Wittke, W., Rock Mechanics. Theory and Applications with case Histories, Springerverlag, Berlin, 1990.
7 Waltham, T, Foundations of Engineering Geology, Second Edition, Spon Press, Taylor & Francis Group, London and New York, 2002.
8 Ramamurthy T., "Engineering in Rocks for Slopes Foundations and Tunnels", PHI Learning Pvt. Ltd., 2007

U23CEV65 **EARTH AND EARTH RETAINING STRUCTURES** **L T P C**
3 0 0 3

COURSE OBJECTIVES

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

1. At the end of this course, students are expected to gain knowledge about earth pressure theories
2. Flexibility and stability analysis of regular and earthquake forces
3. Analysis and design of cantilever and anchored sheet pile walls
4. Basic design concepts of walls and sheet piles
5. Slurry supported trenches and various types of pile walls

UNIT I EARTH PRESSURE THEORIES **09**

ntroduction – State of stress in retained soil mass – Earth pressure theories – Classical and graphical techniques (Culmann's method) – Active and passive cases – Earth pressure due to external loads.

UNIT II COMPACTION, DRAINAGE AND STABILITY OF RETAINING STRUCTURES **09**

Retaining structure – Selection of soil parameters - Lateral pressure due to compaction, strain softening, wall flexibility, drainage arrangements and its influence. – Stability analysis of retaining structure both for regular and earthquake forces.

UNIT III SHEET PILE WALLS **09**

Types of sheet piles - Analysis and design of cantilever and anchored sheet pile walls – free earth support method – fixed earth support method. Design of anchor systems - isolated and continuous

UNIT IV SUPPORTED EXCAVATIONS **09**

Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving. Earth pressure around tunnel lining, shaft and silos – Soil anchors – Soil pinning –Basic design concepts.

UNIT V SLURRY SUPPORTED EXACAVATION 09

Slurry supported trenches-basic principles-slurry characteristics-specifications-diaphragm walls-bored pile walls-contiguous pile wall-secant piles-stability analysis.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

- **CO1**: Analyse the earth pressure acting on retaining structures by applying classical theories considering all influencing parameters and suggest the earth pressure to be considered for the design of retaining structures.
- **CO2**: Apply the knowledge of engineering and earth pressure to analyse and design rigid retaining structures considering effect of compaction, wall flexibility, pore water pressure and earth quake forces
- **CO3**: Apply the knowledge of engineering and earth pressure to analyse and design flexible earth retaining walls and also acquire the knowledge of design of anchors
- **CO4**: Apply the knowledge on lateral earth pressure behind and around excavation to analyse and design braced excavations, slurry supported excavations and underground utilities
- **CO5**: To understand the role of slurry in supporting excavations and
- **CO6:** To perform stability analysis by considering the actual shape of slurry support

REFERENCES:

1 Clayton, C.R.I., Militisky, J. and Woods, R.I., Earth pressure and Earth-Retaining structures, Second Edition, Survey University Press, 1993.

2 Das, B.M., Principles of Geotechnical Engineering, Fourth Edition, The PWS series in Civil Engineering, 1998.

3 Militisky, J. and Woods, R., Earth and Earth retaining structures, Routledge,1992.

4 Winterkorn, H.F. and Fang, H.Y., Foundation Engineering Handbook, Galgotia Booksource, 2000.

5 Rowe, R.K., Geotechnical and Geo environmental Engineering Handbook, Kluwer Academic Publishers, 2001

6 Koerner, R.M. Designing with Geosynthetics, Third Edition, Prentice Hall, 1997.

7 Day, R.W., Geotechnical and Foundation Engineering: Design and Construction, McGraw Hill, 1999.

8 Mandal, J.N., Reinforced Soil and Geotextiles, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1993.

U23CEV66 **PILE FOUNDATION** **L T P C**

3 0 0 3

COURSE OBJECTIVES

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

1. The student will be exposed to the design of piles
2. pile groups and caissons with respect to vertical and lateral loads for various field conditions
3. Usage of pile and various technique employed
4. Types of soil that need pile foundation
5. Structural design of piles and cassions

UNIT I PILE CLASSIFICATIONS AND LOAD TRANSFER PRINCIPLE 09

Necessity of pile foundation – classification of piles – Factors governing choice of type of pile – Load transfer mechanism – piling equipments and methods – effect of pile installation on soil condition – pile raft system – basic interactive analysis - criteria for pile socketing.

UNIT II AXIAL LOAD CAPACITY OF PILES AND PILE GROUPS 09

Allowable load of piles and pile groups – Static and dynamic methods – for cohesive and cohesionless soil – negative skin friction – group efficiency – pile driving formulae - limitation – Wave equation application – evaluation of axial load capacity from field test results - Settlement of piles and pile group.

UNIT III LATERAL AND UPLIFT LOAD CAPACITIES OF PILES 09

Piles under Lateral loads – Broms method, elastic, p-y curve analyses – Batter piles – response to moment – piles under uplift loads – under reamed piles – Drilled shaft – Lateral and pull out capacity from load test.

UNIT IV STRUCTURAL DESIGN OF PILE AND PILE GROUPS 09

Structural design of pile – structural capacity – pile and pile cap connection – pile cap design – shape, depth, assessment and amount of steel – truss and bending theory- Reinforcement details of pile and pile caps — pile subjected to vibration.

UNIT V CAISSONS 09

Necessity of caisson – type and shape - Stability of caissons – principles of analysis and design – tilting of caisson – construction - seismic influences

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: Explain the importance of pile foundation and various functions and responsibilities of geotechnical engineer and contractor, in addition to the piling equipments.

CO2: Determine the vertical load carrying capacity of pile and pile group- keeping the settlement of pile as an important criteria based on field practices and codal provisions.

CO3: Apart from vertically loaded piles, the structures are exposed to the peculiar pile subjected to lateral and uplift load with reference to codal provision and case studies

CO4: Understand the design of pile and pile caps

CO5: Considering the wind and seismic loads

CO6: Explain the importance of caisson foundation and checking the stability of caissons based on codal provisions.

REFERENCES:

1 Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.

2 Poulos, H.G., Davis, E.H., Pile foundation analysis and design, John Wiley and Sons, New York, 1980.

3 Tomlinson, M.J. Foundation engineering, ELBS, Longman Group, U.K. Ltd., England 1995.

4 Michael Tomlinson and John Woodward, Pile design and construction practice, Taylor & Francis Group, London & New York, 2008

5 Cernica, J.N. Geotechnical Engineering Foundation Design, John Wiley and Sons, Inc. 1995

6 Bowles, J.E., Foundation Analysis and Design, Fifth Edition, McGraw Hill, New York, 1996.

7 Donald, P., Coduto, Foundation Design Principles and Practices, Prentice Hall, Inc. Englewood Cliffs, New Jersey, 1996

8 Varghese P.C.," Foundation Engineering", PHI Learning Private Limited, New Delhi, 2005

U23CEV67 **TUNNELING ENGINEERING** **L T P C**
3 0 0 3

COURSE OBJECTIVES

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

1. Students mainly focused in visualizing and critically analyzing the behavior of underground structures.
2. To give idea about the equipment used in underground excavations
3. To understand supporting systems under different loading conditions
4. Earth pressure on the underground structures
5. planning, design and construction; and deeper knowledge in four areas of tunneling

UNIT I TUNNELS AND UNDERGROUND SPACE APPLICATION 09

History-caves-tunnels for transport-water,power supply-storage of LPG –nuclear waste disposal-defence facilities-submerged tunnels-underground library,museums.

UNIT II EXCAVATION TECHNIQUES 09

Types and purpose of tunnels-choice of excavation methods-soft ground tunneling-hardrock tunneling-tunnel drilling-blasting-impact hammers-problems encountered and remedial measures

UNIT III PLANNING AND GEOMETRIC DESIGN OF TUNNELS 09

Topographical –geological survey-rock sampling-testing-determination of location size shape and alignment-subsidence problem on soft ground –tunneling design in hard rock

UNIT IV CONSTRUCTION OF TUNNEL 09

Advanced drilling techniques –TBM-cuttability assessment-shield tunneling-advantages-types of

shield tunneling-factors affecting selection of shield-twin tunnel-NATM

UNIT V DESIGN OF TUNNEL SUPPORTING SYSTEMS AND VENTILATION 09

Classification of supports-active –passive-permanent-temporary-excavation support-steel supports-lining-grouting-ground freezing-environment in underground-various methods of ventilation.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

- **CO1**: To Understand need of utilization of underground space for various applications.
- **CO2**: To study various methods of excavations and tunneling methods.
- **CO3**: Planning and design process of tunnels
- **CO4**: To identify the suitable method of tunneling
- **CO5**: To study various types of support system and its merit and demerits
- **CO6:** Design tunnels, rock support and grouting and evaluate the most important issues in the procedure

REFERENCES:

1 Underground infrastructure planning design construction-R.K.Goel, Bhavani singh, Jian Zhao, Butterworth heinemunn publishers.

2 Practical tunnel construction, Hemphill G.B 2012 Johnwileyand Son

3 Introduction to tunnel construction, David chapran, Nicole metse and Alfred stark,Spor press.

U23CEO11 ENERGY CONSERVATION AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

At the end of the course, the student is expected to

1. Understand and analyse the energy data of industries
2. Carryout energy accounting and balancing
3. Conduct energy audit and suggest methodologies for energy savings
4. Utilise the available resources in optimal ways
5. Understand the energy economics

UNIT I INTRODUCTION 09

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT II ELECTRICAL SYSTEMS 09

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT III THERMAL SYSTEMS 09

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories

UNIT IV ENERGY CONSERVATION IN MAJOR UTILITIES 09

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

UNITV ECONOMICS 09

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Remember the knowledge for Basic combustion and furnace design and selection of thermal and mechanical energy equipment.

CO2: Study the Importance of Stoichiometry relations, Theoretical air required for complete combustion.

CO3: Skills on combustion thermodynamics and kinetics.

CO4: Apply calculation and design tube still heaters.

CO5: Studied different heat treatment furnace

CO6: Practical and theoretical knowledge burner design.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

U23CEO12 TRAFFIC ENGINEERING AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

At the end of the course the students would be able

1. To give an overview of Traffic engineering
2. To study about traffic Regulation
3. To study about signal process
4. Understand the knowledge of traffic safety management
5. To Gain knowledge about various survey methods

UNIT I SOURCES OF WATER **09**

Traffic characteristics: Human, vehicular, and Pavement Characteristics, Problems- presentation of traffic volume data, Annual Average Daily Traffic, Average Daily Traffic, Design hourly traffic volume; Speed- spot speed, presentation of spot speed data, speed and delay studies, methods of conducting spot-speed studies and Speed and Delay studies; Problems Origin and Destination – methods of conducting the survey and presentation of data; parking surveys, presentation of data and analyses, determination of parking demand; Accident studies and analyses; Different problems.

UNIT II CONVEYANCE FROM THE SOURCE **09**

Traffic Flow Characteristics – Basic traffic manoeuvres, Traffic stream flow characteristics, SpeedFlow- Density Relations; Passenger Car Units – Mixed traffic flow and related issues – Concept of PCU value- Factors affecting PCU values- Recommended PCU values for different conditions; Capacity and Level of Service – Factors affecting practical capacity – Design Service Volumes

UNIT III WATER TREATMENT 09

Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation –- sand filters - Disinfection -– Construction, Operation and Maintenance aspects.

UNIT IV ADVANCED WATER TREATMENT 09

Water softening – Desalination- R.O. Plant – demineralization – Adsorption - Ion exchange– Membrane Systems - Iron and Manganese removal - Defluoridation - Construction and Operation and Maintenance aspects

UNITV WATER DISTRIBUTION AND SUPPLY 09

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : An understanding of water quality criteria and standards, and their relation to public health

CO2 : The ability to design the water conveyance system

CO3: Ahe knowledge in various unit operations and processes in water treatment

CO4: An ability to understand the various systems for advanced water treatment

CO5: An insight into the structure of drinking water distribution system

CO6: To understand about water treatment system

TEXT BOOKS:

1. Garg. S.K., "Water Supply Engineering", Khanna Publishers, Delhi, September 2008.
2. Punmia B.C, Arun K.Jain, Ashok K.Jain, " Water supply Engineering" Lakshmi publication private limited, New Delhi, 2016.

REFERENCE BOOKS:

1. Fair. G.M., Geyer.J.C., "Water Supply and Wastewater Disposal", John Wiley and Sons, 1954.
2. Babbit.H.E, and Donald.J.J, "Water Supply Engineering" , McGraw Hill book Co, 1984.
3. Steel. E.W.et al., "Water Supply Engineering" , Mc Graw Hill International book Co, 1984.
4. Duggal. K.N., "Elememts of public Health Engineering", S.Chand and Company Ltd, New Delhi, 1998

U23CEO13 INDUSTRIAL SAFETY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. To educate about the health hazards and the safety measures to be followed in the industrial environment.
2. Describe industrial legislations (Factories Acts, Workmen's Compensation and other laws) enacted for the protection of employees health at work settings
3. Describe methods of prevention and control of Occupational Health diseases, accidents / emergencies and other hazards
4. Understand aboutcontrol measures for occupational health risks
5. Carried out safty measures

UNIT I INTRODUCTION 09

Need for developing Environment, Health and Safety systems in work places - Accident Case Studies - Status and relationship of Acts - Regulations and Codes of Practice - Role of trade union safety representatives. International initiatives - Ergonomics and work place.

UNIT II OCCUPATIONAL HEALTH AND HYGIENE 09

Definition of the term occupational health and hygiene - Categories of health hazards - Exposure pathways and human responses to hazardous and toxic substances - Advantages and limitations of environmental monitoring and occupational exposure limits - Hierarchy of control measures for occupational health risks - Role of personal protective equipment and the selection criteria - Effects on humans - control methods and reduction strategies for noise, radiation and excessive stress.

UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS 09

Features of Satisfactory and Safe design of work premises – good housekeeping - lighting and colour, Ventilation and Heat Control – Electrical Safety – Fire Safety – Safe Systems of work for manual handling operations – Machine guarding – Working at different levels – Process and System Safety

UNIT IV HAZARDS AND RISK MANAGEMENT 09

Safety appraisal - analysis and control techniques – plant safety inspection – Accident investigation - Analysis and Reporting – Hazard and Risk Management Techniques – major accident hazard control – Onsite and Offsite emergency Plans.

UNIT V ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT 09

Concept of Environmental Health and Safety Management – Elements of Environmental Health and Safety Management Policy and methods of its effective implementation and review – Elements of Management Principles – Education and Training – Employee Participation.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: Describe, with example, the common work-related diseases and accidents in occupational setting

CO2: Name essential members of the Occupational Health team

CO3: What roles can a community health practitioners play in an Occupational setting to

ensure the protection, promotion and maintenance of the health of the employee

CO4: To understand about hazard managements

CO5: To learn about health of the employee

CO6: To understand about environment health and safety

TEXT BOOKS

1 "Industrial Hazards and Safety Handbook" by R W King and J Magid

2 "Explosion Hazards and Evaluation" by W E Baker

REFERENCES:

1 Management of Disasters and How to Prevent them" by O P Kharbanda and E A Stallworthy

2 "Safety and Hazards Management in Chemical Industries" by Mamta Vyas

3 "Safety In Chemical Plants/Industry And Its Management" by Rao B K

U23CEO14 GEOGRAPHICAL INFORMATION SYSTEM

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

1. To impart the knowledge on basic components
2. Understand about data preparation and implementation of Geographical Information System.
3. To learn about data output
4. Understand GPS Data Integration
5. Learn about Data Management

UNIT I FUNDAMENTALS OF GIS 09

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

UNIT II SPATIAL DATA MODELS 09

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

UNIT III DATA INPUT AND TOPOLOGY 09

Scanner - Raster Data Input – Raster Data File Formats – Georeferencing – Vector Data Input – Digitizer – Datum Projection and reprojection -Coordinate Transformation – Topology - Adjacency,

connectivity and containment – Topological Consistency – Non topological file formats - Attribute Data linking – Linking External Databases – GPS Data Integration

UNIT IV DATA QUALITY AND STANDARDS 09

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

UNIT V DATA MANAGEMENT AND OUTPUT 09

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

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

TEXT BOOKS

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

REFERENCES:

1 Lo. C. P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 2006
2 Peter A.Burrough, Rachael A.McDonnell (2000). Principles of GIS. Oxford University Press.
3 Ian Heywood (2000). An Introduction to GIS. Pearson Education Asia.
4 M G Srinivas (Edited by), "Remote sensing applications", Narosa Publishing House, 2001
5 Burrough P A., "Principles of GIS for land resource assessment", Clarendon Press, 1994.

U23CEO15 BUILDING SERVICES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. This subject covers the various aspects of pumps and machinery involved in Civil

Engineering practice and the principles of electrical and air conditioning facilities involved

2. Building water supply and drainage have been covered under subjects namely Environmental Engineering and Environmental Engineering Drawing.
3. To preserve machinery, building and services, in good operating condition.
4. Defining and identifying of engineering services systems in buildings.
5. The role of engineering services systems in providing comfort and facilitating life of users of the building.

UNIT I MACHINERIES 09

Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

UNIT II ELECTRICAL SYSTEMS IN BUILDINGS 09

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations- Computer Application design of electrical equipment handled.

UNIT III PRINCIPLES OF ILLUMINATION & DESIGN 09

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilisation factor – Depreciation factor – MSCP – MHCP – Lans of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature– Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS 09

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Subcooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type 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

UNITV FIRE SAFETY INSTALLATION 09

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like noncombustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke

detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers- Computer Application of fire satety

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Challenges and constraints in dealing with existing buildings (technical, economic, social, IEQ/wellbeing.

CO2 : Methods for evaluating existing buildings and their renovation potential

CO3: Renovation solutions

CO4: Design criteria (IEQ, energy performance)

CO5: Economic profitability of measures

CO6: To understand the fire safety

TEXT BOOKS:

1. E.R.Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York, 1968. 6.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.

REFERENCE BOOKS:

1. Philips Lighting in Architectural Design, McGraw-Hill, New York, 1964.2. 3. 4. 5.
2. R.G.Hopkinson and J.D.Kay, "The Lighting of buildings", Faber and Faber, London, 1969.
3. William H.Severns and Julian R.Fellows, "Air-conditioning and Refrigeration", John Wiley and Sons, London, 1988.
4. A.F.C. Sherratt, "Air-conditioning and Energy Conservation", the Architectural Press, London, 1980.
5. National Building Code.

U23CEO16	**GPS AND SURVEY METHODS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

1. To understand the use of Astronomy, Photogrammetry, Total Station and GPS
2. To Explain the difficulties inherent in determining heights with satellite positioning and how they can be overcome
3. To prepare a map or plan to represent an area on a horizontal plan.
4. To Demonstrate a clear understanding of the GPS signal, codes and biases
5. To Discuss the practical applications of GPS and the implications of its modernization

UNIT I ASTRONOMICAL SURVEYING 09

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 09

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

UNIT III TOTAL STATION SURVEYING 09

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 09

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.

UNITV MISCELLANEOUS 09

Reconnaissance – Rout 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 outSettlement and Deformation studies

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Students will able to know the astronomical surveying.
CO2 : do the photogrammetric surveying and interpretation
CO3: solve the field problems with Total station
CO4: know the GPS surveying and the data processing
CO5: understand the route surveys and tunnel alignments
CO6: To learn about hydrographic surveying

TEXT BOOKS:

1. James M.Anderson and Edward M.Mikhail, " Surveying, Theory and Practice", 7 th Edition, McGraw Hill, 2001.
2. Bannister and S.Raymond, "Surveying", 7 th Edition, Longman 2004.

REFERENCE BOOKS:

1. Roy S.K., "Fundamentals of Surveying", 2 nd Edition, Prentice Hall of India, 2004.
2. Arora K.R. "Surveying Vol I & II", Standard Book House, 10 th Edition 2008.
3. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer – Verlag, Berlin, 2003.
4. Seeber G, Satellite Geodesy, Water De Gruyter, Berlin,1998.
5. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1993

U23CEO17 GREEN BUILDING AND VASTU L T P C

3 0 0 3

COURSE OBJECTIVES

1. To describe the importance and necessity of green building.
2. To assess a building on the norms available for green building.
3. To suggest materials and technologies to improve energy efficiency of building.
4. To design and assess building with norms of vastu-shastra.
5. To describe about vastu of a residence existing building

UNIT I INTRODUCTION 09

Introduction of green building, Concept of green building, History of green building, Need of green building in present scenario, Importance of green building Merits and demerits, Classification of green building, Assessment methods Global assessment and certification, Local assessment, LEED India GRIHA (Green Rating for Integrated Habitat Assessment)

UNIT II PRINCIPLES AND ELEMENTS OF GREEN BUILDING 09

Sustainability: concept and reality- Climate responsive process of design: Climatic zones, design sequence, shelter or form, land form, vegetation, water bodies, street widths, open spaces, ground character, plan form, orientation,roof form- Shading devices and their effect.

UNIT III THERMAL PERFORMANCE OF BUILDING 09

Thermal comfort inside the building: Factors affecting, indices, cooling and heating requirementHeat transmission through building sections- thermal performance of building sections-simple calculation for U value and insulation thickness-Day lighting-Ventilation

UNIT IV WATER CONSERVATION 09

3 R's for water conservation, rain water harvesting, lo w flow fixtures, grey water recyclingMaterial conservation: concept of embodied energy, low energy materials, sustainable materials, alternat0ive materials Concept of carbon emission and itsreduction- Functions, policies, guidelines, Energy Conservation Building Code- Introduction to Energy efficiency softwares, carbon calculators

UNITV FUNDAMENTALS OF VASTU 09

Vastu concept: History, scientific approach, importance of shapes size and direction, vastu of a plot, elements of vastu forselecting a plot, vastu of a residence, vastu of existing building

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Students should be able to describe the importance and necessity of green building.

CO2 : Students should be able to assess a building on the norms available for green building.

CO3: Students should be able to suggest materials and technologies to improve energy

efficiency of building.

CO4: Students will able to know about water conservation concepts and concepts of carbon emission.

CO5: Students should be able to design and assess building with norms of vastu-shastra.

CO6: To learn about building construction with vastu

TEXT BOOKS:

1. Climate responsive architecture (A design hand book for energy efficient buildings), Arvind Krishnana, Simos Yannas, Nick Baker, S V Szokolay, McGraw hill Education, Seventh reprint, 2013
2. 2. RenewableEnergy and Environment -A Policy Analysis for India, H, Ravindranath, K Usha Rao, B Natarajan, P Monga, Tata McGraw Hill, 2007

REFERENCE BOOKS:

1. Energy and the Environment, JM Fowler, McGraw Hill, New York, 2nd Edition, 1984 2. 3. 4. 5.
2. Handbook on functional requirements of buildings (SP41), BIS, New Delhi, 1987
3. EnergyConservation building code (ECBC), Bureau of energy efficiency, 2011
4. A Practical Approach to Vaastu Shastra, Col.Bhaskar Sarkar,2008
5. Water supply & Sanitary Engineering by G. S. Birdie (Dhanpat Rai Publication)

U23CEO18 TEXTILE EFFLUENT TREATMENTS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To impart awareness about the pollution created by different stages of wet processing
2. To familiarize the students about the importance of water and its analysis
3. To enable the students to understand about the waste water treatment plants and various treatments carried out.
4. To Design considerations of various unit operations and processes of Water treatment facilities
5. To knowledge on need and principles of risk assessment methodologies and tools.

UNIT I INTRODUCTION **09**

Constituents of water and their effect on textile wet processing, Effluent discharge standards for inland surface water public sewers, on land for irrigation, marine coastal areas and drinking water parameters, Quality requirements of water for cotton and synthetic Textile processing.

UNIT II PRIMARY TREATMENT **09**

Characteristics and treatment of cotton, synthetics and wool processing effluents, Reduction of

pollution load, Primary treatment methods - screening, sedimentation, equalisation, neutralisation, coagulation and flocculation.

UNIT III SECONDARY TREATMENT 09

Secondary treatment methods – Trickling filtration, Activated sludge process, aerated lagoons, secondary sedimentation, oxidation ponds, Anaerobic Digestion, sludge disposal.

UNIT IV TERTIARY TREATMENT 09

Tertiary treatment – Evaporation (solar and steam), Advanced oxidation system, Membrane technologies (MF, UF, NF & RO), Reverse osmosis, ion exchange and activated carbon treatment. Quality parameters at entry and exit of RO.

UNITV AIR POLLUTION CONTROL 09

Air Pollution - Properties of air pollutants, control of air pollutants – Air pollution control equipment, Ambient air quality standards. Noise pollution – Types of noise – Noise measurement and – Control of noise pollution.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Understand the textile processing related causes for pollution

CO2 : Understand the effluent discharge standards and different processes involved in waste water treatment

CO3: Understand the concept of treatment process.

CO4: Students will able to know about air pollution control and techniques used.

CO5: Perform the research and development to produce zero discharge effluents

CO6: To learn about the treatment and air, noise pollutioncontrol

TEXT BOOKS:

1. Rao,C.S., “Environment Pollution control Engineering”, New age International Ltd. and Publishers, New Delhi, 2021.
2. Reife, A., and Freeman, H.S., (Ed), “Environmental chemistry of dyes and pigment”, Wiley. London, 2000, ISBN: 047158276.

REFERENCE BOOKS:

1. Horrockks, A.R (Ed), “Ecotextiles’98: Sustainable development”, The Text.Inst., Manchester 2021
2. Modak.P., “The textile industry and the environment”, UNEP:HMSO, Blackwells, Leeds, 2003, ISBN: 9280713671
3. Mohd Yusuf “Handbook of textile effluent remediation”1st edition ISBN: 139789814774901.
4. "Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Development,Government of India, New Delhi,2013.
5. Metcalf & Eddy, "Wastewater Engineering" – Treatment and Reuse, Tata McGraw Hill Company, New Delhi, 2010.

U23CEO21	BIODIVERSITY CONSERVATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

1. The identification of different aspects of biological diversity and conservation techniques.
2. To understand taxonomy
3. Understand about Factorsaffecting Diversity and impacts
4. Carried out wildlife sanctuaries
5. Understand National Movements and International Convention

UNIT I INTRODUCTION 09

Concept of Species, Variation; Introduction to Major Plant Groups; Evolutionary relationships between Plant Groups; Nomenclature and History of plant taxonomy; Systems of Classification and their Application; Study of Plant Groups; Study of Identification Characters; Study of important families of Angiosperms; Plant Diversity Application.

UNIT II INTRODUCTION TO ANIMAL DIVERSITY AND TAXONOMY 09

Principles and Rules of Taxonomy; ICZN Rules, Animal Study Techniques; Concepts of Taxon, Categories, Holotype, Paratype, Topotype etc; Classification of Animal kingdom, Invertebrates, Vertebrates, Evolutionary relationships between Animal Groups.

UNIT III MICROBIAL DIVERSITY 09

Microbes and Earth History, Magnitude, Occurrence and Distribution. Concept of Species, Criteria for Classification, Outline Classification of Microorganisms (Bacteria, Viruses and Protozoa); Criteria for Classification and Identification of Fungi; Chemical and Biochemical Methods of Microbial Diversity Analysis

UNIT IV MEGA DIVERSITY 09

Biodiversity Hot-spots, Floristic and Faunal Regions in India and World; IUCN Red List; Factors affecting Diversity, Impact of Exotic Species and Human Disturbance on Diversity, Dispersal, Diversity-Stability Relationship; Socio- economic Issues of Biodiversity; Sustainable Utilization of Bioresources; National Movements and International Convention/Treaties on Biodiversity.

UNITV CONSERVATIONS OF BIODIVERSITY 09

In-Situ Conservation- National parks, Wildlife sanctuaries, Biosphere reserves; Ex-situ conservation- Gene bank, Cryopreservation, Tissue culture bank; Long term captive breeding, Botanical gardens, Animal Translocation, Zoological Gardens; Concept of Keystone Species, Endangered Species, Threatened Species, Rare Species, Extinct Species

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : An insight into the structure and function of diversity for ecosystem stability.
CO2 : Understand the concept of animal diversity and taxonomy
CO3: Understand socio-economic issues pertaining to biodiversity
CO4: An understanding of biodiversity in community resource management.
CO5: Student can apply fundamental knowledge of biodiversity conservation to solve problems
CO6: To understand about biodiversity andNational Movements

TEXT BOOKS:

1. A textbook of Botany: Angiosperms- Taxonomy, Anatomy, Economic Botany & Embryology. S. Chand, Limited, Pandey, B. P. January 2001
2. Principles of Systematic Zoology, Mcgraw-Hill College, Ashlock, P.D., Latest Edition.

REFERENCE BOOKS:

1. Microbiology, MacGraw Hill Companies Inc, Prescott, L.M., Harley, J.P., and Klein D.A. (2022).
2. Microbiology, Pearson Publisher, Gerard J. Tortora, Berdell R. Funke, Christine L.Case, 13
3. Ecological Census Technique: A Handbook, Cambridge University Press, Sutherland, W
4. Encyclopedia of Biodiversity, Academic Press, Simonson Asher Levin.

U23CEO22	BIOTECHNOLOGY FOR WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To learn basics of biological process
2. Understand biomass and solid waste management
3. Understand biomass production
4. An understand Composting technologies, Composting systems
5. Manage chemicals production fromwaste

UNIT I BIOLOGICAL TREATMENT PROCESS 09

Fundamentals of biological process - Anaerobic process – Pretreatment methods in anaerobic process – Aerobic process, Anoxic process, Aerobic and anaerobic digestion of organic wastes - Factors affecting process efficiency - Solid state fermentation – Submerged fermentation – Batch and continous fermentation

UNIT II WASTE BIOMASS AND ITS VALUE ADDITION 09

Types of waste biomass – Solid waste management - Nature of biomass feedstock – Biobased economy/process – Value addition of waste biomass – Biotransformation of biomass –

Biotransformation of marine processing wastes – Direct extraction of biochemicals from biomass – Plant biomass for industrial application

UNIT III BIOCONVERSION OF WASTES TO ENERGY 09

Perspective of biofuels from wastes - Bioethanol production – Biohydrogen Production – dark and Photofermentative process - Biobutanol production – Biogas and Biomethane production - Single stage anaerobic digestion, Two stage anaerobic digestion - Biodiesel production - Enzymatic hydrolysis technologies

UNIT IV CHEMICALS AND ENZYME PRODUCTION FROM WASTES 09

Production of lactic acid, succinic acid, citric acid – Biopolymer synthesis – Production of Amylases - Lignocellulolytic enzymes - Pectinolytic enzymes - Proteases – Lipases

UNITV BIOCOMPOSTING OF ORGANIC WASTES 09

Overview of composting process - Benefitis of composting, Role of microorganisms in composting - Factors affecting the composting process - Waste Materials for Composting, Fundamentals of composting process - Composting technologies, Composting systems – Nonreactor Composting, Reactor composting - Compost Quality

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : To learn the various methods biological treatment
CO2 : To know the details of waste biomass and its value addition
CO3: To develop the bioconversion processes to convert wastes to energy
CO4: To synthesize the chemicals and enzyme from wastes
CO5: To produce the biocompost from wastes

TEXT BOOKS:

1. Antoine P. T., (2017) "Biofuels from Food Waste Applications of Saccharification Using Fungal Solid State Fermentation", CRC press
2. Joseph C A., (2019)"Anaerobic Waste-Wastewater Treatment and Biogas Plants-A Practical Handbook", CRC Press,.

REFERENCE BOOKS:

1. Palmiro P. and Oscar F.D'Urso, (2016) 'Biotransformation of Agricultural Waste and By-Products',The Food, Feed, Fibre, Fuel (4F) Economy, Elsevier
2. Kaur Brar S., Gurpreet Singh D. and Carlos R.S., (Eds), (2014)'Biotransformation of Waste Biomass into High Value Biochemicals', Springer.
3. Keikhosro K, Editor, (2015) 'Lignocellulose-Based Bioproducts', Springer.
4. John P, (2014) 'Waste Management Practices-Municipal, Hazardous, and Industrial', Second Edition, CRC Press, 2014

		L	T	P	C
U23CEO23	**REMOTE SENSING CONCEPTS**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

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

1. To introduce the concepts of remote sensing processes and its components.
2. To expose the various remote sensing platforms and sensors and to introduce the elements of
3. Undersatand about satellites
4. Learn about Concepts of Image rectification
5. Understand the Radiation sources

UNIT I REMOTE SENSING AND ELECTROMAGNETIC RADIATION 09

Definition – components of RS – History of Remote Sensing – Merits and demerits of data collation between conventional and remote sensing methods - Electromagnetic Spectrum – Radiation principles - Wave theory, Planck‘s law, Wien’s Displacement Law, Stefan’s Boltzmann law, Kirchoff‘s law – Radiation sources: active & passive - Radiation Quantities

UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL 09

Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows - Energy balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance – Spectroradiometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation, soil and water – solid surface scattering in microwave region.

UNIT III ORBITS AND PLATFORMS 09

Motions of planets and satellites – Newton‘s law of gravitation - Gravitational field and potential - Escape velocity - Kepler‘s law of planetary motion - Orbit elements and types – Orbital perturbationsand maneuvers – Types of remote sensing platforms - Ground based, Airborne platforms and Spaceborne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites –Lagrange Orbit.

UNIT IV SENSING TECHNIQUES 09

Classification of remote sensors – Resolution concept : spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors – microwave sensors – Calibration of sensors - High Resolution Sensors - LIDAR , UAV – Orbital and sensor characteristics of live Indian earth observation satellites

UNIT V DATA PRODUCTS AND INTERPRETATION 09

Photographic and digital products – Types, levels and open source satellite data products –- selection and procurement of data– Visual interpretation: basic elements and interpretation keys Digitalinterpretation–Concepts of Imagerectification,Image enhancement and Image classification

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: Understand the concepts and laws related to remote sensing
CO2: Understand the interaction of electromagnetic radiation with atmosphere and earth material
CO3: Acquire knowledge about satellite orbits and different types of satellites
CO4: Understand the different types of remote sensors
CO5: Gain knowledge about the concepts of interpretation of satellite imagery
CO6: To learn about radiation sources and digital products

TEXT BOOKS

1 Thomas M.Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York,2015.
2 George Joseph and C Jeganathan, Fundamentals of Remote Sensing,Third Edition Universities Press (India) Private limited, Hyderabad, 2018

REFERENCES:

1 Janza, F.Z., Blue H.M. and Johnson,J.E. Manual of Remote Sensing. Vol.1, American Society of Photogrametry, Virginia, USA, 2002.
2 Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press, 1995
3 Paul Curran P.J. Principles of Remote Sensing. Longman, RLBS, 1988.
4 Introduction to Physics and Techniques of Remote Sensing , Charles Elachi and Jacob Van Zyl, 2006 Edition II, Wiley Publication.
5 Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, 2011

U23CEO24 FIRE SAFETY ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:
1. To enable the students to acquire knowledge of Fire and Safety Studies
2. To learn about the effect of fire on materials used for construction, the method of test for non-
3. combustibility & fire resistance
4. To learn about fire area, fire stopped areas and different types of fire-resistant doors
5. To learn about the method of fire protection of structural members and their repair due to fire

UNIT I INHERENT SAFETY CONCEPTS 09

Compartment fire-factors controlling fire severity, ventilation controlled and fuel controlled fires; Spread of fire in rooms, within building and between buildings. Effect of temperature on the properties of structural materials- concrete, steel, masonry and wood; Behavior of non-structural materials on fire- plastics, glass, textile fibres and other house hold materials.

UNIT II PLANT LOCATIONS 09

Compartment temperature-time response at pre-flashover and post flashover periods; Equivalence of fire severity of compartment fire and furnace fire; Fire resistance test on structural elementsstandardheatingcondition,Indianstandardtestmethod,performance criteria.

UNIT III WORKING CONDITIONS 09

Fire separation between building- principle of calculation of safe distance. Design principles of fire resistant walls and ceilings; Fire resistant screens- solid screens and water curtains; Local barriers; Fire stopped areas-in roof, in fire areas and in connecting structures; Fire doors- Low combustible, Non-combustible and Spark-proof doors; method of suspension of fire doors; Air-tight sealing of doors;

UNIT IV FIRE SEVERITY AND REPAIR TECHNIQUES 09

Fabricated fire proof boards-calcium silicate, Gypsum, Vermiculite, and Perlite boards; Fire protection of structural elements - Wooden, Steel and RCC.. Reparability of fire damaged structures- Assessment of damage to concrete, steel, masonry and timber structures, Repair techniques- repair methods to reinforced concrete Columns, beams and slabs, Repair to steel structural members, Repair to masonry structures.

UNIT V WORKING AT HEIGHTS 09

Safe Access - Requirement for Safe Work Platforms- Stairways - Gangways and Ramps-Fall Prevention & Fall Protection - Safety Belts - Safety nets - Fall Arrestors- Working on Fragile Roofs -Work Permit Systems-Accident Case Studies.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: Understand the effect of fire on materials used for construction

CO2: Understand the method of test for non-combustibility and fire resistance; and will be able to select different structural elements and their dimensions for a particular fire resistance ratingof a building.

CO3: To understand the design concept of fire walls, fire screens, local barriers and fire doors and able to select them appropriately to prevent fire spread.

CO4: To decide the method of fire protection to RCC, steel, and wooden structural elements andtheir repair methods if damaged due to fire.

CO5: Describe the safety techniques and improve the analytical and intelligence to take the right decision at right time.

CO5: To understand all the requirements for safe work Platforms

TEXT BOOKS

1 Roytman, M. Y,"Principles of fire safety standards for building construction". Amerind Publishing Co. Pvt. Ltd., New Delhi,1975

2 John A. Purkiss,"Fire safety engineering design of structures" (2nd edn.), Butterworth Heinemann, Oxford, UK,2009.

REFERENCES:

1 Smith, E.E. and Harmathy, T.Z. (Editors),"Design of buildings for fire safety". ASTM Special
Publication 685, American Society for Testing and Materials, Boston, U.S.A,1979.

2 Butcher, E. G. and Parnell, A. C, "Designing of fire safety". JohnWiley and Sons Ltd., New York, U.S.A.1983.

3 Jain, V.K,"Fire safety in buildings" (2nd edn.). New Age International(P) Ltd., New Delhi,2010. 4.Hazop&Hazan,"Identifying and Assessing Process Industry Hazards", Fourth Edition ,1999

4 Frank R. Spellman, Nancy E. Whiting,"The Handbook of Safety Engineering: Principles and Applications", 2009

U23CEO25	NANOMATERIALS AND APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. Understanding the evolution of nanomaterials in the scientific era and make them to understand different types of nanomaterials for the future engineering applications
2. Gaining knowledge on dimensionality effects on different properties of nanomaterials
3. Getting acquainted with the different processing techniques employed for fabricating nanomaterials
4. Having knowledge on the different characterisation techniques employed to characterise the nanomaterials
5. Acquiring knowledge on different applications of nanomaterials in different disciplines of engineering

UNIT I NANOMATERIALS 09

Introduction, Classification: 0D, 1D, 2D, 3D nanomaterials and nano-composites, their mechanical, electrical, optical, magnetic properties; Nanomaterials versus bulk materials.

UNIT II THERMODYNAMICS & KINETICS OF NANOSTRUCTURED MATERIALS 09

Size and interface/interphase effects, interfacial thermodynamics, phase diagrams, diffusivity, grain growth, and thermal stability of nanomaterials.

UNIT III PROCESSING 09

Bottom-up and top-down approaches for the synthesis of nanomaterials, mechanical alloying,

chemical routes, severe plastic deformation, and electrical wire explosion technique.

UNIT IV STRUCTURAL CHARACTERISTICS 09

Principles of emerging nanoscale X-ray techniques such as small angle X-ray scattering and X-ray absorption fine structure (XAFS), electron and neutron diffraction techniques and their application to nanomaterials; SPM, Nanoindentation, Grain size, phase formation, texture, stress analysis

UNITV APPLICATIONS 09

Applications of nanoparticles, quantum dots, nanotubes, nanowires, nanocoatings; applications in electronic, electrical and medical industries

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Evaluate nanomaterials and understand the different types of nanomaterials
CO2 : Recognise the effects of dimensionality of materials on the properties
CO3: Process different nanomaterials and use them in engineering applications
CO4: Use appropriate techniques for characterising nanomaterials
CO5: Identify and use different nanomaterials for applications in different engineering fields.
CO6: Use the nanomaterials in medical industries

TEXT BOOKS:

1. Bhusan, Bharat (Ed), "Springer Handbook of Nanotechnology", 2nd edition, 2007.
2. Carl C. Koch (ed.), NANOSTRUCTURED MATERIALS, Processing, Properties and Potential Applications, NOYES PUBLICATIONS, Norwich, New York, U.S.A.

REFERENCE BOOKS:

1. Poole C.P, and Owens F.J., Introduction to Nanotechnology, John Wiley 2003
2. Nalwa H.S., Encyclopedia of Nanoscience and Nanotechnology, American Scientific Publishers 2004
3. Zehetbauer M.J. and Zhu Y.T., Bulk Nanostructured Materials, Wiley 2008
4. Wang Z.L., Characterization of Nanophase Materials, Wiley 2000
5. Gutkin Y., Ovid'ko I.A. and Gutkin M., Plastic Deformation in Nanocrystalline Materials, Springer 2004

U23CEO26 PLASTIC MATERIALS FOR ENGINEERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. Understand the advantages, disadvantages and general classification of plastic materials industry
2. To know the manufacturing, sources, and applications of engineering thermoplastics

3. Understand the basics as well as the advanced applications of various plastic materials in the
4. To understand the preparation methods of thermosetting materials
5. Select suitable specialty plastics for different end applications

UNIT I INTRODUCTION TO PLASTIC MATERIALS 09

Introduction to Plastics – Brief history of plastics, advantages and disadvantages, thermoplastic and thermosetting behavior, amorphous polymers, crystalline polymers and cross-linked structures. General purpose thermoplastics/ Commodity plastics: manufacture, structure, properties and applications of polyethylene (PE), cross-linked PE, chlorinated PE, polypropylene, polyvinyl chloridecompounding, formulation, polypropylene (PP)

UNIT II ENGINEERING THERMOPLASTICS AND APPLICATIONS 09

Engineering thermoplastics – Aliphatic polyamides: structure, properties, manufacture and applications of Nylon 6, Nylon 66. Polyesters: manufacture, structure, properties and uses of PET, PBT. Manufacture, structure, properties and uses of Polycarbonates, acetal resins, polyimides, PMMA, polyphenylene oxide, thermoplastic polyurethane (PU)

UNIT III THERMOSETTING PLASTICS 09

Thermosetting Plastics – Manufacture, curing, moulding powder, laminates, properties and uses of phenol formaldehyde resins, urea formaldehyde, melamine formaldehyde, unsaturated polyester resin, epoxy resin, silicone resins, polyurethane resins.

UNIT IV MISCELLANEOUS PLASTICS FOR END APPLICATIONS 09

Miscellaneous plastics- Manufacture, properties and uses of polystyrene, HIPS, ABS, SAN, poly(tetrafluoroethylene) (PTFE), TFE and copolymers, PVDF, PVA, poly (vinyl acetate), poly (vinyl carbazole), cellulose acetate, PEEK, High energy absorbing polymers, super absorbent polymerstheir synthesis, properties and applications

UNITV PLASTICS MATERIALS FOR BIOMEDICAL APPLICATIONS 09

Sources, raw materials, methods of manufacturing, properties and applications of bio-based polymers- poly lactic acid (PLA), poly hydroxy alkanoates (PHA), PBAT, bioplastics- bio-PE, bio-PP, bio-PET, polymers for biomedical applications

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : To study the importance, advantages and classification of plastic materials

CO2 : Summarize the raw materials, sources, production, properties and applications of various engineering thermoplastics

CO3: To understand the application of polyamides, polyesters and other engineering thermoplastics, thermosetting resins

CO4: Know the manufacture, properties and uses of thermosetting resins based onpolyester, epoxy, silicone and PU

CO5: To understand the engineering applications of various polymers in miscellaneous areas and applications of different biopolymers

CO6: Use plastic materials for biomedical waste

TEXT BOOKS:

1. Marianne Gilbert (Ed.), Brydson's Plastics Materials, 8 thEdn., Elsevier (2017).
2. J.A.Brydson, Plastics Materials, 7 thEdn., Butterworth Heinemann (1999).

REFERENCE BOOKS:

1. Manas Chanda, Salil K. Roy, Plastics Technology Handbook, 4 thEdn., CRC press (2006).
2. A. Brent Strong, Plastics: Materials and Processing, 3 rdEdn., Pearson Prentice Hall (2006).
3. H. Dominighaus, Plastics for Engineers, Hanser Publishers, Munich, 1988.
4. Olagoke Olabisi, Kolapo Adewale (Eds.), Handbook of Thermoplastics 2 ndEdn., CRC press (2016).
5. Charles A. Harper, Modern Plastics Handbook, McGraw-Hill, New York, 1999.

U23CEO27	INTRODUCTION TO NON-DESTRUCTIVE TESTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. Understanding the basic importance of NDT in quality assurance.
2. Imbibing the basic principles of various NDT techniques, its applications, limitations, codes and standards.
3. Equipping themselves to locate a flaw in various materials, products.
4. Applying apply the testing methods for inspecting materials in accordance with industry specifications and standards
5. Acquiring the knowledge on the selection of the suitable NDT technique for a given application

UNIT I INTRODUCTION TO NDT & VISUAL TESTING 09

Concepts of Non-destructive testing-relative merits and limitations-NDT Versus mechanical testing, Fundamentals of Visual Testing – vision, lighting, material attributes, environmental factors, visual perception, direct and indirect methods – mirrors, magnifiers, boroscopes and fibroscopes – light sources and special lighting.

UNIT II LIQUID PENETRANT & MAGNETIC PARTICLE TESTING 09

Liquid Penetrant Inspection: principle, applications, advantages and limitations, dyes, developers and cleaners, Methods & Interpretation. Magnetic Particle Inspection: Principles, applications, magnetization methods, magnetic particles, Testing Procedure, demagnetization, advantages and limitations, – Interpretation and evaluation of test indications.

UNIT III EDDY CURRENT TESTING & THERMOGRAPHY 09

Eddy Current Testing: Generation of eddy currents– properties– eddy current sensing elements,

probes, Instrumentation, Types of arrangement, applications, advantages, limitations – Factors affecting sensing elements and coil impedance, calibration, Interpretation/Evaluation. Thermography- Principle, Contact & Non-Contact inspection methods, Active & Passive methods, Liquid Crystal – Concept, example, advantages & limitations. Electromagnetic spectrum, infrared thermography- approaches, IR detectors, Instrumentation and methods, applications.

UNIT IV ULTRASONIC TESTING & AET 09

Ultrasonic Testing: Types of ultrasonic waves, characteristics, attenuation, couplants, probes, EMAT. Inspection methods-pulse echo, transmission and phased array techniques, types of scanning and displays, angle beam inspection of welds, time of flight diffraction (TOFD) technique, Thickness determination by ultrasonic method, Study of A, B and C scan presentations, calibration. Acoustic Emission Technique – Introduction, Types of AE signal, AE wave propagation, Source location, Kaiser effect, AE transducers, Principle, AE parameters, AE instrumentation, Advantages & Limitations, Interpretation of Results, Applications.

UNITV RADIOGRAPHY TESTING 09

Sources-X-rays and Gamma rays and their characteristics-absorption, scattering. Filters and screens, Imaging modalities-film radiography and digital radiography (Computed, Direct, Real Time, CT scan). Problems in shadow formation, exposure factors, inverse square law, exposure charts, Penetrameters, safety in radiography.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Realize the importance of NDT in various engineering fields.

CO2 : Have a basic knowledge of surface NDE techniques which enables to carry out various inspection in accordance with the established procedures.

CO3: Calibrate the instrument and inspect for in-service damage in the components by means of Eddy current testing as well as Thermography testing.

CO4: Differentiate various techniques of UT and AET and select appropriate NDT methods for better evaluation.

CO5: Interpret the results of Radiography testing and also have the ability to analyse the influence of various parameters on the testing.

CO5: To understand radiography and eddy current testmethods

TEXT BOOKS:

1. Baldev Raj, T. Jayakumar and M. Thavasimuthu, Practical Non Destructive Testing, Alpha Science International Limited, 3rd edition, 2002.
2. J. Prasad and C. G. K. Nair, Non-Destructive Test and Evaluation of Materials, Tata McGrawHill Education, 2nd edition, 2011.

REFERENCE BOOKS:

1. ASM Metals Handbook, V-17, "Nondestructive Evaluation and Quality Control", American Society of Metals, USA, 2001.
2. Barry Hull and Vernon John,"Nondestructive Testing", Macmillan, 1989.
3. Chuck Hellier, “Handbook of Nondestructive Evaluation”, Mc Graw Hill, 2012.

4. Louis Cartz, "Nondestructive Testing", ASM International, USA, 1995.
5. Ravi Prakash, “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010.

U23CEO28	AIR POLLUTION AND CONTROL	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.
2. To introduce students to basic concepts of pollution.
3. The contents involved the knowledge of causes of air pollution.
4. The contents involved the knowledge of health related to air pollution.
5. To develop skills relevant to control of air pollution.

UNIT I INTRODUCTION 09

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.

UNIT II METEOROLOGY 09

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise. Emerging trends in air pollution treatment, control and management

UNIT III CONTROL OF PARTICULATE CONTAMINANTS 09

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle - Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators.

UNIT IV CONTROL OF GASEOUS CONTAMINANTS 09

Factors affecting Selection of Control Equipment – Working principle - absorption, Adsorption, condensation, Incineration, Bio filters – Process control and Monitoring.

UNIT V INDOOR AIR QUALITY MANAGEMENT 09

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : An understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management

CO2 : Ability to identify, formulate and solve air and noise pollution problems

CO3: Ability to design stacks and particulate air pollution control devices to meet applicable Standards.

CO4: Ability to select control equipments.

CO5: Ability to ensure quality, control and preventive measures.

CO6: To understand concept of air pollution control and management

TEXT BOOKS:

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, springer science + science media LLC,2004.
2. Noel de Nevers, "Air Pollution Control Engineering", Waveland press,Inc 2017.

REFERENCE BOOKS:

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