CARE COLLEGE OF ENGINEERING
(An Autonomous Institution)

Approved AICTE New Delhi | Affiliated to Anna University Chennai
No 27, Thayanur, Tiruchirappalli 620 009

Regulations 2024
Undergraduate Degree
B.E. Civil Engineering
Full Time Programmes
Curriculum and Syllabus

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Chairperson
Board of Studies

HEAD
Dept. of Civil Engineering
CARE College of Engineering
Trichy-620 009.

Principal

Principal
CARE College of Engineering (Autonomous)
No. 27, Thayanur, Trichy - 620 009.

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Department of Civil Engineering

Institute Vision

Transform Lives through Education and Research.

Institute Mission

To impart quality education to students through critical thinking, creativity, leadership and spirit of entrepreneurship**.**

Institute Values

We develop in each member the ability and passion to work effectively for the betterment of humanity with cultural awareness, high ethical and moral values and a sense of social responsibility.

Department Vision

To foster excellence in Civil Engineering through Innovation, Sustainable development and Modern technologies

Department Mission

- To maintain a culture that nurtures research aptitude, environmental awareness, lifelong learning, and industry interaction.
- To imbibe innovative thinking, instil leadership quality and entrepreneurial aspiration.
- To equip students with a sharp competitive spirit and high ethical values.

CARE COLLEGE OF ENGINEERING, TIRUCHIRAPPALLI 620 009

(AN AUTONOMOUS INSTITUTION)

REGULATION 2024 CURRICULUM AND SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

B.E. CIVIL ENGINEERING

Program Educational Objectives (PEOs)

PEO1: Contribute to the development of sustainable infrastructure.
PEO2: Adopt to become part of organization or as Entrepreneurs, will pursue to learn to harness evolving technologies and materials.
PEO3: Become professional Civil Engineers with ethics and societal responsibility.

Knowledge and Attitude Profile (WK)

WK1 (**Natural Science):** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2 (Mathematics and Modelling): Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3 (Engineering Fundamentals): A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4 (Engineering Specialization): Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5 (Environmental impact on design and practice): Knowledge, including efficient resource use, environmental impacts, whole-life cost, reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
WK6 (Newer Practical Knowledge): Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7 (Engineer role and responsibility in Society): Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8 (Critical Thinking and Creativity): Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9 (Ethics and Diversity): Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Program Outcomes: On completion of the program, the graduates will be able to
PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Specific Outcomes (PSOs)

PSO1: Apply the knowledge of mathematical concepts, science and engineering principles to identify and solve complex Civil Engineering problems
PSO2: Use research-based knowledge and modern Civil Engineering tools to create professional Civil Engineers



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CURRICULUM AND SYLLABI FOR I TO VIII SEMESTERS
SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
THEORY COURSES										
1	U24MA111	Matrices and Calculus	BSC	3	1	0	4	4	40	60
2	U24GE111	Problem Solving using Python	ESC	3	0	0	3	3	40	60
3	U24HS111	Heritage of Tamils	HSMC	1	0	0	1	1	40	60
THEORY CUM PRACTICAL COURSES										
4	U24HS123	Communicative English for Engineers	HSMC	3	0	2	5	4	50	50
5	U24PH113	Engineering Physics	BSC	3	0	2	5	4	50	50
6	U24CY113	Engineering Chemistry	BSC	3	0	2	5	4	50	50
PRACTICAL COURSES										
7	U24GE122	Problem Solving using Python Laboratory	ESC	0	0	4	4	2	60	40
				16	**1**	**10**	**27**	**22**		

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
THEORY COURSES										
1	U24MA211	Statistics and Numerical Methods	BSC	3	1	0	4	4	40	60
2	U24CE221	Engineering Mechanics	ESC	3	0	0	3	3	40	60
3	U24EE211	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3	40	60
4	U24CE211	Engineering Graphics	ESC	2	0	4	6	4	40	60
5	U24HS211	Tamils and Technology	HSMC	1	0	0	1	1	40	60
THEORY CUM PRACTICAL COURSES										
6	U24HS223	Technical English for Engineers	HSMC	2	0	2	4	3	50	50
PRACTICAL COURSES										
7	U24CE232	Engineering Practices for Civil and Mechanical Engineers	ESC	0	0	4	4	2	60	40
8	U24EE222	Basic Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2	60	40
9	U24EM212	Professional development	EEC	0	0	2	2	1	100	
				14	**1**	**16**	**31**	**23**		

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
THEORY COURSES										
1	U24MA311	Transforms and Partial Differential Equations	BSC	3	1	0	4	4	40	60
2	U24CE311	Strength of Materials	PCC	3	0	0	3	3	40	60
3	U24CE321	Concrete Technology	PCC	3	0	0	3	3	40	60
4	U24CE331	Fluid Mechanics	PCC	3	0	0	3	3	40	60
5	U24CE341	Construction Materials and Technology	PCC	3	0	0	3	3	40	60
THEORY CUM PRACTICAL COURSES										
6	U24CE353	Surveying and Levelling	PCC	3	0	2	5	4	50	50
PRACTICAL COURSES										
7	U24CE362	Material Testing Laboratory	PCC	0	0	4	4	2	60	40
8	U24EM312	Design Thinking and Innovation	EEC	0	0	2	2	1	100	
				18	**1**	**8**	**27**	**23**		

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
THEORY COURSES										
1	U24CE411	Structural Analysis	PCC	3	1	0	4	4	40	60
2	U24CE421	Water Supply Engineering	PCC	3	0	0	3	3	40	60
3	U24CE431	Soil Mechanics	PCC	3	0	0	3	3	40	60
4	U24CE441	Hydrology and Water Resources Engineering	PCC	3	0	0	3	3	40	60
5	U24EM411	Aptitude Reasoning – I	EEC	1	0	0	1	1	100	
THEORY CUM PRACTICAL COURSES										
6	U24CE453	Hydraulics and Hydraulic Machinery	PCC	3	0	2	5	4	50	50
7	U24CE463	Highway and Railway Engineering	PCC	2	0	2	4	3	50	50
PRACTICAL COURSES										
8	U24CE472	Soil Mechanics Laboratory	PCC	0	0	4	4	2	60	40
9	U24EM422	Soft skill and Personality Development – I	EEC	0	0	2	2	1	100	-
				18	**1**	**10**	**29**	**24**		

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
THEORY COURSES										
1	U24CE511	Design of Reinforced Concrete Elements	PCC	3	1	0	4	4	40	60
2	U24CE521	Foundation Engineering	PCC	3	0	0	3	3	40	60
3	U24EM511	Aptitude and Reasoning – II	EEC	2	0	0	2	2	100	-
4	U24MG511	Leadership and Team Management	EEC	2	0	0	2	2	40	60
5		Professional Elective - I	PEC					3		
6		Professional Elective - II	PEC					3		
7		Mandatory Course - I*	MC	3	0	0	3	0	100	-
THEORY CUM PRACTICAL COURSES										
8	U24CE533	Waste Water Engineering	PCC	3	0	2	5	4	50	50
PRACTICAL COURSES										
9	U24CE542	Computer Aided Drafting Laboratory	PCC	0	0	4	4	2	60	40
10	U24EM522	Soft skill and Personality Development – II	EEC	0	0	2	2	1	100	
				22	**1**	**8**	**31**	**24**		

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
THEORY COURSES										
1	U24CE611	Design of Steel Structures	PCC	3	1	0	4	4	40	60
2	U24CE621	Irrigation Engineering	PCC	3	0	0	3	3	40	60
3	U24MG611	Project Management	HSMC	2	0	0	2	2	40	60
4	U24MG621	Entrepreneurship	EEC	2	0	0	2	2	40	60
5		Professional Elective – III	PEC					3		
6		Open Elective – I	OEC					3		
7		Mandatory Course - II*	MC	3	0	0	3	0	100	-
THEORY CUM PRACTICAL COURSES										
8	U24CE633	Building Information Modelling	PCC	2	0	4	6	4	50	50
PRACTICAL COURSES										
9	U24CE642	Estimation and Costing Laboratory	PCC	0	0	4	4	2	60	40
				21	**1**	**8**	**30**	**23**		

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
THEORY COURSES										
1	U24MG711	Human Values and Ethics	HSMC	2	0	0	2	2	40	60
2	U24MG721	Total Quality Management	HSMC	3	0	0	3	3	40	60
3		Professional Elective - IV	PEC					3		
4		Professional Elective - V	PEC					3		
5		Professional Elective - VI	PEC					3		
6		Open Elective II	OEC					3		
PRACTICAL COURSES										
7	U24CE712	Mini Project	EEC	0	0	4	4	2	60	40
8	U24CE722	Summer Internship*	EEC	0	0	4	4	2	100	-
				17	**0**	**8**	**25**	**21**		

*During Summer Holidays

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
PRACTICAL COURSES										
1	U24CE812	Capstone Project / Industry internship	EEC	0	0	16	16	8	60	40
				0	**0**	**16**	**16**	**8**		

PROFESSIONAL ELECTIVES

VERTICAL 1: STRUCTURAL ENGINEERING

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24CESE01	Advanced Design of Reinforced Concrete Structures	PEC	3	0	0	3	3	40	60
2	U24CESE02	Design of Steel Concrete Composite Structures	PEC	3	0	0	3	3	40	60
3	U24CESE03	Prefabricated Structures	PEC	3	0	0	3	3	40	60
4	U24CESE04	Prestressed Concrete Structures	PEC	3	0	0	3	3	40	60
5	U24CESE05	Maintenance, Repair and Rehabilitation of Structures	PEC	3	0	0	3	3	40	60
6	U24CESE06	Dynamics and Earthquake Resistant Structures	PEC	3	0	0	3	3	40	60
7	U24CESE07	Finite Element Method	PEC	3	0	0	3	3	40	60

VERTICAL 2: CONSTRUCTION PROJECT MANAGEMENT

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24CECP01	Formwork Engineering	PEC	3	0	0	3	3	40	60
2	U24CECP02	Construction Equipment and Machinery	PEC	3	0	0	3	3	40	60
3	U24CECP03	Sustainable Construction and Lean Construction	PEC	3	0	0	3	3	40	60
4	U24CECP04	Structural Masonry	PEC	3	0	0	3	3	40	60
5	U24CECP05	Construction Management and Safety	PEC	3	0	0	3	3	40	60
6	U24CECP06	Advanced Construction Techniques	PEC	3	0	0	3	3	40	60
7	U24CECP07	Energy Efficient Buildings	PEC	3	0	0	3	3	40	60

VERTICAL 3: GEO INFORMATICS

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24CEGI01	Total Station and GPS Surveying	PEC	3	0	0	3	3	40	60
2	U24CEGI02	Remote Sensing Concepts	PEC	3	0	0	3	3	40	60
3	U24CEGI03	Satellite Image Processing	PEC	3	0	0	3	3	40	60
4	U24CEGI04	Cartography and GIS	PEC	3	0	0	3	3	40	60
5	U24CEGI05	Photogrammetry	PEC	3	0	0	3	3	40	60
6	U24CEGI06	Airborne and Terrestrial laser mapping	PEC	3	0	0	3	3	40	60
7	U24CEGI07	Hydrographic Surveying	PEC	3	0	0	3	3	40	60

VERTICAL 4: ENVIRONMENTAL ENGINEERING

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24CEEE01	Climate Change Adaptation and Mitigation	PEC	3	0	0	3	3	40	60
2	U24CEEE02	Air and Noise Pollution Control Engineering	PEC	3	0	0	3	3	40	60
3	U24CEEE03	Environmental Impact Assessment	PEC	3	0	0	3	3	40	60
4	U24CEEE04	Industrial Wastewater Management	PEC	3	0	0	3	3	40	60
5	U24CEEE05	Solid and Hazardous Waste Management	PEC	3	0	0	3	3	40	60
6	U24CEEE06	Environmental Policy and Legislations	PEC	3	0	0	3	3	40	60
7	U24CEEE07	Environment, Health and Safety	PEC	3	0	0	3	3	40	60

VERTICAL 5: TRANSPORTATION ENGINEERING

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24CETE01	Airports and Harbours	PEC	3	0	0	3	3	40	60
2	U24CETE02	Traffic Engineering and Management	PEC	3	0	0	3	3	40	60
3	U24CETE03	Urban Planning and Development	PEC	3	0	0	3	3	40	60
4	U24CETE04	Smart Cities	PEC	3	0	0	3	3	40	60
5	U24CETE05	Intelligent Transport Systems	PEC	3	0	0	3	3	40	60
6	U24CETE06	Pavement Engineering	PEC	3	0	0	3	3	40	60
7	U24CETE07	Transportation Planning Process	PEC	3	0	0	3	3	40	60

OPEN ELECTIVES

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24CEOE01	Fire Safety Engineering	OEC	3	0	0	3	3	40	60
2	U24CEOE02	Geographical Information System	OEC	3	0	0	3	3	40	60
3	U24CEOE03	Nanomaterials and Applications	OEC	3	0	0	3	3	40	60
4	U24CEOE04	Biodiversity Conservation	OEC	3	0	0	3	3	40	60
5	U24CEOE05	Drinking Water Supply & Treatment	OEC	3	0	0	3	3	40	60

MANDATORY COURSES

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24MC11	Disaster Risk Reduction and Management	MC	3	0	0	3	0	100	-
2	U24MC21	Environmental Science	MC	3	0	0	3	0	100	-
3	U24MC31	History Of Science and Technology in India	MC	3	0	0	3	0	100	-
4	U24MC41	Personal Finance	MC	3	0	0	3	0	100	-
5	U24MC51	Well-Being With Traditional Practices- Yoga, Ayurveda and Siddha	MC	3	0	0	3	0	100	-

Summary
Civil Engineering

S.No	Category	Credits per Semester								Credits Total
		I	II	III	IV	V	VI	VII	VIII	
1.	HSMC	5	4				2	5		16
2.	BSC	12	4	4						20
3.	ESC	5	14							19
4.	PCC			18	22	13	13			66
5.	PEC					6	3	9		18
6.	OEC						3	3		6
7.	EEC		1	1	2	5	2	4	8	23
	Total	22	23	23	24	24	23	21	8	168

MINOR COURSES

VERTICAL 1: BUSINESS DATA ANALYTICS

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24MI401	Statistics for Management	MN	3	0	0	3	3	40	60
2	U24MI402	Datamining for Business Intelligence	MN	3	0	0	3	3	40	60
3	U24MI403	Human Resource Analytics	MN	3	0	0	3	3	40	60
4	U24MI404	Marketing and Social Media Web Analytics	MN	3	0	0	3	3	40	60
5	U24MI405	Operation and Supply Chain Analytics	MN	3	0	0	3	3	40	60
6	U24MI406	Financial Analytics	MN	3	0	0	3	3	40	60

VERTICAL 2: PUBLIC ADMINISTRATION

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24MI301	Principles of Public Administration	MC	3	0	0	3	3	40	60
2	U24MI302	Constitution of India	MC	3	0	0	3	3	40	60
3	U24MI303	Public Personnel Administration	MC	3	0	0	3	3	40	60
4	U24MI304	Administrative Theories	MC	3	0	0	3	3	40	60
5	U24MI305	Indian Administrative System	MC	3	0	0	3	3	40	60
6	U24MI306	Public Policy Administration	MC	3	0	0	3	3	40	60

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SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
THEORY COURSES										
1	U24MA111	Matrices and Calculus	BSC	3	1	0	4	4	40	60
2	U24GE111	Problem Solving using Python	ESC	3	0	0	3	3	40	60
3	U24HS111	Heritage of Tamils	HSMC	1	0	0	1	1	40	60
THEORY CUM PRACTICAL COURSES										
4	U24HS123	Communicative English for Engineers	HSMC	3	0	2	5	4	50	50
5	U24PH113	Engineering Physics	BSC	3	0	2	5	4	50	50
6	U24CY113	Engineering Chemistry	BSC	3	0	2	5	4	50	50
PRACTICAL COURSES										
7	U24GE122	Problem Solving using Python Laboratory	ESC	0	0	4	4	2	60	40
				16	1	10	27	22		

ASSESSMENT SCHEME

Sl. No	Course Type	L	T	P	C	CIA Weightage (Theory)				CIA	ESE		CIA (W)	ESE (W)	Min. Marks to Pass for 100	
						T1	A1	T2	A2	Prac	Th	Prac			ESE	Total
1	U24MA111	3	1	0	4	60	40	60	40	-	100		40	60	45	50
2	U24GE111	3	0	0	3	60	40	60	40	-	100		40	60	45	50
3	U24HS111	1	0	0	1	60	40	60	40	-	100		40	60	45	50
4	U24HS123	3	0	2	4	60	40	60	40	100	70	30	50	50	45	50
5	U24PH113	3	0	2	4	60	40	60	40	100	70	30	50	50	45	50
6	U24CY113	3	0	2	4	60	40	60	40	100	70	30	50	50	45	50
7	U24GE122	0	0	4	2	-	-	-	-	100	-	100	60	40	45	50

(W) – Weightage

U24MA111	MATRICES AND CALCULUS	L	T	P	C
		3	1	0	4

Course Objective:

- To develop the use of matrix algebra techniques those are needed to engineers for practical applications.
- To familiarize the students with differential calculus.
- To introduce the methods of solving linear and nonlinear ordinary differential equations.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.

Detailed Syllabus

UNIT I MATRICES **9+3**

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

UNIT II DIFFERENTIAL CALCULUS **9+3**

Functions of single variable – Limit of the function- Continuity and Differentiability - Mean value Theorems - Partial derivatives - Total derivative - Taylor series (in one and two variables) - Maxima and Minima (in one and two variables).

UNIT III ORDINARY DIFFERENTIAL EQUATION **9+3**

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.

UNIT IV INTEGRAL CALCULUS **9+3**

Evaluation of definite and improper integrals -Change of order of integration - Double integrals in polar coordinates - Area enclosed by plane curves - Triple integrals.

UNIT V VECTOR CALCULUS **9+3**

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

Total Periods: 60

Learning Resources

1	Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 44thEdition, New Delhi, 2015.
2	Erwin Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10thEdition, NewDelhi, 2016
3	Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10thEdition, 2016
4.	Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
5	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply the matrix algebra methods for solving practical problems.	Apply
CO2	Apply differential calculus tools in solving various Engineering problems.	Apply
CO3	Apply various techniques in solving differential equations.	Apply
CO4	Apply double and triple integration techniques in solving areas and volumes.	Apply
CO5	Evaluate of line, surface and volume integrals using Gauss, Stokes and Green's Theorems.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	-	-	-	-	2	2	-	3	-	-
CO2	3	3	3	-	-	-	-	2	2	-	3	-	-
CO3	3	3	3	-	-	-	-	2	2	-	3	-	-
CO4	3	3	3	-	-	-	-	2	2	-	3	-	-
CO5	3	3	3	-	-	-	-	2	2	-	3	-	-
Avg.	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**3**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24GE111	**PROBLEM SOLVING USING PYTHON**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

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

Detailed Syllabus

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.
UNIT V FILES, MODULES, PACKAGES 9 Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).
Total Periods: 45

Learning Resources

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.
5	John V. Guttag, Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understand Data, Third Edition, MIT Press, 2021
6	Eric Matthes, Python Crash Course: A Hands-on Project Based Introduction to Programming, 2nd Edition, No Starch Press, 2019.
7	https://www.python.org/
8	Martin C. Brown, Python: The Complete Reference, 4th Edition, McGraw Hill, 2018.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Develop algorithmic solutions to simple computational problems.	Apply
CO2	Write simple Python programs using the basic data types, expressions and statements.	Apply
CO3	Write simple Python programs using conditionals and loops for solving problems and decompose a Python program into functions.	Apply
CO4	Represent compound data types using Python lists, tuples, dictionaries, etc.	Apply
CO5	Read and write data from/to files in Python programs.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	2	1	-	2	3	3	2	-
CO2	2	2	1	2	1	-	2	3	3	2	-
CO3	2	2	1	2	1	-	2	3	3	2	-
CO4	2	2	1	3	1	-	2	3	3	2	-
CO5	2	2	1	3	1	-	2	3	3	2	-
Avg.	2	2	1	2	1	-	2	3	3	2	-

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24HS111	தமிழர்மரபு /HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

Course Objective:

- Recognize Tamil literature and its significance in Tamil culture.
- Introduce the Tamils' rich artistic and cultural legacy.
- Familiarize the different types of folk and martial arts that are unique to Tamil Nadu.
- Acquaint the concept of Thinai in Tamil literature and culture.
- Comprehend the significance of Tamil in developing Indian culture.

Detailed Syllabus

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, Leatherpuppetry, 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.	
UNIT V 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 Periods: 15

Learning Resources

1	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4.	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).
5	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology& Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
6	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author).

7	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu).
8	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Describe the various types of Tamil Literature.	Understand
CO2	Discuss about Tamil Arts and Sculpture.	Understand
CO3	Explain the Tamil Folks and Martial Arts.	Understand
CO4	Summarize the Thinai Concepts of Tamil.	Understand
CO5	Review the contribution of Tamil Culture to Indian Culture and National Movements.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	2	2	2	3	-	-	-	-
CO2	-	-	-	-	-	2	2	2	3	-	-	-	-
CO3	-	-	-	-	-	2	2	2	3	-	-	-	-
CO4	-	-	-	-	-	2	2	2	3	-	-	-	-
CO5	-	-	-	-	-	2	2	2	3	-	-	-	-
Avg.	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 Moderate (Medium), 1 – Slight (Low)

U24PH113	**ENGINEERING PHYSICS**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

Course Objective:

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves, optics and its applications.
- To introduce the basics knowledge of lasers and fibre optics.
- Equipping the students to successfully understand the importance of quantum mechanics.
- To make the students understand the basics of crystal structure and its importance in studying materials properties.

Detailed Syllabus

UNIT I MECHANICS **9**

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM Rotation of rigid bodies: Rotational kinematics – Theorems of M .I –moment of inertia of continuous bodies – torque – rotational dynamics of rigid bodies –– gyroscope - torsional pendulum – double pendulum

UNIT II ELECTROMAGNETIC WAVES AND OPTICS **9**

Maxwell's equations - wave equation; Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - Producing electromagnetic waves - Cell-phone reception, Reflection and refraction of light waves - interference –Michelson interferometer –Theory of air wedge and experiment.

UNIT III LASERS AND FIBRE OPTICS	**9**
Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO2 laser, semiconductor laser –Basic applications of lasers in industry. Fiber optics: Principle, Numerical aperture and acceptance angle –types of optical fibers (material, refractive index, mode)- fibre optic communication- losses associated with optical fibers- fibre optic sensors: pressure and displacement- medical endoscope.	
UNIT IV QUANTUM MECHANICS	**9**
Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization – particle in an infinite potential well: 1D- particle in a infinite potential well:2D and 3D Boxes (Qualitative).	
UNIT V CRYSTAL PHYSICS	**9**
Crystal structures: Crystal structures: BCC, FCC and HCP – crystal imperfections- edge and screw dislocations – grain and twin boundaries - Burgers vector and elastic strain energy- Slip systems, plastic deformation of materials and Miller indices –distance between successive planes – crystalline and noncrystalline material.	

List of Experiments (Any Seven experiments)

Sl. No	List of Experiments
1	Determination of rigidity modulus – Torsion pendulum
2	Determination of Young's modulus by non-uniform bending method
3	Determination of wavelength using Laser.
4	Determination of Numerical aperture and acceptance angle in an optical fiber.
5	Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6	Determination of thickness of a thin wire – Air wedge method
7	Determination of band gap of a semiconductor
8	Determination of Young's modulus by uniform bending method.
9	Compact disc- Determination of width of the groove using laser.
10	Simple harmonic oscillations of cantilever.
11	Spectrometer - Determination of wavelength of Mercury Spectrum using diffraction grating.
12	Michelson's interferometer -Determine the wave length of monochromatic light.
13	Melde's Experiment - Determine the Frequency of a tuning fork.
	Total Periods: 45+30

Learning Resources

1	D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2	E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
3	Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics,McGraw- Hill (Indian Edition), 2017.
4	Gaur R K and Gupta S L, "Engineering Physics", DhanpatRai Publications, 2018.
5	Charles Kittel, "Introduction to Solid State Physics", Wiley India Pvt. Ltd, 7th ed., 2017.
6	D. K. Mynbaev and Lowell L. Scheiner, Fiber Optic Communication Technology, 2011,1st Edition, Pearson, USA.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply the principles of mechanics to solve problems.	Apply
CO2	Apply the knowledge of the Maxwell's equations for electromagnetic waves and optics.	Apply
CO3	Apply the knowledge on the concepts of laser and their applications in fiber optics.	Apply
CO4	Apply quantum mechanical principles towards the formation of energy bands.	Apply
CO5	Describe the basics of crystals, their structures and defects.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	2	-	1	2	2	-	3	-	-
CO2	3	3	2	-	2	-	1	2	2	-	3	-	-
CO3	3	3	2	-	2	-	1	2	2	-	3	-	-
CO4	3	3	2	-	2	-	1	2	2	-	3	-	-
CO5	3	3	2	-	2	-	1	2	2	-	3	-	-
Avg.	**3**	**3**	**2**	**-**	**2**	**-**	**1**	**2**	**2**	**-**	**3**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CY113	**ENGINEERING CHEMISTRY**	**L**	**T**	**P**	**C**
		3	0	2	4

Course Objective:(Theory)

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

Detailed Syllabus

UNIT I WATER AND ITS TREATMENT **9**

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

UNIT II NANOCHEMISTRY **9**

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

UNIT III PHASE RULE AND COMPOSITES	**9**
Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process. **Composites:** Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). **Nano Composites:** Properties and applications of Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.	
UNIT IV FUELS AND COMBUSTION	**9**
Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel. **Combustion of fuels:** Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method.	
UNIT V ENERGY SOURCES AND STORAGE DEVICES	**9**
Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of Silicon (si) Solar cell, Wind energy, Geo thermal 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; Super capacitors: Storage principle, types and examples.	

List of Experiments

Sl. No	List of Experiments
1	Determination of types of alkalinity in a water sample.
2	Determination of amount of alkalinity in a water sample.
3	Determination of total, temporary and permanent hardness of water by EDTA method.
4	Determination of DO content of water sample by Winkler's method.
5	Determination of chloride content of water sample by Argentometric method.
6	Determination of strength of given hydrochloric acid using pH meter.
7	Determination of strength of acids in a mixture of acids using conductivity meter.
8	Conductometric titration of barium chloride against sodium sulphate (precipitation titration).
9	Conductometric titration of strong acid vs strong base.
10	Estimation of iron content of the given solution using potentiometer.
	Total Periods: 45+30

Learning Resources

1	P. C. Jain and Monica Jain, *Engineering Chemistry*, 17th Edition, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2018.
2	Sivasankar B., *Engineering Chemistry*, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2008.
3	Mary Francisca L. J., *Engineering Chemistry – I*, 1st Edition, 2004.
4	O. G. Palanna, *Engineering Chemistry*, McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Describe the water treatment processes and calculate the quality parameters of different types in water samples and apply the appropriate method to find the pH, conductance and potential values of various solutions.	Understand
CO2	Apply the concepts of nanoscience in engineering applications.	Apply
CO3	Apply the knowledge of phase rule and composites for material selection requirements.	Apply
CO4	Identify the types of fuels and calculate the calorific value and explosive range for engineering processes.	Understand
CO5	Apply suitable energy resources for engineering sectors.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	1	-	1	2	-	2	-	-
CO2	3	-	-	-	-	1	-	1	2	-	2	-	-
CO3	3	-	-	-	-	1	-	1	2	-	2	-	-
CO4	3	-	-	-	-	1	-	1	2	-	2	-	-
CO5	3	-	-	-	-	1	-	1	2	-	2	-	-
Avg.	**3**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**2**	**-**	**2**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24HS123	**COMMUNICATIVE ENGLISH FOR ENGINEERS**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

Course Objective:

To improve the communicative competence of learners

- To learn to use basic grammatical structures in suitable contexts.
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text.
- To help learners use language effectively in both informal and professional contexts.
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals

Detailed Syllabus

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION 1

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

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 8

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself.

Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II NARRATION AND SUMMATION **9**

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

UNIT III DESCRIPTION OF A PROCESS / PRODUCT **9**

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

UNIT IV CLASSIFICATION AND RECOMMENDATIONS **9**

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

UNIT V EXPRESSION **9**

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

List of Experiments

Sl. No	List of Experiments
1	Listening comprehension
2	Telephone conversation & Introductions (listening & speaking)
3	Mock Interviews
4	Narrating personal experiences
5	Short Oral Presentations
6	Advertising a product
7	Situational conversation – 3 in a team
8	Creating educational videos
9	Group discussion
10	ICT based presentations
	Total Periods: 45+30

Learning Resources

1	Communication Book, Portfolio Penguin, 2018.Authoredby Mikael Krogerus, Roman Tschäppeler.ISBN-13 : 978-0241982280.
2	Communicative English for Engineers and Professionals, Pearson Education India, 2010. Authored by Bhatnagar Nitin, ISBN: 9788131732045, 8131732045
3	English for Science & Technology, Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.
4	Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma,

	Oxford Univ. Press, 2016, New Delhi.
5	English For Technical Communication (With CD) By Aysha Viswamohan, McGraw Hill Education, ISBN : 0070264244, 2008.
6	How to win at Interviews & Group Discussions, Abhishek Publications, 2014. Authored by D. S. Cheema, ISBN: 9788182475175, 8182475171.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain different points of view during discussions.	Apply
CO2	Prepare for formal ICT based presentations and video creation.	Apply
CO3	Construct English sentences in both formal and informal contexts.	Apply
CO4	Interpret technical texts, audio materials and visual representation.	Understand
CO5	Write letters, definitions, descriptions, narrations and essays on various topics.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	1	2	3	-	3	-	-
CO2	-	-	-	-	-	-	1	2	3	-	3	-	-
CO3	-	-	-	-	-	-	1	2	3	-	3	-	-
CO4	-	-	-	-	-	-	1	2	3	-	3	-	-
CO5	-	-	-	-	-	-	1	2	3	-	3	-	-
Avg.	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**3**	**-**	**3**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24GE122	**PROBLEM SOLVING USING PYTHON LABORATORY**	**L**	**T**	**P**	**C**
		0	0	4	2

Course Objective:

- To learn about variables, operators available and how to write loops and decision statements in Python.
- To learn and implement programs using non-recursive and recursive functions.
- To learn and execute a program using different data types – String, List, Advanced List, Dictionary, Tuple, Sets, Python Modules and Packages.
- To learn how to read and write files in Python and also learn to use exception handling in Python applications for error handling.
- To build a mini project using fundamental programming constructs like variables, conditional logic, looping, and function and other required modules.

List of Experiments

S. No	List of Experiments
1	Environment setup and execute basic exercises to learn about variables and operators available in Python.
2	Execute programs using Python control flow – Python loops and control statements.
3	Implement programs using string and array in Python.
4	Write functions and pass arguments [Non-Recursive, Recursive] in Python.

5	Execute programs to learn different data types in Python – String, List, Advanced List, Dictionary, Tuple, Sets.
6	Learn and execute programs using Python modules and packages.
7	Execute programs using Python directory and files management.
8	Implement programs to learn about Python exception handling.
9	Mini Project [Group Project – Demo and Presentation].
	Total Periods: 60

Learning Resources

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.
5	Reema Thareja, Python Programming using Problem Solving Approach, Oxford University Press, 2019.
6	John V. Guttag, Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understand Data, Third Edition, MIT Press, 2021.
7	Eric Matthes, Python Crash Course: A Hands-on Project Based Introduction to Programming, 2nd Edition, No Starch Press, 2019.
8	https://www.python.org/
9	Martin C. Brown, Python: The Complete Reference, 4th Edition, McGraw Hill, 2018.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Understand and make use of variables, operators available and how to write loops and decision statements in Python.	Apply
CO2	Execute programs to implement non-recursive and recursive functions in Python.	Apply
CO3	Write Python programs using core data structures like array, string, lists, set, dictionaries and use tuples.	Apply
CO4	Use and carry out examples to handle file systems and exception handling in Python.	Apply
CO5	Deconstruct exemplary applications in Python.	Analyse

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	2	1	-	2	1	2	2	-
CO2	2	2	1	2	1	-	2	1	2	2	-
CO3	2	2	1	2	1	-	2	1	2	2	-
CO4	2	2	1	3	1	-	2	1	2	2	-
CO5	2	2	1	3	1	1	2	1	3	2	1
Avg.	**2**	**2**	**1**	**3**	**1**	**1**	**2**	**1**	**3**	**2**	**1**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
THEORY COURSES										
1	U24MA211	Statistics and Numerical Methods	BSC	3	1	0	4	4	40	60
2	U24CE221	Engineering Mechanics	ESC	3	0	0	3	3	40	60
3	U24EE211	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3	40	60
4	U24CE211	Engineering Graphics	ESC	2	0	4	6	4	40	60
5	U24HS211	Tamils and Technology	HSMC	1	0	0	1	1	40	60
THEORY CUM PRACTICAL COURSES										
6	U24HS223	Technical English for Engineers	HSMC	2	0	2	4	3	50	50
PRACTICAL COURSES										
7	U24CE232	Engineering Practices Laboratory for Civil and Mechanical Engineers	ESC	0	0	4	4	2	60	40
8	U24EE222	Basic Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2	60	40
9	U24EM212	Professional Development	EEC	0	0	2	2	1	100	
				14	1	16	31	23		

ASSESSMENT SCHEME

Sl. No	Course Type	L	T	P	C	CIA Weightage (Theory)				CIA	ESE		CIA (W)	ESE (W)	Min. Marks to Pass for 100	
						T1	A1	T2	A2	Prac	Th	Prac			ESE	Total
1	U24MA211	3	1	0	4	60	40	60	40	-	100	-	40	60	45	50
2	U24CE221	3	0	0	3	60	40	60	40	-	100	-	40	60	45	50
3	U24EE211	3	0	0	3	60	40	60	40	-	100	-	40	60	45	50
4	U24CE211	2	0	4	4	60	40	60	40	-	100	-	40	60	45	50
5	U24HS211	1	0	0	1	60	40	60	40	-	100	-	40	60	45	50
6	U24HS223	2	0	2	3	60	40	60	40	100	50	50	50	50	45	50
7	U24CE232	0	0	4	2	-	-	-	-	100	-	100	60	40	45	50
8	U24EE222	0	0	4	2	-	-	-	-	100	-	100	60	40	45	50
9	U24EM212	0	0	2	1	-	-	-	-	-	-	-	100	-	-	50

(W) – Weightage

U24MA211	STATISTICS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

Course Objective:

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

Detailed Syllabus

UNIT I TESTING OF HYPOTHESIS	**9+3**
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F- distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit	
UNIT II DESIGN OF EXPERIMENTS	**9+3**
One way and two-way classifications - Completely randomized design – Randomized block design – Latin square design.	
UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	**9+3**
Solution of algebraic and transcendental equations - Fixed point iteration method - Newton Raphson method - Solution of linear system of equations - Gauss elimination method –Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method.	
UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION	**9+3**
Lagrange's and Newton's divided difference interpolation – 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	**9+3**
Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.	
	Total Periods: 60

Learning Resources

1	Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 44th 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

3	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
4	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
5	Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition 2020

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply the concept of testing of hypothesis for small and large samples in real life problems.	Apply
CO2	Apply the basic concepts of classifications of design of experiments in the engineering field.	Apply
CO3	Determine the numerical solution of algebraic, transcendental and system of linear equations.	Apply
CO4	Apply appropriate numerical methods to solve the interpolation with equal and unequal intervals.	Apply
CO5	Determine the solution of ordinary differential equation of first order by Euler, Taylor and Runge-Kutta methods.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	-	-	-	-	2	2	-	3
CO2	3	3	3	-	-	-	-	2	2	-	3
CO3	3	3	3	-	-	-	-	2	2	-	3
CO4	3	3	3	-	-	-	-	2	2	-	3
CO5	3	3	3	-	-	-	-	2	2	-	3
Avg.	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE211	ENGINEERING GRAPHICS	L	T	P	C
		2	0	4	4

Course Objective:

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

- Drawing engineering curves.
- Drawing projection of points, lines and plane surfaces.
- Drawing orthographic projection of solids and freehand sketches.
- Drawing projection of sectioned solids and development of surfaces.
- Drawing isometric and perspective projections of simple solids.

Detailed Syllabus

UNIT I PLANE CURVES	**6+12**
Basic Geometrical constructions, Curves used in engineering practices: Conics - Construction of ellipse, parabola and hyperbola by eccentricity method - Construction of cycloid, Epicycloid and Hypocycloid - construction of involutes of square, circle and polygon - Drawing of tangents and normal to the above curves.	
UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE	**6+12**
Orthographic projection- Principles-Principal Planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method. Projection of planes (square, circle and polygon) - Inclined to H.P & V.P.	
UNIT III PROJECTION OF SOLIDS AND FREEHAND SKETCHING	**6+12**
Projection of simple solids like prisms, pyramids, cylinders, cones when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles - Representation of Three Dimensional objects - Layout of views- Freehand sketching of multiple views from pictorial views of objects.	
UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	**6+12**
Sectioning of solids (Prisms, pyramids cylinders and cones) in simple vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other - Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids - Prisms, pyramids cylinders and cones. (Inclined to H.P or V.P)	
UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS	**6+12**
Principles of isometric projection - isometric scale - isometric projections of simple solids Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple Solids-Prisms, pyramids and cylinders by visual ray method.	
	Total Periods: 90

Learning Resources

1	Bhatt N.D. and Panchal V.M., —Engineering Drawing, Charotar Publishing House, 53rd Edition, 2019.
2	Venugopal K. and Prabhu Raja V., —Engineering Graphics", New Age International (P) Limited, 2008.
3	Natrajan K.V., —A Text Book of Engineering Graphics‖, Dhanalakshmi Publishers, Chennai, 2018
4	Basant Agarwal and Agarwal C.M., —Engineering Drawing‖, McGraw Hill, 2nd Edition, 2019.
5	Gopalakrishna K.R., —Engineering Drawing‖ (Vol. I&II combined), Subhas Publications, Bangalore, 27thEdition, 2017.
6	Luzzader, Warren.J. and Duff, John M., —Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
7	Parthasarathy N. S. and Vela Murali, —Engineering Graphics‖, Oxford University, Press, New Delhi, 2015.

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Construct the conic curves, cycloids and involutes.	Apply
CO2	Solve problems involving projection of points, lines and plane surfaces	Apply
CO3	Construct projection of simple solids and Free hand sketches	Apply

CO4	Construct projection of simple sectioned solids and development of surfaces	Apply
CO5	Solve problems involving isometric and perspective projections of simple solids.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	-	-	2	2	3	-	2	2	2
CO2	3	2	2	-	-	-	2	2	3	-	2	2	2
CO3	3	2	2	-	-	-	2	2	3	-	2	2	2
CO4	3	2	2	-	-	-	2	2	3	-	2	2	2
CO5	3	2	2	-	-	-	2	2	3	-	2	2	2
Avg.	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**3**	**-**	**2**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE221	ENGINEERING MECHANICS	L	T	P	C
		3	0	0	3

Course Objective:

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

Detailed Syllabus

UNIT I STATICS OF PARTICLES **9**

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

UNIT II EQUILIBRIUM OF RIGID BODIES **9**

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

UNIT III DISTRIBUTED FORCES **9**

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

UNIT IV FRICTION **9**

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

UNIT V DYNAMICS OF PARTICLES **9**
Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact of bodies.
Total Periods: 45

Learning Resources

1	Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education.,12th Edition, 2019.
2	Vela Murali, —Engineering Mechanics-Statics and Dynamicsǁ, Oxford University Press, 2018.
3	Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
4	Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Illustrate the vectorial and scalar representation of forces and moments	Apply
CO2	Analyse the rigid body in equilibrium	Analyse
CO3	Evaluate the properties of distributed forces	Apply
CO4	Determine the friction and the effects by the laws of friction	Apply
CO5	Calculate dynamic forces exerted in rigid body	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	-	-	-	2	2	-	2	-	-
CO2	3	3	2	2	-	-	-	2	2	-	2	-	-
CO3	3	3	2	2	-	-	-	2	2	-	2	-	-
CO4	3	3	2	2	-	-	-	2	2	-	2	-	-
CO5	3	3	2	2	-	-	-	2	2	-	2	-	-
Avg.	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24EE211	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

- To understand Basic DC & AC electrical circuits
- To impart knowledge in Basic Electrical wiring & Safety and Protection.
- To understand basic principles of Transformers and Rotating Machines.
- To educate on the fundamental concepts of analog devices & digital electronics.
- To introduce the Working principle of various measuring instruments.



Detailed Syllabus

UNIT I BASIC CONCEPTS OF DC ELECTRIC CIRCUITS:	**9**
Basic Terminology, Resistances in series and parallel; Capacitors & Inductors: energy stored. Ohm's Law and Kirchhoff's Laws-Problems; Analysis of DC electric circuits: Mesh current method - Node voltage methods- Numerical problems. Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, power, power factor. solutions of sinusoidally excited R-L-C circuits.	
UNIT II ELECTRICAL WIRING	**9**
Connectors and switches, systems of wiring, domestic wiring installation, sub circuits in domestic wiring, simple control circuit in domestic installation, industrial electrification. SAFETY and PROTECTION: Safety, electric shock, first aid for electric shock and other hazards, safety rules, use of multimeters, grounding, importance of grounding, equipment grounding for safety. Protection-need for earthing, fuses and circuit breakers. Energy Tariff calculation for domestic loads.	
UNIT III ELECTRICAL DC & AC MACHINES	**9**
Constructional features, working principle of DC motor and DC generator, Emf and Voltage equations. Three phase circuit and production of rotating magnetic field. Working principle of induction motor and torque-speed characteristics (concept only). Single-Phase Transformer: Brief idea on constructional parts, classifications, working principle. EMF equation.	
UNIT IV ANALOG & DIGITAL ELECTRONICS	**9**
Semiconductor Materials: Silicon & Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor, Thyristors- Types, I-V Characteristics and Applications. Review of number systems-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems).	
UNIT V MEASUREMENTS & INSTRUMENTATION	**9**
Transducers; Definitions, Types of transducers and their applications for measurements-Classification of instruments-Types of indicating Instruments - Energy meter - multimeters – Oscilloscopes – three-phase power measurement, instrument transformers (CT and PT), DSO- Block diagram	
	Total Periods:45

Learning Resources

1	Kothari DP and I.J Nagrath, —Basic Electrical and Electronics Engineering‖, Second Edition, McGraw Hill Education, 2020
2	Sedha R.S., —A text book book of Applied Electronics‖, S. Chand & Co., 2008
3	S.K. Bhattacharya —Basic Electrical and Electronics Engineering‖, Pearson Education, Second Edition, 2017.
4	Fundamentals of Electrical and Electronics Engineering, B. L. Theraja, S. Chand and Company.REPRINT 2013, ISBN 8121926602
5	Del. Toro, —Principles of Electrical Engineering‖, Prentice Hall of India
6	A.K. Sawhney, Puneet Sawhney_ A Course in Electrical & Electronic Measurements & Instrumentation‘, Dhanpat Rai and Co, 2015.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Demonstrate a comprehensive understanding of elementary concepts in DC & AC electrical circuits.	Apply
CO2	Explain the principles and practices of electrical wiring & concepts of safety	Understand

	and protection.	
CO3	Summarize a comprehensive observation of electrical rotating machines.	Understand
CO4	Analyze the characteristics, basic concepts of analog & digital electronics.	Analyse
CO5	Classify operating principles of measuring Instruments.	Analyse

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	1	3	2	1	-
CO2	3	3	2	2	-	-	-	-	1	3	3	2	-
CO3	3	3	3	3	-	-	-	-	1	3	3	3	-
CO4	3	3	3	3	-	-	-	-	1	3	3	3	-
CO5	3	3	3	2	-	-	-	-	1	3	3	3	-
Avg.	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**3**	**3**	**3**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24HS211	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

Course Objective:

- To facilitate the student to understand weaving and technology of sangam age.
- To create an awareness on structural design of Tamils during sangam age.
- To help students to distinguish between all the levels of manufacturing technology in ancient period.
- To understand the ancient knowledge of agriculture and irrigation technology.
- To enable the students to understand the digitalization of Tamil Language.

Detailed Syllabus

UNIT I WEAVING AND CERAMIC TECHNOLOGY **3**

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

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY **3**

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 **3**

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and goldCoins 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 **3**

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.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING **3**
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 Periods: 15

Learning Resources

1	Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
3	Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K. D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies).
5	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).
6	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author).
7	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
8	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Review the Weaving and Ceramic Technology during Tamil Sangam Age.	Understand
CO2	Describe the Construction Technology and various Architecture during Tamil Sangam Age.	Understand
CO3	Discuss the Manufacturing Technology with Archeological Evidences.	Understand
CO4	Explain the Agriculture and Irrigation Technology during Tamil Sangam Age.	Understand
CO5	Describe Tamil Software and Digitalization Tamil Literatures.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	2	-	-	2	2	1	3	-	-	-	-
CO2	-	-	2	-	-	2	2	1	3	-	-	-	-
CO3	-	-	2	-	-	2	2	1	3	-	-	-	-
CO4	-	-	2	-	-	2	2	1	3	-	-	-	-
CO5	-	-	2	-	-	2	2	1	3	-	-	-	-
Avg.	**-**	**-**	**2**	**-**	**-**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



U24HS223	TECHNICAL ENGLISH FOR ENGINEERS	L	T	P	C
		2	0	2	3

Course Objective:

- To engage learners in meaningful language activities to improve their LSRW skills.
- To enhance learners' awareness of general rules of writing for specific audiences.
- To help learners understand the purpose, audience, contexts of different types of writing.
- To develop analytical thinking skills for problem solving in communicative contexts.
- To demonstrate an understanding of job applications and interviews for internship and placements.

Detailed Syllabus

UNIT I MAKING COMPARISONS	**6**
Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases.	
UNIT II EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING	**6**
Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds	
UNIT III PROBLEM SOLVING	**6**
Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences	
UNIT IV REPORTING OF EVENTS AND RESEARCH	**6**
Reading – Newspaper articles; Writing – Proposal writing - Picture description - Accident Report, Survey Report. Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions.	
UNIT V THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY	**6**
Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.	
Total Periods: 30	

List of Experiments

S. No	List of Experiments
1	Role Play Exercises Based on Workplace Contexts
2	Understand lexical items via movie clippings – Individual task
3	Discussing news stories
4	Dialogues (with cue cards)-Understand common technology terms
5	Pronunciation, Intonation, Stress and Rhythm (Level 1)
6	Pronunciation, Intonation, Stress and Rhythm (Level 2)
7	Public Speech: Talking about self in a Professional Setting, Introduction of Speakers, Vote of thanks - 3 in a team
8	Writing a short article (Can be compiled as a magazine)
9	Verbal ability exercises for competitive examinations
10	Visume
	Total Periods: 30

Learning Resources

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 Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.
3	Better English Pronunciation, (2005), J. D. O'Connor, Second Edition, ISBN-13:978-0521682589.
4	Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
5	Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
6	A Modern Approach to Verbal & Non-Verbal Reasoning - Includes Latest Questions and their Solutions, Revised Edition, R. S. Aggarwal, January 2018.

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Articulate English with proper pronunciation, intonation, stress and rhythm.	Apply
CO2	Develop verbal ability skills for attending competitive examinations.	Apply
CO3	Employ speaking and writing skills in professional contexts.	Apply
CO4	Write effective resumes in the context of job search.	Apply
CO5	Interpret the denotative and connotative meanings of technical texts.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	1	2	3	-	3	-	-
CO2	-	-	-	-	-	-	1	2	3	-	3	-	-
CO3	-	-	-	-	-	-	1	2	3	-	3	-	-
CO4	-	-	-	-	-	-	1	2	3	-	3	-	-
CO5	-	-	-	-	-	-	1	2	3	-	3	-	-
Avg.	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**3**	**-**	**3**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE232	ENGINEERING PRACTICES FOR CIVIL AND MECHANICAL ENGINEERS	L	T	P	C
		0	0	4	2

Course Objective:

- Use suitable tools for making carpentry components and pipe connections for plumbing works.
- Apply the welding techniques to join the structures.
- Performing the basic machining operations using Lathe and drilling machine.
- Apply sheet metal and foundry operations to make household products.
- Demonstrating assembly of a Fridge and household washing machine.

List of Experiments

Sl No	List of Experiments
	CIVIL ENGINEERING PRACTICES
	Plumbing Works
	Demonstrating basic plumbing operations
1	Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in households.
2	Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.
	Carpentry Works
	Demonstrating basic carpentry operations
1	Making a T-Joint
2	Making wooden furniture using carpentry operations
	MECHANICAL ENGINEERING PRACTICES
	Welding
	Demonstrating basic welding operations
1	Preparation of butt joint and lap joints by Shielded metal arc welding.
2	Studying on Gas welding practice
	Basic Machining
1	Making (simple)Turning on mild steel rod using Lathe machine
2	Making (simple) Drilling on mild steel plate using drilling machine
	Sheet metal Work
	Demonstrating basic sheet metal operations
1	Model Making of a square Tray
	Foundry Work
	Demonstrating basic foundry operations
1	Model Making of a computer Mouse
	Assembly Work
	Demonstrating basic assembly operations
1	Study on Assembling a Fridge.
2	Study on Assembling a household washing machine
	Total Periods:60

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
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 woodwork.	Apply
CO2	Apply weld techniques to join structures using arc welding	Apply
CO3	Practice simple machining work	Apply
CO4	Apply sheet metal and foundry operations to make household products.	Apply
CO5	Demonstrate assembling of a Fridge and household washing machine	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	-	2	2	2	-	-	-	3	3	2
CO2	3	3	-	-	2	2	2	-	-	-	3	3	2
CO3	3	3	-	-	2	2	2	-	-	-	3	3	2
CO4	3	3	-	-	2	2	2	-	-	-	3	3	2
CO5	3	3	-	-	2	2	2	-	-	-	3	3	2
Avg.	**3**	**3**	**-**	**-**	**2**	**2**	**2**	**-**	**-**	**-**	**3**	**3**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24EE222	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

Course Objective:

- To provide hands-on experience in the operation and testing of basic electrical circuits and components.
- To familiarize students with laboratory equipment and techniques commonly used in electrical engineering
- To promote teamwork, communication, and problem-solving abilities through collaborative laboratory activities and projects.

List of Experiments

Sl No	List of Experiments
1	To identify and understand the use of different electronic and electrical instruments.
2	Load test on separately excited DC generator
3	Load test on DC shunt motor.
4	Load test on Single phase Transformer
5	Load test on Induction motor
6	Verification of Circuit Laws
7	Three-phase Power measurement with two wattmeter methods.
8	Study of half wave and Full-wave (Bridge) rectifiers with and without capacitor filter circuit.
9	Realization of basic logic gates: Truth table verification of OR, AND, NOT, NOT and NAND logic gates
10	Study of CRO and measurement of AC signals
11	Characteristics of LVDT
	Total Periods:60

Learning Resources

1	"Basic Electrical and Electronics Engineering Laboratory Manual" Author: S. K. Bhattacharya, Debabrata Chattopadhyay Publisher: Prentice Hall India Learning Private Limited Sedha R.S., — A text book book of Applied Electronicsǁ, S. Chand & Co., 2008.
2	"Introduction to Electrical Engineering Laboratory Experiments" Author: Anthony J. Hayter, David T. Hayt Publisher: Wiley.

3	"Electrical Engineering Laboratory Experiments" Author: Allen M. Agarwal, Dr. S. T. Kamala, Dr. S. Jayalakshmi Publisher: New Age International Del. Toro, —Principles of Electrical Engineeringll, Prentice Hall of India.
4	"Fundamentals of Electric Circuits Laboratory Manual" Author: Charles K. Alexander, Matthew N. O. Sadiku Publisher: McGraw-Hill Education.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Identify and use common electrical components.	Understand
CO2	Analyze the basic characteristics of transformers and electrical machines.	Apply
CO3	Demonstrate a thorough understanding of basic electrical principles, including Ohm's Law, Kirchhoff's laws	Analyse
CO4	Distinguish of using laboratory equipment such as oscilloscopes, multimeters, LVDT	Analyse
CO5	Practice teamwork and communication skills through collaborative laboratory exercises	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	3	3	-	-	-	2	-	2	-	1
CO2	3	2	3	3	3	-	-	-	2	-	2	-	1
CO3	3	2	3	3	3	-	-	-	2	-	2	-	1
CO4	3	2	3	3	3	-	-	-	2	-	2	-	1
CO5	3	2	3	3	3	-	-	-	2	-	2	-	1
Avg.	**3**	**2**	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**1**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24EM212	**PROFESSIONAL DEVELOPMENT**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

Course Objective:

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



List of exercises

Sl. No	List of exercises
1	**MS WORD:** **10** Create and format a document Working with tables Working with Bullets and Lists Working with styles, shapes, smart art, charts Inserting objects, charts and importing objects from other office tools Creating and Using document templates Inserting equations, symbols and special characters Working with Table of contents and References, citations Insert and review comments Create bookmarks, hyperlinks, endnotes footnote Viewing document in different modes Working with document protection and security Inspect document for accessibility
2	**MS EXCEL:** **10** Create worksheets, insert and format data Work with different types of data: text, currency, date, numeric etc. Split, validate, consolidate, Convert data Sort and filter data Perform calculations and use functions:(Statistical, Logical, Mathematical, date, Time etc.,) Work with Lookup and reference formulae Create and Work with different types of charts Use pivot tables to summarize and analyse data Perform data analysis using own formulae and functions Combine data from multiple worksheets using own formulae and built-in functions to generate results Export data and sheets to other file formats Working with macros Protecting data and Securing the workbook
3	**MS POWERPOINT:** **10** Select slide templates, layout and themes Formatting slide content and using bullets and numbering Insert and format images, smart art, tables, charts Using Slide master, notes and handout master Working with animation and transitions Organize and Group slides Import or create and use media objects: audio, video, animation Perform slideshow recording and Record narration and create presentable videos
	Total Periods: 30

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Create quality documents, by structuring and organizing content for their day to day technical and academic requirements using MS Word	Apply
CO2	Perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding using MS Excel	Apply
CO3	Create high-quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects using MS Power Point	Apply

CO4	Prepare an effective report using MS word and MS Excel on any subject content	Apply
CO5	Present the report using MS Power Point	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	2	-	2	-	-
CO2	-	-	-	-	-	-	-	2	2	-	2	-	-
CO3	-	-	-	-	-	-	-	2	2	-	2	-	-
CO4	-	-	-	-	-	-	-	2	2	-	2	-	-
CO5	-	-	-	-	-	-	-	2	2	-	2	-	-
Avg.	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
THEORY COURSES										
1	U24MA311	Transforms and Partial Differential Equations	BSC	3	1	0	4	4	40	60
2	U24CE311	Strength of Materials	PCC	3	0	0	3	3	40	60
3	U24CE321	Concrete Technology	PCC	3	0	0	3	3	40	60
4	U24CE331	Fluid Mechanics	PCC	3	0	0	3	3	40	60
5	U24CE341	Construction Materials and Techonolgy	PCC	3	0	0	3	3	40	60
THEORY CUM PRACTICAL COURSES										
6	U24CE353	Surveying and Levelling	PCC	3	0	2	5	4	50	50
PRACTICAL COURSES										
7	U24CE362	Material Testing Laboratory	PCC	0	0	4	4	2	60	40
8	U24EM312	Design Thinking and Innovation	EEC	0	0	2	2	1	100	
				18	**1**	**8**	**27**	**23**		

ASSESSMENT SCHEME

Sl. No	Course Type	L	T	P	C	CIA Weightage (Theory)				CIA	ESE		CIA (W)	ESE (W)	Min. Marks to Pass for 100	
						T1	A1	T2	A2	Prac	Th	Prac			ESE	Total
1	U24MA311	3	1	0	4	60	40	60	40	-	100	-	40	60	45	50
2	U24CE311	3	0	0	3	60	40	60	40	-	100	-	40	60	45	50
3	U24CE321	3	0	0	3	60	40	60	40	-	100	-	40	60	45	50
4	U24CE331	3	0	0	3	60	40	60	40	-	100	-	40	60	45	50
5	U24CE341	3	0	0	3	60	40	60	40	-	100	-	40	60	45	50
6	U24CE353	3	0	2	5	60	40	60	40	100	70	30	50	50	45	50
7	U24CE362	0	0	4	2	-	-	-	-	100	-	100	60	40	45	50
8	U24EM312	0	0	2	1		-	-	-	-	-	-	100	-	-	50

(W) – Weightage

U24MA311	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS (Common to B.E. Mechanical Engineering)	L	T	P	C
		3	1	0	4

Course Objectives:

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

Detailed Syllabus

UNIT I PARTIAL DIFFERENTIAL EQUATIONS	**9+3**
Formation of partial differential equations–Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types- Lagrange's linear equation-Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.	
UNIT II FOURIER SERIES	**9+3**
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval's identity – Harmonic analysis.	
UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	**9+3**
Classification of PDE – Method of separation of variables - Fourier series solutions of one- dimensional wave equation–One-dimensional equation of heat conduction –Steady state solution of two-dimensional equation of heat conduction (Cartesian coordinates only).	
UNIT IV FOURIERTRANSFORMS	**9+3**
Statement of Fourier integral theorem–Fourier transform pair–Fourier sine and cosine transforms–Properties–Transforms of simple functions–Convolution theorem–Parseval's identity.	
UNIT V Z-TRANSFORMS AND DIFFERENCE EQUATIONS	**9+3**
Z-transforms - Elementary properties – Convergence of Z-transforms– Initial and final value theorems - Inverse Z-transform using partial fraction and convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms.	
	TOTAL: 60 PERIODS

Learning Resources

1	Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2019.
2	Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2022.
3	Veerarajan. T, "Transforms and Partial Differential Equation" 3rd Edition McGraw Hill Education
4	Mercy Merlin. R "Transforms and Partial Differential Equation" Charulatha Publication Private limited.
5	Narayanan. S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S. Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
6	Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics",10thEdition, Laxmi

	Publications Pvt. Ltd, 2021.
7	James. G., "Advanced Modern Engineering Mathematics", 4thEdition, Pearson Education, New Delhi, 2016.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply the concept of partial differential equation to solve the problems.	Apply
CO2	Determine the Fourier coefficients in the Fourier series expansion of the specified function of various complex problems in engineering.	Apply
CO3	Apply the Fourier series techniques in solving one and two dimensional heat flow problems.	Apply
CO4	Solve the problems in Fourier Transforms.	Apply
CO5	Solve partial differential equations using Z transform techniques.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	-	-	-	-	2	2	-	3		
CO2	3	3	3	-	-	-	-	2	2	-	3		
CO3	3	3	3	-	-	-	-	2	2	-	3		
CO4	3	3	3	-	-	-	-	2	2	-	3		
CO5	3	3	3	-	-	-	-	2	2	-	3		
Avg.	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**3**		

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE311	STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the concepts of stress, strain, and torsion in materials to evaluate their mechanical behavior.
- To analyze determinate beams and shear stress distribution and their structural implications.
- To study the behavior of columns, indeterminate beams, deflection analysis, and strain energy principles.
- To apply failure theories and truss analysis for efficient and safe structural design.

Detailed Syllabus

UNIT 1 FUNDAMENTAL CONCEPTS OF STRESS, STRAIN AND TORSION **9**

Stress & strain - Hooke's law, elastic constants - relation between elastic constants - Analysis of bars -thermal stresses - elongation of a composite bar due to temperature - Principal planes and Principal stresses - two-dimensional stress systems - Torsion on circular shafts.

UNIT 2 DETERMINATE BEAMS AND SHEAR STRESS DISTRIBUTION **9**

Types of beams, supports and loads - concept and significance of shear force and bending moment - shear force and bending moment diagram for cantilever, simply supported and

overhanging beams - simple bending theory - shear stress distribution for rectangular and I section.
UNIT 3 BEHAVIOUR OF COLUMNS AND INDETERMINATE BEAMS 9 Axial load combined bending and axial load - Euler's theory of long column – limitations – long columns under eccentric loading - Rankine, Gordon's formula - Shear force and bending moment diagram for Propped cantilever beam, continuous beam and fixed beam - Stresses in beams.
UNIT 4 DEFLECTION OF BEAMS AND STRAIN ENERGY 9 Double integration method - Macaulay's method - Moment area method - Conjugate beam method for simply supported and cantilever beams - problems in finding slope & deflection of beams. Strain energy - Maxwell's law of reciprocal deflection.
UNIT 5 THEOREM OF FAILURES AND ANALYSIS OF TRUSSES 9 Theories of failure - maximum principal stress theory - maximum principal strain theory - maximum shear stress theory - strain energy theory - shear strain energy theory - problems in finding factor of safety - Analysis of simple trusses - method of joints and tension coefficient
Total : 45 Periods

Learning Resources

1	Rajput R.K. "Strength of Materials (Mechanics of Solids)", S. Chand & company Ltd., New Delhi, 2022.
2	Rattan. S. S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2017.
3	Punmia B. C., Ashok Kumar Jain and Arun Kumar Jain, "Theory of Structures" (SMTS) Vol - II, Laxmi Publishing Pvt Ltd, New Delhi 2017.
4	Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2017
5	Singh. D.K., " Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2021
6	Egor. P.Popov, Engineering Mechanics of Solids, Prentice Hall of India, Second Edition New Delhi 2015
7	William A .Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, Tata McGraw Hill Publishing company, 2017

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply the fundamental concepts of stress, strain, and torsion to analyze various materials under various loading conditions.	Apply
CO2	Construct shear force and bending moment diagrams for determinate beams and determine the shear stress distribution	Apply
CO3	Determine the behavior and stability of columns and indeterminate beams under different loading conditions	Apply
CO4	Calculate beam deflections and apply strain energy principles.	Apply
CO5	Apply failure theories and determine forces in trusses	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	-	-	-	2	2	-	2	3	2
CO2	3	3	2	2	-	-	-	2	2	-	2	3	2
CO3	3	3	2	2	-	-	-	2	2	-	2	3	2
CO4	3	3	2	2	-	-	-	2	2	-	2	2	2
CO5	3	3	2	2	-	-	-	2	2	-	2	3	2
Avg.	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**2.8**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE321	CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objective:

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

Detailed Syllabus

UNIT I: CONSTITUENT MATERIALS	**9**
Cement – Manufacturing process - Different types - Chemical composition and Properties -Tests on cement - IS Specifications – Aggregates – Classification - Mechanical properties and tests as per BIS Grading requirements -Water - Quality of water for use in concrete.	
UNIT II: CHEMICAL AND MINERAL ADMIXTURES	**9**
Accelerators-Retarders- Plasticisers- Super plasticizers- Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline -Their effects on concrete properties	
UNIT III: PROPORTIONING OF CONCRETE MIX	**9**
Principles of Mix Proportioning-Properties of concrete related to Mix Design-Physical properties of materials required for Mix Design - Design Mix and Nominal Mix-BIS Method of Mix Design - Mix Design Examples	
UNIT IV: FRESH AND HARDENED PROPERTIES OF CONCRETE	**9**
Workability-Tests for workability of concrete-Slump Test and Compacting factor Test-Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS - Properties of Hardened concrete- Stress-strain curve for concrete-Determination of Modulus of elasticity.	
UNIT V: SPECIAL CONCRETES	**9**
Light weight concretes - High strength concrete - Fibre reinforced concrete – Ferrocement - Ready mix concrete – SIFCON - Shotcrete – Polymer concrete - High performance concrete- self compacting concrete - Geopolymer Concrete – Green concrete.	
Total Periods: 45	

Learning Resources

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

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Describe the requirements of cement, aggregates and water for concrete	Understand
CO2	Differentiate suitable admixtures for enhancing the properties of concrete	Understand
CO3	Design concrete mixes as per IS method of mix design	Apply
CO4	Determine the properties of concrete at a fresh and hardened state.	Apply
CO5	Discuss the importance of special concrete for specific requirements.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	-	-	-	-	2	2	-	2	2	2
CO2	3	3	-	-	-	-	-	2	2	-	2	2	2
CO3	3	3	3	3	-	-	-	2	2	-	2	2	2
CO4	3	3	-	-	-	-	-	2	2	-	2	2	2
CO5	3	3	-	-	-	-	-	2	2	-	3	2	2
Avg.	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE331	FLUID MECHANICS	L	T	P	C
		3	0	0	3

Course Objective:

- To introduce the students about properties and behaviour of the fluids under static conditions and to impart basic knowledge of the dynamics of fluids through the control volume approach and to expose to the applications of the conservation laws to a) flow measurements
- Flow through pipes (both laminar and turbulent) and
- Forces on pipe bends with an exposure to the significance of boundary layer theory and its applications

Detailed Syllabus

UNIT I FLUIDS PROPERTIES AND FLUID STATICS **9**

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

UNIT II BASIC CONCEPTS OF FLUID FLOW **9**

Kinematics: Classification of flows – Streamline, streak-line and path-lines – Stream function and velocity potentials – Flow nets; Dynamics: Application of control volume to continuity, energy and momentum – Euler's equation of motion along a streamline – Bernoulli's equation – Applications to velocity and discharge measurements – Linear momentum equation – Application to Pipe bends – Moment of momentum equation.

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES **9**

Fundamental dimensions – Dimensional homogeneity – Rayleigh's method and Buckingham Pi theorem – Dimensionless parameters – Similitude and model studies – Distorted and undistorted models.

UNIT IV INCOMPRESSIBLE VISCOUS FLOW **9**

Reynolds experiment – Laminar flow in pipes and between parallel plates – Development of laminar and turbulent flows in pipes – Darcy-Weisbach equation – Moody diagram – Major and minor losses

of flow in pipes – Total energy line – Hydraulic grade line – Siphon – Pipes in series and parallel – Equivalent pipes.
UNIT V BOUNDARY LAYERS **9** Definition of boundary layers – Laminar and turbulent boundary layers – Displacement, momentum and energy thickness – Momentum integral equation – Applications – Separation of boundary layer – Drag and Lift forces.
Total Periods: 45

Learning Resources

1	Bansal R.K, “A Text Book of Fluid Mechanics and Hydraulic Machines” Lakshmi Publications, New Delhi, 11th Edition 2023
2	Modi P.N and Seth S.M, “Hydraulics and Fluid Mechanics Including Hydraulic Machines” Standard Book House” New Delhi, 22nd Edition 2019
3	Streeter, V.L. Wylie, E. B. and Bedford K.W, Fluid Mechanics. (9th Ed.) Tata McGraw Hill, New Delhi, 1998.
4	Chandramouli P N, Applied Hydraulic Engineering, Yes Dee Publisher, 2017
5	Ven Te Chow, Open Channel Hydraulics, McGraw Hill, New York, 2015.
6	Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 19th edition, 2013.
7	Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2019.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Differentiate between solid and fluid properties and its behaviour in static conditions.	Understand
CO2	Apply the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.	Apply
CO3	Correlate the parameters in the given fluid phenomenon and to predict the performance of prototypes by model studies.	Apply
CO4	Estimate the losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel.	Apply
CO5	Explain the concept of boundary layer and its application to find the drag force excreted by the fluid on the flat solid surface.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2				2	2		2	3	2
CO2	3	2	2	2				2	2		2	3	2
CO3	3	3	3	2				2	2		2	3	2
CO4	3	3	3	2				2	2		2	3	2
CO5	3	3	3	2				2	2		2	3	2
Avg.	**3**	**3**	**3**	**2**				**2**	**2**		**2**	**3**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE341	CONSTRUCTION MATERIALS AND TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the properties, selection criteria, and applications of traditional and modern building materials.
- To gain knowledge of various construction practices, service requirements, and structural components essential for building design.
- To explore the selection and utilization of construction equipment for efficient material handling and structural execution.
- To understand the role of sustainable and advanced materials in enhancing construction durability, energy efficiency, and environmental impact.

Detailed Syllabus

UNIT I STONES - BRICKS - CONCRETE BLOCKS – LIME	**9**
Stone as building material – Criteria for selection – Tests on stones – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive strength – Water Absorption – Efflorescence – Lime– Preparation of lime mortar – Concrete hollow blocks – Lightweight concrete blocks.	
UNIT II BUILDING MATERIALS AND THEIR APPLICATIONS	**9**
Timber – Market forms – Plywood – Veneer – False ceiling materials – Steel – Mechanical treatment – Aluminum – Uses – Market forms – Glass – Ceramics – Refractories – Composite Materials – Types and applications – FRP – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement.	
UNIT III CONSTRUCTION PRACTICES & SERVICE REQUIREMENTS	**9**
Types of Foundations – Shallow and Deep Foundations – Stone Masonry – Brick Masonry – Plastering and Pointing – Cavity Walls – Diaphragm Walls – Formwork – Centering and Shuttering – Shoring – Scaffolding – Underpinning – Roofing – Flooring – Joints in concrete – Contraction/Construction/Expansion joints – Fire Protection – Thermal Insulation – Ventilation and Air conditioning – Acoustics and Sound Insulation – Damp Proofing.	
UNIT IV CONSTRUCTION EQUIPMENTS	**9**
Selection of equipment for earthwork excavation, concreting, material handling and erection of structures – Dewatering and pumping equipment.	
UNIT V MODERN AND SUSTAINABLE MATERIALS	**9**
Acoustic and Thermal Insulation Materials-Cork, sheep wool, straw panels, and aerogel-based insulations. –Nano Materials in Construction-Nanoparticles, Nano coatings, and their role in enhancing material properties.– 3D Printing in Construction- Additive manufacturing, printable materials, and sustainability benefits- Carbon-Sequestering Materials-Carbon-negative concrete, CO_2-absorbing bricks, and their role in sustainability.– Bacteria-based self-healing concrete, - Green roofs, cool roofs –waste based materials, and recycled plastics in construction.	
	Total Periods:45

Learning Resources

1	Varghese. P. C, Building Materials, Second Edition PHI Learning Ltd., 2015.
2	Arora S.P and Bindra S.P Building construction, Dhanpat Rai and sons, 2022.
3	Punmia, B.C Building construction, Laxmi publication (p) ltd.,2023
4	Varghese. P. C, Building Construction, Second Edition PHI Learning ltd., 2016
5	Peurifoy R.L., Schexnayder, C. J., Shapira A., Schmitt. R., Construction Planning Equipment and Methods, Tata McGraw-hill, 2024.
6	Srinath L.S., PERT and CPM -Principles and applications, Affiliated East West Press 2023

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Describe the good quality brick, stone and blocks for construction.	Understand
CO2	Summarize the market forms of timber, steel, aluminum and applications of various composite materials.	Understand
CO3	Explain the best construction and service practices such as thermal insulations and air conditioning of the building	Understand
CO4	Differentiate the various equipment for construction works conditioning of building	Understand
CO5	Discuss the modern and sustainable construction materials	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2						2	2		2	3	3
CO2	3	2						2	2		2	3	3
CO3	3	2						2	2		2	3	3
CO4	3	3						2	2		2	3	3
CO5	3	3						2	2		2	3	3
Avg.	**3**	**2**						**2**	**2**		**2**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE353	**SURVEYING AND LEVELLING**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

Course Objective:

- To understand the fundamentals of surveying and the application of its practices.
- To identify the suitable method of surveying for various measurement processes in civil engineering.
- To apply appropriate surveying methods in field measurements for accurate data collection.
- To perform integrated laboratory experiments to gain practical exposure to surveying procedures and measuring practices.

Detailed Syllabus

UNIT I FUNDAMENTALS OF SURVEYING AND MEASUREMENT OF ANGLES **9**

Surveying: Definition, Principles and Classifications - Bearings and Azimuth - Conventional tools for angle measurement: Compass Traversing, Open Traverse, Closed Traverse, Theodolite: Repetition and Reiteration - Error Correction: Local Attraction, Law of Weights, Most Probable value.

UNIT II MEASUREMENT OF ELEVATION **9**

Levelling: Definition, Datum, Benchmarks, Classifications – Curvature and Refraction - Contouring - Conventional tools for levelling: Dumpy level and Tilting level, Rise and Fall method, Height of Collimation method - Trigonometric Levelling: Single plane and Double plane.

UNIT III MEASUREMENT OF DISTANCE **9**

Conventional methods of Distance measurements: Chaining and Ranging, Tape - Heights and distances – Tacheometric surveying – Stadia Tacheometry – Tangential Tacheometry – Trigonometric levelling – Single Plane method – Double Plane method

UNIT IV CONTROL SURVEYING AND ADJUSTMENT	**9**
Horizontal and vertical control – Methods – Triangulation – Traversing – Trilateration – Concepts of measurements and errors – Error propagation and Linearization – Adjustment methods - Least square methods – Angles, lengths and levelling network.	
UNIT V MODERN SURVEYING	**9**
Total Station: Digital Theodolite, EDM, Electronic field book – Advantages – Parts and accessories – Working principle – Observables – Errors - COGO functions – Field procedure and applications - GPS: Advantages – System components – Signal structure – Selective availability and antispoofing receiver components and antenna – Planning and data acquisition – Data processing – Errors in GPS – Field procedure and applications.	
	Total Periods: 45

List of Experiments

S. No	List of Experiments
1	Compass Traversing – Measuring Bearings & arriving included angles
2	Measurements of angles by using Theodolite
3	Fly levelling using Dumpy level
4	Check levelling using Dumpy level
5	Determination of elevation of an object using single plane method when base is Accessible/inaccessible.
6	Determination of Tacheometric Constants
7	Heights and distances by stadia Tacheometry
8	Heights and distances by Tangential Tacheometry
9	Recording and setting out of levels using Total Station
10	Determination of Distance and angles using Total Station
11	Construction survey practices - Area and Volume Calculation using Total Station
12	Data Acquisition of Position and Elevation using GPS Survey
	Total Periods: 45 + 30

Learning Resources

1	Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, Sixteenth Edition, 2016.
2	T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008.
3	R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
4	S. K. Roy, Fundamentals of Surveying, Second Edition, Prenticeˆ Hall of India2010
5	K. R. Arora, Surveying Vol I & II, Standard Book house, Twelfth Edition 2013.
6	C. Venkatramaiah, Textbook of Surveying, Universities Press, Second Edition, 2011.

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Determine angles using tools like theodolites and compasses and correct errors using surveying principles and techniques	Apply
CO2	Compute terrain levels and ground features using the levelling methods and considering curvature and refraction.	Apply

CO3	Solve complex distance and height measurements in fieldwork implementing Theodolite Surveying concepts.	Apply
CO4	Establish horizontal and vertical control using triangulation, traversing, and adjustment methods.	Apply
CO5	Operate modern surveying instruments like Total Stations and GPS for field procedures and error evaluation.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2	-	-	2	2		2	3	2
CO2	3	2	2	2	2	-	-	2	2		2	3	2
CO3	3	2	2	2	2	-	-	2	2		2	3	2
CO4	3	2	2	2	2	-	-	2	2		2	3	3
CO5	3	2	2	2	2	-	-	2	2		2	3	3
Avg.	3	2	2	2	2	-	-	2	2		2	3	2.4

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE362	MATERIAL TESTING LABORATORY	L	T	P	C
		0	0	4	2

Course Objective:

- To evaluate the fundamental properties of cement for its suitability in construction.
- To analyze the strength and durability characteristics of metals for engineering applications.
- To assess the quality and performance of aggregates for use in construction projects.
- To examine the structural reliability of bricks and concrete for various building applications.

List of Experiments

S. No	List of Experiments
I	**TESTS ON METALS**
a	Tension test on steel rod
b	Torsion test on mild steel rod
c	Deflection test on metal beam
d	Double shear test on metal
e	Impact test on metal specimen (Izod and Charpy)
f	Hardness test on metals (Rockwell and Brinell Hardness Tests)
g	Compression test on helical spring
h	Deflection test on carriage spring
II	**TESTS ON CEMENT**
a	Determination of fineness of cement
b	Determination of consistency of cement
c	Determination of specific gravity of cement
d	Determination of initial and final setting time of cement
III	**TESTS ON FINE AGGREGATE**
a	Determination of specific gravity of fine aggregate
b	Determination of grading of fine aggregate
IV	**TESTS ON COARSE AGGREGATE**
a	Determination of elongation index of coarse aggregate

b	Determination of flakiness index of coarse aggregate
c	Determination of aggregate crushing value of coarse aggregate
V	**TESTS ON BRICKS**
a	Determination of compressive strength of bricks
b	Determination of water absorption and efflorescence of bricks
VI	**TESTS ON CONCRETE**
a	Determination of slump of concrete
b	Determination of compressive strength of concrete
	TOTAL: 60 PERIODS

Learning Resources

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

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Determine the different mechanical properties of Metals	Apply
CO2	Determine the physical properties of cement	Apply
CO3	Articulate the different physical properties of fine and coarse aggregate.	Apply
CO4	Perform the different physical properties of brick	Apply
CO5	Determine the properties of fresh and hardened concrete.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	2			2	2		2	2	2
CO2	2	2	2	2	2			2	2		2	3	2
CO3	2	2	2	2	2			2	2		2	3	2
CO4	2	2	2	2	2			2	2		2	3	2
CO5	2	2	2	2	2			2	2		2	3	2
Avg.	**2**	**2**	**2**	**2**	**2**			**2**	**2**		**2**	**2.8**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

		L	T	P	C
U24EM312	**DESIGN THINKING AND INNOVATION (Common to B.E. Civil, CSE and Mechanical and B./Tech. AIDS in Third Semester and B.E. ECE in Fifth Semester)**	**0**	**0**	**2**	**1**

Course Objective:

- Empathizing with users to uncover their real problems and desires.
- Promoting out-of-the-box thinking to develop unique and effective solutions.
- Using prototyping, testing, and refining ideas to ensure the best outcome.

- Testing assumptions early to prevent costly mistakes and enhance decision-making.
- Creating innovative products, services, or processes that improve market competitiveness.

List of Exercises

Sl No	List of Exercises	No of periods
1	Design Thinking – models – Why design thinking? Case Studies. Innovation – 7Cs of Innovation. Identify a case study.	4
2	Empathize – tools - customer Journey map – case studies – Empathize the identified case study	4
3	Analyze – tools, multi-whys, case study, conflict of interest. Analyze the identified case study	4
4	Ideate and solve – brainstorming – TRIZ method, trial and error method – Solve the identified case study	4
5	Prototype/process and test – tools and methods – create a prototype for the identified case study	4
6	Iterate to improve the prototype/process – revisit the methods to improve the prototype.	8
7	Submit the report and final prototype/process of the case study.	2
	Total Periods	**30**

Learning Resources

1	Pavan Soni, Design your thinking, Penguin Random House India Pvt, Ltd., India, 2022
2	Don Norman, The Desing of everyday things, Basic Books, New York, 2013
3	B.K. Chakravarthy, Janaki Krishnamoorthi, Innovation by Design Lessons from Post Box Design & Development, Springer, New Delhi2013
4	Balaramadurai, Karmic Design Thinking, 2020
5	Design by Innovation NPTEL Course B.K. Chakravarthy IIT Bombay https:/ /npt el.ac.in/ courses/107 101086
6	Design Thinking and Innovation NPTEL Cours Ravi Poovaiah,IIT Bombay https:/ /onlinecourses.swa yam2.ac.in/ aic23_g e17/preview
7	Design Thinking A Premier NPTEL Course, Prof. Ashwin Mahalingam, Prof. Bala Ramadurai, IIT Madras https:/ /onlinecourses.npt el.a c.in/ noc22_ mg32/ preview

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply the tools to empathize the identified case study	Apply

CO2	Analyze the data and information to conceptualize the solution for the case study	Analyse
CO3	Ideate and solve the case study using appropriate tools	Apply
CO4	Create a prototype/process of the case study	Create
CO5	Iterate to improvise the prototype/process of the case study	Analyse

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2			2	2	2	2	2	2	2	2	
CO2	2	2			2	2	2	2	2	2	2	2	
CO3	2	2			2	2	2	2	2	2	2	2	
CO4	2	2			2	2	2	2	2	2	2		3
CO5	2	2			2	2	2	2	2	2	2		3
Average	**2**	**2**			**2**	**2**	**2**	**2**	**2**	**2**	**2**	2	3

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
THEORY COURSES										
1	U24CE411	Structural Analysis	PCC	3	1	0	4	4	40	60
2	U24CE421	Water Supply Engineering	PCC	3	0	0	3	3	40	60
3	U24CE431	Soil Mechanics	PCC	3	0	0	3	3	40	60
4	U24CE441	Hydrology and Water Resources Engineering	PCC	3	0	0	3	3	40	60
5	U24EM411	Aptitude Reasoning – I	EEC	1	0	0	1	1	100	–
THEORY CUM PRACTICAL COURSES										
6	U24CE453	Hydraulics and Hydraulic Machinery	PCC	3	0	2	5	4	50	50
7	U24CE463	Highway and Railway Engineering	PCC	2	0	2	4	3	50	50
PRACTICAL COURSES										
8	U24CE472	Soil Mechanics Laboratory	PCC	0	0	4	4	2	60	40
9	U24EM422	Soft skill and Personality Development – I	EEC	0	0	2	2	1	100	–
				18	**1**	**10**	**29**	**24**		

ASSESSMENT SCHEME

Sl. No	Course Type	L	T	P	C	CIA Weightage (Theory)				CIA	ESE		CIA (W)	ESE (W)	Min. Marks to Pass for 100	
						T1	A1	T2	A2	Prac	Th	Prac			ESE	Total
1	U24CE411	3	1	0	4	60	40	60	40	-	100		40	60	45	50
2	U24CE421	3	0	0	3	60	40	60	40	-	100		40	60	45	50
3	U24CE431	3	0	0	3	60	40	60	40	-	100		40	60	45	50
4	U24CE441	3	0	0	3	60	40	60	40	-	100		40	60	45	50
5	U24EM411	1	0	0	1	-	-	-	-	-	-	-	100	-	-	50
6	U24CE453	3	0	2	4	60	40	60	40	100	70	30	50	50	45	50
7	U24CE463	2	0	2	3	60	40	60	40	100	50	50	50	50	45	50
8	U24CE472	0	0	4	2	-	-	-	-	100	-	100	60	40	45	50
9	U24EM422	0	0	2	2	-	-	-	-	-	-	-	100	-	-	50

(W) – Weightage

U24CE411	STRUCTURAL ANALYSIS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

- To analyse determinate and indeterminate structures using classical and matrix methods and the method of drawing influence lines.
- To analyse Arches and suspension bridges.

Detailed Syllabus

UNIT I SLOPE DEFLECTION METHOD	**12**
Kinematic Indeterminacy - Analysis of Continuous Beams and Rigid Frames - Support Settlements - Symmetric Frames with Symmetric and Skew-Symmetric Loading.	
UNIT II MOMENT DISTRIBUTION METHOD	**12**
Stiffness - Distribution and Carry over Factors - Analysis of Continuous Beams- Plane Rigid Frames with and Without Sway	
UNIT III INFLUENCE LINES FOR DETERMINATE AND INDETERMINATE BEAMS	**12**
Concept Of Influence Lines - Influence Lines for Reactions in Statically Determinate Structures - Influence Lines for Shear Force and Bending Moment - Application of Müller Breslau's Principle - Influence Lines for Support Reactions, Shear Forces, And Bending Moments in Indeterminate Beams	
UNIT IV MATRIX ANALYSIS OF STRUCTURES	**12**
Analysis of Indeterminate Continuous Beams, Pin-Connected Planar Frameworks, and Rigidly Connected Planar Frames Using the Direct Flexibility Method and the Stiffness Method	
UNIT V ARCHES AND SUSPENSION BRIDGES	**12**
Arches - Eddy's Theorem – Analysis of Three-Hinged, Two-Hinged and Fixed Arches – Parabolic and Circular. Analysis of Suspension Bridges – Suspension Bridges with Three Hinged and Two Hinged Stiffening Girders	
Total Periods: 60	

Learning Resources:

1	Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, Theory of Structures, Laxmi Publications, New Delhi, 2017.
2	Bhavikatti, S.S,Structural Analysis,Vol.1,& 2, Vikas Publishing House Pvt.Ltd. New Delhi, 2020.
3	Reddy, C.S., Basic Structural Analysis, Tata McGraw-Hill, New Delhi, 2019.
4	Ghali, A., Neville, M., and Brown, T.G., Structural Analysis: A Unified Classical and Matrix Approach, CRC Press, 2021.
5	Wang, C.K., Intermediate Structural Analysis, McGraw-Hill Book Company, 2017.

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Analyse continuous beams and rigid frames using slope deflection method	Apply
CO2	Apply moment distribution method for solving indeterminate structures	Apply

CO3	Construct and interpret influence lines for determinate and indeterminate beams	Apply
CO4	Solve the structural systems using matrix flexibility and stiffness matrix method	Apply
CO5	Analyse structural behaviour of arches and suspension bridges	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	2	-	-	-	2	2	2	2	3	2
CO2	3	2	3	2	-	-	-	2	2	2	2	3	2
CO3	3	2	3	2	-	-	-	2	2	2	2	3	2
CO4	3	2	3	2	-	-	-	2	2	2	2	3	2
CO5	3	2	3	2	-	-	-	2	2	2	2	3	2
Avg.	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**3**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High),2– Moderate (Medium),1– Slight (Low)

U24CE421	WATER SUPPLY ENGINEERING	L	T	P	C
		3	0	0	3

Course Objective:

- To introduce students about various components and design of water supply scheme, water treatment methods, water storage distribution system and design of intake structures.

Detailed Syllabus

UNIT I SOURCES OF WATER **9**

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

UNIT II CONVEYANCE FROM THE SOURCE **9**

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

UNIT III WATER TREATMENT **9**

Objectives - Unit operations and processes - Principles, functions, and design of water treatment plant units, sedimentation, aerators of flash mixers, Coagulation and flocculation - Clarifloccuator - sand filters - filtration - reverse osmosis - water treatment practices in urban &rural areas.

UNIT IV ADVANCED WATER TREATMENT **9**

Water softening - Desalination - R.O. Plant - demineralization - Adsorption - Ion exchange Membrane Systems - Iron and Manganese removal - Disinfection, Chlorination - action, factors influencing, free chlorination, combined chlorination, ozonation, UV radiation, Defluoridation - MBR process - Recent advances

UNIT V WATER DISTRIBUTION AND SUPPLY **9**

Requirements of water distribution - Components - Selection of pipe material - Service reservoirs - Functions - Network design - Economics - Analysis of distribution networks - Computer applications -

Appurtenances - Leak detection - Water supply system in buildings - House service connection - Fixtures and fittings, systems of plumbing and types of plumbing.
TOTAL PERIODS: 45

Learning Resources:

1	Garg S.K “Water Supply Engineering”, Khanna Publishers, 34th Edition, New Delhi 2015
2	Modi, P.N., Water Supply Engineering, Vol.I Standard Book House, New Delhi, 2016.
3	Duggal K.N., “Elements of Environmental Engineering” S. Chand and Co. Ltd., New Delhi, 2014.
4	Punmia B.C, Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi 2016.
5	Syed R. Qasim and Edward M. Motley Guang Zhu, Water Works Engineering Planning, Design and Operation, Prentice Hall of India Learning Private Limited, New Delhi, 2009.
6	Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999

Course Outcomes:

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

CO	Course Outcome Statement	Knowledge Level
CO1	Determine the quantity of water and analyse its quality parameters.	Apply
CO2	Differentiate various intake structures and select suitable pipe material for water conveyance	Understand
CO3	Design various units of conventional water treatment plants.	Apply
CO4	Discuss the various advanced treatment systems and knowledge about the recent advances in water treatment process	Understand
CO5	Plan and design a water distribution system for a building/city.	Apply

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	1	-	-	-	1	2	-	-	-	-
CO2	3	2	-	1	-	-	-	1	2	-	-	-	-
CO3	3	3	2	-	-	3	2	2	2	-	2	3	2
CO4	3	1	-	-	2	3	3	2	2	-	2	3	2
CO5	3	2	-	2	2	3	3	2	2	2	2	3	2
Avg.	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**	**3**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High),2– Moderate(Medium),1– Slight (Low)



U24CE431	SOIL MECHANICS	L	T	P	C
		3	0	0	3

Course Objective:

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

Detailed Syllabus

UNIT I SOIL CLASSIFICATION AND COMPACTION **9**

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

UNIT II EFFECTIVE STRESS AND PERMEABILITY **9**

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

UNIT III STRESS DISTRIBUTION AND SETTLEMENT **9**

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

UNIT IV SHEAR STRENGTH **9**

Shear strength of cohesive and cohesion less soils - Mohr - Coulomb failure theory - Measurement of shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests - Pore pressure parameters - Cyclic mobility - Liquefaction.

UNIT V SLOPE STABILITY **9**

Stability Analysis - Infinite slopes and finite slopes - Total stress analysis for saturated clay - Friction circle method - Use of stability number - Method of slices - Fellenious and Bishop's method - Slope protection measures.

TOTAL PERIODS: 45

Learning Resources:

1	Dr. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers Distributors, New Delhi,2022
2	Murthy, V.N.S, "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd.,

	New Delhi,2021
3	Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition, 2021.
4	Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International (P) Limited, Publishers New Delhi (India),2022
5	Braja M. Das, "Fundamentals of Geotechnical Engineering", Fourth Edition, Cengage Learning, New Delhi,2021

Course Outcomes:

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Classify the different types of soil & identify their index properties.	Understand
CO2	Differentiate the flow of water through cohesive and cohesionless soils.	Understand
CO3	Determine the stress distribution for different loadings and also gain knowledge on different settlement & compaction parameters	Apply
CO4	Describe the different tests for identifying shear strength of soils based on different parameters.	Understand
CO5	Determine the stability of slopes based on different soil parameters.	Apply

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	2	-	2	1	1	1	2	2	2	3
CO2	3	2	1	1	-	2	1	1	1	2	2	2	3
CO3	3	2	3	3	-	2	1	1	1	2	2	2	3
CO4	3	2	1	1	-	2	1	1	1	2	2	2	3
CO5	3	2	1	1	-	2	1	1	1	2	2	2	3
Avg.	**3**	**2**	**2**	**2**	-	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High),2– Moderate (Medium),1– Slight (Low)

U24CE441	**HYDROLOGY AND WATER RESOURCES ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

- 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.

Detailed Syllabus

UNIT I PRECIPITATION AND ABSTRACTIONS	**9**
Hydrological cycle - Meteorological measurements - Types and forms of precipitation - Rain gauges - Spatial analysis of rainfall data using Thiessen polygon and Iso-hyetal methods - Interception - Evaporation: Measurement, Evaporation suppression methods - Infiltration: Horton's equation - Double ring infiltrometer - Infiltration indices.	
UNIT II RUNOFF	**9**
Catchment: Definition, Morphological characteristics - Factors affecting runoff - Run off estimation using Strange's table and empirical methods - SCS-CN method - Stage discharge relationship - Flow measurements - Hydrograph - Unit Hydrograph - IUH.	
UNIT III HYDROLOGICAL EXTREMES	**9**
Natural Disasters - Frequency analysis - Flood estimation - Flood management - Definitions of drought: Meteorological, Hydrological, Agricultural and Integrated - IMD method - NDVI analysis - Drought Prone Area Programme (DPAP).	
UNIT IV RESERVOIRS	**9**
Classification of reservoirs - Site selection - General principles of design - Spillways - Elevation - Area - Capacity curve - Storage estimation - Sedimentation - Life of reservoirs - Rule curve	
UNIT V GROUNDWATER & MANAGEMENT	**9**
Origin - Classification and types - Properties of aquifers - Governing equations - Steady and unsteady flow - Artificial recharge - RWH in rural and urban areas	
TOTAL PERIODS: 45	

Learning Resources:

1	Subramanya .K. "Engineering Hydrology", 5th Edition, McGraw Hill, New Delhi 2022.
2	Jayarami Reddy .P. "Hydrology", 3rd Edition, Laxmi Publications, New Delhi 2022.
3	R.K.Sharma & T.K. Sharma, "Hydrology and Water Resources Engineering", 5 th Edition, Dhanapati Rai Publications, New Delhi 2021
4	Raghunath .H.M., "Hydrology: Principles, Analysis, Design", New Age International Publishers, 3rd Edition, New Delhi 2021.
5	Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill, New Delhi 2021.
6	David Keith Todd and Larry W. Mays, "Groundwater Hydrology", 3rd Third Edition, John Wiley & Sons, New Delhi 2022.

Course Outcomes:

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Describe the various hydrological parameters	Understand
CO2	Apply the technique for developing hydrographs for estimating the peak runoff from different catchment areas	Apply
CO3	Estimate the peak floods and also gain knowledge in Flood management & drought	Apply
CO4	Classify the different reservoirs & spillways and also to gain knowledge on the design principles of both reservoirs & spillways.	Understand
CO5	Describe the different features of groundwater & Aquifers	Understand

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	-	2	-	2	2	-	2	2	3
CO2	2	2	2	1	-	2	-	3	2	-	2	2	3
CO3	2	2	2	2	-	3	-	2	2	-	2	2	3
CO4	2	2	2	1	-	3	2	2	2	-	3	2	3
CO5	2	2	2	1	-	3	2	2	2	-	2	2	3
Avg.	**2**	**2**	**2**	**1**	-	**2**	**2**	**2**	**2**	-	**2**	**2**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High),2– Moderate(Medium),1– Slight (Low)

U24EM411	**APTITUDE AND REASONING – I**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

Course Objective:

Enhance analytical and logical reasoning skills to solve problems efficiently.
Strengthen understanding of basic arithmetic, algebra, geometry, and data interpretation.
Train students to approach problems systematically and apply suitable techniques.
Foster quick thinking and reduce error rates through practice and time-bound exercises.

Detailed Syllabus

Quantitative aptitude • Numbers: Number series, arithmetic progression, geometric progression • HCF and LCM: Highest common factor – split method, division method, Least Common Multiples – prime factor method, division method. • Simplification – BODMAS rule • Average and Percentage • Simple and Compound Interest Profit, loss and discounts • Ratio and proportion: Ratio – compound ratio, inverse ratio. Proportion – direct proportion, inverse proportion • Mixture and alligation: Mixture, alligation, mean concentration • Problems based on ages	20

• Partnerships: Simple partnership, compound partnership	
Reasoning: • Number series and letter series • Odd one out • Coding and decoding • Missing characters/numbers and analogies • Blood relations problems • Direction sense tests • Sequencing and ranking test	10
TOTAL PERIODS	**30**

Learning Resources:

1	R.V. Praveen, "Quantitative Aptitude and Reasoning", 3rd Edition , Eastern Economy Edition, PHI Learning, New Delhi,2016
2	Dr. R.S. Aggarwal, " Quantitative Aptitude", S Chand Publishing, New Delhi 2017
3	Dr. R.S. Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", S Chand Publishing, New Delhi 2017
4	https://www.indiabix.com/
5	https://www.geeksforgeeks.org/
6	https://faceprep.in/
7	https://prepinsta.com/
8	https://www.javatpoint.com/

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Solve quantitative aptitude problems involving arithmetic, algebra, percentages, ratios, etc., using logical approaches.	Apply
CO2	Analyze problems and apply reasoning strategies such as deduction, inference, and pattern recognition.	Analyse
CO3	Solve problems in simple and compound interest, profit, loss and discount	Apply
CO4	Solve problems based on ages and partnership	Apply
CO5	Demonstrate improved performance in time-bound aptitude tests through consistent practice.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	1	-	2	-	-
CO2	-	-	-	-	-	-	-	2	1	-	2	-	-
CO3	-	-	-	-	-	-	-	2	1	-	2	-	-
CO4	-	-	-	-	-	-	-	2	1	-	2	-	-
CO5	-	-	-	-	-	-	-	2	1	-	2	-	-
Avg.	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High),2– Moderate (Medium),1– Slight (Low)

U24CE453	HYDRAULICS AND HYDRAULIC MACHINERY	L	T	P	C
		3	0	2	4

Course Objective:

- To impart basic knowledge to the students about the open channel flows with analysis of uniform flow, gradually varied flow and rapidly varied flow and to expose them to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, Centrifugal and Reciprocating pumps.
- To provide hands-on experience in calibration of flow meters, performance characteristics of pumps and turbines.

Detailed Syllabus

UNIT I UNIFORM FLOW **9**

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Fundamental equations - Sub-critical, Super critical and Critical flow - Velocity distribution in open channel - Steady uniform flow: Chezy's equation, Manning equation - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.

UNIT II VARIED FLOWS **9**

Dynamic equations of gradually varied - Water surface flow profile classifications: Hydraulic Slope, Hydraulic Curve - Profile determination by Numerical method: Direct step method and Standard step method – Change in Grades.

UNIT III RAPIDLY VARIED FLOWS **9**

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

UNIT IV TURBINES **9**

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

UNIT V PUMPS **9**

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

TOTAL PERIODS: 45

List of Experiments:

Sl. No	List of Experiments
1	Flow measurement in pipe using Rotameter
2	Flow measurement in pipe using orifice meter
3	Flow measurement in pipe using venturi meter
4	Flow measurement in open channel using notches
5	Flow measurement - Bernoulli's experiment
6	Determination of frictional loss in pipes.
7	Determination of minor losses in pipes



8	Determination of metacentric height of a floating body
9	Characteristics of Pelton wheel turbine
10	Characteristics of Francis turbine
11	Characteristics of Centrifugal pump
12	Characteristics of Gear pump
13	Characteristics of Reciprocating pump
14	Characteristics of Submersible pump
	Total Periods: 45 + 30

Learning Resources:

1	Bansal R.K, "A Text Book of Fluid Mechanics and Hydraulic Machines" Lakshmi Publications, New Delhi, 10th Edition 2019
2	Modi P.N and Seth S.M, "Hydraulics and Fluid Mechanics Including Hydraulic Machines" Standard Book House" New Delhi, 22nd Edition 2019
3	Streeter, V.L. Wylie, E. B. and Bedford K.W, Fluid Mechanics. (9th Ed.) Tata McGraw Hill, New Delhi, 1998.
4	Chandramouli P N, Applied Hydraulic Engineering, Yes Dee Publisher, New Delhi,2017
5	VenTe Chow, Open Channel Hydraulics, McGraw Hill, New York, 2009.
6	Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 19th edition, 2013.
7	Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2019.

Course Outcomes:

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Describe the basics of open channel flow, its classification and analysis of uniform flow in steady state conditions with specific energy concept and its application	Apply
CO2	Analyse steady gradually varied flow, water surface profiles and its length calculation using direct and standard step methods with change in water surface profiles due to change in grades.	Apply
CO3	Derive the relationship among the sequent depths of steady rapidly varied flow and estimating energy loss in hydraulic jump with exposure to positive and negative surges.	Apply
CO4	Design turbines and explain the working principle	Apply
CO5	Differentiate pumps and explain the working principle with characteristic curves and design centrifugal and reciprocating pumps.	Apply

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	-	-	1	2	2	1	2	3	2
CO2	3	2	2	-	-	-	1	2	2	1	2	3	2
CO3	3	3	3	2	1	-	2	2	2	1	2	3	2
CO4	3	3	3	3	1	-	2	2	2	2	2	3	2
CO5	3	3	3	3	1	-	2	2	2	2	2	3	2
Avg.	**3**	**2.6**	**2.6**	**2.67**	**1**	**-**	**1.6**	**2**	**2**	**1.4**	**2**	**3**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High),2– Moderate(Medium),1– Slight (Low)

U24CE463	HIGHWAY AND RAILWAY ENGINEERING	L	T	P	C
		2	0	2	3

Course Objective:

- To give an overview about the highway and railway engineering with respect to planning, design, construction and maintenance as per IRC standards, specifications and methods
- To learn the principles and procedures of testing of materials used in the construction of highways.

Detailed Syllabus

UNIT I HIGHWAY ENGINEERING	**6**
Classification of highways - Institutions for Highway planning, design and construction at different levels - factors influencing highway alignment - Typical cross sections of Urban and Rural roads - Engineering surveys for alignment - Conventional and Modern method	
UNITII DESIGN OF HIGHWAY ELEMENTS	**6**
Cross sectional elements - Horizontal curves, super elevation, transition curves, widening of curves - Sight distances - Vertical curves, gradients - pavement components and their role - Design practice for flexible and rigid pavements (IRC methods only).	
UNIT III HIGHWAY CONSTRUCTION AND MAINTENANCE	**6**
Highway construction materials, properties, testing methods - Construction practice of flexible and concrete pavement Highway drainage - Evaluation and Maintenance of pavements.	
UNIT IV RAILWAY PLANNING AND CONSTRUCTION	**6**
Elements of permanent way - Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges - Track Stress, coning of wheels, creep in rails, defects in rails - Route alignment surveys, conventional and modern methods - Geometric design of railway, gradient, super elevation, widening of gauge on curves (Problems) - Railway drainage Level Crossings Signalling.	
UNIT V RAILWAY TRACK CONSTRUCTION MAINTENANCE AND OPERATION	**6**
Points and Crossings - Design of Turnouts, Working Principle-Track Circuiting - Construction & Maintenance - Conventional, Modern methods and Materials, Lay outs of Railway Stations and Yards, Rolling Stock, Tractive Power, Track Resistance - Role of Indian Railways in National Development - Railways for Urban Transportation - LRT & MRTS Feasibility study, Planning and construction	
	TOTAL PERIODS: 30

List of Experiments:

Sl. No	List of Experiments
1	Specific gravity determination of the coarse aggregate sample
2	Determination of abrasion value of the coarse aggregate sample
3	Determination of water absorption capacity of the coarse aggregate sample.
4	Specific gravity determination of the bitumen/asphalt sample
5	Determination of consistency of the bituminous material

6	Viscosity determination of bituminous binder
7	Determination of softening point of the asphalt/bitumen sample
8	Determination of ductility value of the bitumen sample
9	Estimation of loss of bitumen on heating
10	Determination of optimum binder content by Marshall method
11	Determination of stripping value of the bituminous mix Demonstration
12	Determination of bitumen content in the bituminous mix by cold solvent extraction method
	Total Periods: 30 + 30

Learning Resources:

1	Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", Nem Chand Publishers, 2014
2	Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai,2010
3	Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications, 6th edition Delhi, 2015
4	C. Venkatramaiah., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels., Universities Press (India) Private Limited, Hyderabad, 2015
5	Indian Road Congress (IRC), Guidelines for the Design of Flexible Pavements, (Third Revision), IRC:37-2012
6	Indian Road Congress (IRC), Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, (Third Revision), IRC:58-2012
7	Yang H. Huang, "Pavement Analysis and Design", Pearson Education Inc, Nineth Impression, South Asia,2012
8	IRC-37–2012,The Indian roads Congress, Guidelines for the Design of Flexible Pavements, New Delhi
9	Saxena Subhash, C. and Satyapal Arora, A Course in Railway Engineering, Dhanapat Rai and Sons, Delhi, 1998.

Course Outcomes:

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

CO	Course Outcome Statement	Knowledge Level
CO1	Gain knowledge on planning a highway according to the principles	Understand

	and standards adopted by various institutions in India.	
CO2	Design the geometric features of the road network and components of pavement.	Apply
CO3	Test the highway materials and construction practice methods and know its properties and able to perform pavement evaluation and management	Apply
CO4	Discuss the different methods of route alignment and design elements in railway planning and constructions.	Understand
CO5	Describe the different construction techniques and maintenance of track laying and railway stations	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	2	-	3	1	3	-	-	-	-	3
CO2	3	3	3	2	2	-	2	3	2	-	2	3	2
CO3	3	3	2	2	2	3	3	3	-	-	3	3	2
CO4	3	-	-	-	-	3	-	3	-	1	-	-	3
CO5	3	-	3	-	2	-	-	-	2	-	-	2	-
Avg.	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**1**	**3**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High),2– Moderate(Medium),1– Slight (Low)

U24CE472	SOIL MECHANICS LABORATORY	L	T	P	C
		0	0	4	2

Course Objective:

To familiarize the students to determine the Various Index properties of soil and also helps the students in Identifying the compaction characters, Strength and Prediction of Various Engineering properties of Soil.

List of experiments

I	**DETERMINATION OF INDEX PROPERTIES**
1	Specific 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 tests
II	**DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS**
6	Field density Test (Core cutter & Sand replacement method)
7	Determination of moisture – density relationship using standard proctor compaction test.
III	**DETERMINATION OF ENGINEERING PROPERTIES OF SOIL**
8	Permeability determination (constant head and falling head methods)
9	One-dimensional consolidation test (Determination of co-efficient of consolidation only)
10	Direct shear test in cohesion less soil
11	Unconfined compression test in cohesive soil
12	Laboratory vane shear test in cohesive soil
13	Tri-axial compression test in cohesion less soil (Demonstration only)
14	California Bearing Ratio Test

IV	TEST ON GEO SYNTHESIS (DEMONSTRATION ONLY)
15	Determination of tensile strength and Interfacial friction angle
16	Determination of apparent opening sizes and permeability
	TOTAL PERIODS: 60

Learning Resources

1	Dr.Arora, K. R., "Soil Mechanics and Foundation Engineering", Standard Publishers Distributors, New Delhi,2021
2	Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition, 2021
3	Braja M.Das., "Soil Mechanics: Laboratory Manual", Oxford University Press, eighth edition, 2022.
4	Soil Engineering Laboratory Instruction Manual" published by Engineering College Cooperative Society, Anna University, Chennai, 2021

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Determine the different Index properties of soil	Apply
CO2	Determine the density and compaction characteristics for various types of soils.	Apply
CO3	Perform the tests to identify the flow of water through different soil mediums.	Apply
CO4	Articulate the rate of compression & settlement in soil	Apply
CO5	Determine the shear strength parameters of soil for both drained and undrained conditions	Apply

Course Articulation Matrix

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

For CO-PO/PSO Mapping: 3 – Substantial (High),2– Moderate(Medium),1– Slight (Low)

U24EM422	SOFT SKILLS AND PERSONALITY DEVELOPMENT – I	L	T	P	C
		0	0	2	1

Course Objective:

- To understand and interpret human perception and behaviour, enhancing interpersonal awareness.
- To enhance self-management, including habit formation, stress regulation, and personal productivity
- Develop conflict-resolution skills, aiming for win-win outcomes through structured strategies.
- Strengthen communication abilities—active listening, telephone etiquette, and overcoming listening barriers.

List of Exercises

Sl. No.	List of Exercises
1	Introduction: A New Approach to Learning, Planning and Goal-Setting
2	Human Perceptions: Understand People
3	Aiming for Excellence: Developing Potential and Self-Actualisation
4	Self-Management Skills- Time management & Self-motivation
5	Self-Management Skills- Stress management & Adaptability
6	Conflict Resolution Skills
7	Using The Zeigarnik Effect for Productivity and Personal Growth, Forming Habits of Success
8	Communication: Significance of Listening, Active Listening, Barriers to Active Listening
9	Telephone Communication: Basic Telephone Skills, Advanced Telephone Skills, Essential Telephone Skills
10	Profile Building
	Total Periods: 30

Learning Resources

1	Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.
2	Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.
3	Klaus, Peggy, Jane Rohman & Molly Hamaker. The Hard Truth about Soft Skills. London: HarperCollins E-books, 2007.
4	Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Develop an actionable growth plan aligning self-development with objectives.	Apply
CO2	Analyze the habit loop; design personal interventions to break bad habits.	Analyse
CO3	Analyze examples of interpersonal conflict, propose dual solutions using conflict-model frameworks.	Analyse
CO4	Apply stress-management strategies: reframing, planning, relaxation exercises.	Apply
CO5	Apply techniques to rectify the barriers in active listening	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	1	2	-	2	-	-
CO2	-	-	-	-	-	-	-	1	2	-	2	-	-
CO3	-	-	-	-	-	-	-	1	2	-	2	-	-
CO4	-	-	-	-	-	-	-	1	2	-	2	-	-
CO5	-	-	-	-	-	-	-	1	2	-	2	-	-
Avg.	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**2**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
THEORY COURSES										
1	U24CE511	Design of Reinforced concrete elements	PCC	3	1	0	4	4	40	60
2	U24CE521	Foundation Engineering	PCC	3	0	0	3	3	40	60
3	U24EM511	Aptitude and Reasoning – II	EEC	2	0	0	2	2	100	-
4	U24MG511	Leadership and Team Management	EEC	2	0	0	2	2	40	60
5		Professional Elective - I	PEC					3		
6		Professional Elective - II	PEC					3		
7		Mandatory Course - I*	MC	3	0	0	3	0	100	-
THEORY CUM PRACTICAL COURSES										
8	U24CE533	Waste Water Engineering	PCC	3	0	2	5	4	50	50
PRACTICAL COURSES										
9	U24CE542	Computer Aided Drafting Laboratory	PCC	0	0	4	4	2	60	40
10	U24EM522	Soft skill and Personality Development - II	EEC	0	0	2	2	1	100	
				22	**1**	**8**	**31**	**24**		

ASSESSMENT SCHEME

Sl. No	Course Type	L	T	P	C	CIA Weightage (Theory)				CIA	ESE		CIA (W)	ESE (W)	Min. Marks to Pass for 100	
						T1	A1	T2	A2	Prac	Th	Prac			ESE	Total
1	U24CE511	3	1	0	3	60	40	60	40	-	100	-	40	60	45	50
2	U24CE521	3	0	0	3	60	40	60	40	-	100	-	40	60	45	50
3	U24EM511	2	0	0	2	-	-	-	-	-	-	-	100	-	-	50
4	U24MG511	2	0	0	2	60	40	60	40	-	100	-	40	60	45	50
5	PEC – I														45	50
6	PEC – II														45	50
7	U24CE533	3	0	2	4	60	40	60	40	100	70	30	50	50	45	50
8	U24CE542	0	0	4	2	-	-	-	-	100	-	100	60	40	45	50
9	U24EM522	0	0	2	1	-	-	-	-	-	-	-	100	-	-	50
10	MC – I	3	0	0	0	-	-	-	-	-	-	-	100	-	-	50

(W) – Weightage

U24CE511	DESIGN OF REINFORCED CONCRETE ELEMENTS	L	T	P	C
		3	1	0	4

Course Objective:

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

Detailed Syllabus

UNIT I METHODS OF DESIGN OF CONCRETE STRUCTURES	**12**
Concept of Design Philosophies (Elastic method, ultimate load method and limit state method) - Limit State philosophy as detailed in IS code-Advantages of Limit State Method over other methods-Analysis and design of singly and doubly reinforced rectangular beams by limit State Method - Case Study of Beams in a Residential RC Building	
UNIT II LIMIT STATE METHOD-FLANGED BEAM, SHEAR& TORSION	**12**
Analysis and design of flanged beams –Use of design aids for Flexure - Behaviour of RC members in bond and Anchorage-Design requirements as per current code-Behaviour of RC beams in shear and torsion - Design of RC members for combined bending, shear and torsion - serviceability.	
UNIT III LIMIT STATE DESIGN OF SLABS AND STAIRCASE	**12**
Analysis and design of cantilever, one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions- Types of Staircases – Design of dog-legged Staircase – Case Study of Slabs and Staircase in a Residential RC Building - Introduction to Flat Slab.	
UNIT IV LIMIT STATE DESIGN OF COLUMNS	**12**
Types of columns – Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending - Case study of Columns in a Residential RC Building	
UNIT V LIMIT STATE DESIGN OF FOOTING	**12**
Design of wall footing – Design of axially and eccentrically loaded rectangular pad and sloped footings – Design of combined rectangular footing for two columns only - Case study of Footings in a Residential RC Building	
Total Periods 60	

Learning Resources

1	N. Subramanian, "Design of Reinforced Concrete Structures", Oxford University Press, New Delhi, 2013.
2	Gambhir. M.L., "Fundamentals of Reinforced Concrete Design",Prentice Hall of India Private Limited, New Delhi, 2008
3	Krishnaraju.N “Design of Reinforced Concrete Structures“, CBS Publishers & Distributors Pvt.Ltd.,NewDelhi,2019
4	Sinha,S.N.,“Reinforced Concrete Design”,Tata McGraw Hill Publishing Company Ltd.,New Delhi,2017
5	Unnikrishna Pillai, S.,Devdas Menon,“Reinforced Concrete Design”,Tata McGraw Hill Publishing Company Ltd.,2022

6	Punmia.B.C., Ashok Kumar Jain ,Arun Kumar Jain, “Limit State Design of Reinforced Concrete”,Laxmi Publication Pvt. Ltd., New Delhi, 2023
7	Shah V L Karve S R., "Limit State Theory and Design of Reinforced Concrete", Structures Publications, Pune, 2023
8	Bureau of Indian Standards, "Plain and reinforced concrete - Code of practice," IS 456:2000 (Reaffirmed 2021), New Delhi, India, 2000.
9	https://onlinecourses.nptel.ac.in/noc22_ce65/preview

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the design concepts of Reinforced Concrete members and design the members using Limit State method	Understand
CO2	Calculate and apply design procedures for flanged beams, shear, torsion, anchorage, and development length.	Apply
CO3	Design a RC slab and staircase and draw the reinforcement detailing.	Apply
CO4	Design short columns for axial, uni-axial and bi-axial eccentric loadings	Apply
CO5	Design wall footings, isolated footings and combined rectangular footing	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	1	3	1	1	3	2	1	3	3
CO2	3	3	3	3	1	3	1	1	3	2	1	3	3
CO3	3	3	3	3	1	3	1	1	3	2	1	3	3
CO4	3	3	3	3	1	3	1	1	3	2	1	3	3
CO5	3	3	3	3	1	3	1	1	3	2	1	3	3
Avg	**3**	**3**	**3**	**3**	**1**	**3**	**1**	**1**	**3**	**2**	**1**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE521	**FOUNDATION ENGINEERING**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objective:

- To give an overview about the different Site investigation methods for determining the geotechnical characters
- To impart knowledge on the bearing capacity of foundations & settlements on different soil conditions
- To familiarize the students about the geotechnical design characters, factors, type of foundations and retaining walls.

Detailed Syllabus

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION	**9**
Scope and objectives – Methods of exploration – Auguring and boring – Wash boring and rotary drilling – Depth and spacing of bore holes – Soil samples – Representative and undisturbed – Sampling methods –Types of samplers – Penetration tests (SPT and SCPT) – Data interpretation - Comparison of traditional vs modern investigation approaches - Selection of foundation based on soil condition- Bore log report - digital tools	
UNIT II BEARING CAPACITY AND SETTLEMENTS	**9**
Introduction – Location and depth of foundation – Codal provisions – Types of Bearing Capacity –– Terzaghi's formula and BIS formula – Factors affecting bearing capacity –– Allowable bearing pressure –. Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements – Codal provision – Methods of minimizing total and differential settlements.	
UNIT III SHALLOW FOUNDATIONS	**9**
Types of Isolated footing, Combined footing, Mat foundation – Contact pressure & settlement distribution – Proportioning of foundations for conventional rigid behaviour – Minimum depth for rigid behaviour – Applications – Floating foundation – Special foundations – Seismic force consideration – Codal provision - Foundation Drainage.	
UNIT IV PILE FOUNDATIONS	**9**
Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – Static formula – Dynamic formulae (Engineering news and Hileys) – Negative skin friction – Efficiency and Load Carrying capacity of Pile Group – Uplift capacity – Settlement of pile groups – Interpretation of pile load test (routine test only), Under reamed piles.	
UNIT V RETAINING WALLS	**9**
Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesionless and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls – Codal provision - Case studies.	
	Total Periods: 45

Learning Resources

1	Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", New Age International (P) Ltd, New Delhi,2023.
2	Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributors Ltd., New Delhi, 2018.
3	Dr.Arora,K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers Distributors, New Delhi,2021.
4.	Das, B.M. "Principles of Foundation Engineering" (Eighth edition), Thompson Asia Pvt. Ltd., Singapore, 2019.
5	Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill publishing company Ltd., New Delhi, 2013
6	https://onlinecourses.nptel.ac.in/noc21_ce39/preview

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Describe the geotechnical characteristics obtained from subsurface investigations for foundation design.	Understand
CO2	Determine the bearing capacity of shallow foundations & differential settlement.	Apply
CO3	Differentiate the suitability of shallow foundations under various soil conditions.	Understand
CO4	Determine the load carrying capacity of pile foundations.	Apply
CO5	Calculate the lateral earth pressure and Stability analysis of retaining walls	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	3	-	-	2	-	2	2	2	-	2	3
CO2	2	2	3	-	-	2	-	3	2	3	-	2	3
CO3	2	2	3	-	-	2	-	2	2	3	-	2	3
CO4	2	2	3	-	-	2	-	2	2	3	-	2	3
CO5	2	2	3	-	-	2	-	2	2	2	-	2	3
Avg.	2	2	3	-	-	2	-	2	2	2	-	2	3

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24EM511	Aptitude and Reasoning – II	L	T	P	C
		2	0	0	2

Course Objective:

- Enhance analytical and logical reasoning skills to solve problems efficiently.
- Strengthen understanding of basic arithmetic, algebra, geometry, and data interpretation.
- Train students to approach problems systematically and apply suitable techniques.
- Foster quick thinking and reduce error rates through practice and time-bound exercises**.**
- Understand data interpretation using bar chart, pie chart and table chart

Syllabus topics

Topic titles	No of periods
Quantitative aptitude ● Time and work ● Pipes and Cistern ● Chain Rule and wages ● Time speed and distance ● Train problems ● Boats and streams ● Races and games ● Permutations and Combinations ● Probability ● Heights and distance ● Logarithms ● Surds and indices ● Mensuration – 2D, 3D ● Date interpretation – pie chart, bar chart, table chart. Data sufficiency in logical reasoning	20
Reasoning: ● Symbols and notations ● Mathematical operators and Venn diagrams ● Puzzles ● Cubes and Dice ● Clocks and Calendars ● Critical Reasoning ● Non-verbal reasoning ● Verbal Ability	10

Learning Resources

1	R.V. Praveen, “Quantitative Aptitude and Reasoning”, 3rd Edition , Eastern Economy Edition, PHI Learning, New Delhi, 2016
2	Dr. R.S. Aggarwal, “ Quantitative Aptitude”, S Chand Publishing, New Delhi 2017
3	Dr. R.S. Aggarwal, “A Modern Approach to Verbal & Non-Verbal Reasoning”, S Chand Publishing, New Delhi 2017

4	https://www.indiabix.com/
5	https://www.geeksforgeeks.org/
6	https://faceprep.in/
7	https://prepinsta.com/
8	https://www.javatpoint.com/

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Solve quantitative aptitude problems involving time & work, chain rule and wages etc., using logical approaches.	Apply
CO2	Analyze problems and apply reasoning strategies such as deduction, inference, and pattern recognition.	Analyse
CO3	Solve problems on data interpretation, including bar charts, pie charts, tables, and graphs.	Apply
CO4	Solve problems in probability, height and distance and logarithms logically	Apply
CO5	Demonstrate improved performance in time-bound aptitude tests through consistent practice.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	1	-	2	-	-
CO2	-	-	-	-	-	-	-	2	1	-	2	-	-
CO3	-	-	-	-	-	-	-	2	1	-	2	-	-
CO4	-	-	-	-	-	-	-	2	1	-	2	-	-
CO5	-	-	-	-	-	-	-	2	1	-	2	-	-
Avg.	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24MG511	**LEADERSHIP AND TEAM MANAGEMENT**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

Course Objective:

- To introduce students to fundamental leadership theories, models, and frameworks for understanding leadership effectiveness.
- To develop the ability to analyze leadership styles, personality traits, emotional intelligence, and ethical values in organizational contexts.
- To enhance students' competence in evaluating leadership behavior, decision-making, and crisis management in diverse environments.
- To equip students with skills to lead groups and teams through effective communication, delegation, conflict management, and motivation.
- To enable students to design and apply strategies for developing high-performance, multicultural, and virtual teams using contemporary leadership practices.

Detailed Syllabus

UNIT I INTRODUCTION TO LEADERSHIP & TEAM MANAGEMENT	**6**
Leadership Myths; Interactional Framework for Analyse leadership; Leadership Development: The First 90 Days as a Leader; Leader Development- The Action-Observation-Reflection Model. LMX Theory and Normative Decision Model; Situational Leadership Model; Contingency Model and Path Goal Theory.	
UNIT II LEADERSHIP TYPES AND ATTRIBUTES	**6**
Emotional Approach Charismatic and Transformational Leadership; Leadership for Tomorrow, Leadership Attributes; Personality Traits and Leadership; Personality Types and Leadership; Intelligence and Leadership; Emotional Intelligence and Leadership. Power and Leadership; The art of influence in leadership; Leadership and "Doing the Right Things; Character-Based Approach to Leadership; Role of Ethics and Values in Organisational Leadership	
UNIT III LEADERSHIP BEHAVIOUR	**6**
Leadership Behaviour, Assessing Leadership Behaviour: Multi-rater feedback instruments, The Dark Side of Leadership -Destructive Leadership, Managerial Incompetence and Derailment, Negotiation and Leadership, Leadership in Crisis Situation, The Situation and The Environment, Culture and Leadership, Global Leadership, Motivation and Leadership	
UNIT IV INTRODUCTION TO GROUPS AND TEAMS	**6**
Characteristics of Leaders, Followers and Situation, Group Dynamics, Team Formation, Delegation and Empowerment, Leading Teams: Enhancing Teamwork Within a Group, The Leader's Role in Team-Based Organizations, Leader Actions That Foster Team Effectiveness, Offsite Training and Team Development, Understand Team Processes and Team Coaching, Team Decision Making and Conflict Management, Virtual Teams	
UNIT V MANAGING MULTICULTURAL TEAMS	**6**
Building Great Teams, Experiential Learning, Action Learning, Developmental Planning: Gaps Analysis, Coaching and Mentoring, Women in Leadership Roles, Building Effective Relationship with Subordinates and Peers, Fostering Followers Satisfaction, The Art of Communication, Setting Goals and Providing Constructive Feedback, Enhancing Creativity Problem Solving Skill, Building High-Performance Teams: The Rocket Model, Building Credibility and Trust, Skills for Developing others.	
	Total Periods:30

Learning Resources

1	Peter G. Northouse, "Leadership: Theory and Practice", 8th Edition, Sage Publications, 2019.
2	Stephen P. Robbins and Timothy A. Judge, "Organizational Behavior", 18th Edition, Pearson Education, 2019.
3	Robert N. Lussier and Christopher F. Achua, "Leadership: Theory, Application, and Skill Development", 6th Edition, Cengage Learning, 2016.
4	Jon R. Katzenbach and Douglas K. Smith, "The Wisdom of Teams", Harvard Business School Press, 2005.
5	Daniel Goleman, "Emotional Intelligence", Bantam Books, 2006.
6	Leadership and Team Effectiveness, Dr. Santosh Rangnekar, IIT Roorkee (NPTEL Course) https://onlinecourses.nptel.ac.in/noc22_mg39/preview

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain and compare major leadership theories, models, and frameworks.	Understand
CO2	Describe leadership styles, attributes, personality, and emotional intelligence in organizational situations.	Understand
CO3	Discuss leadership behavior, ethics, power, and decision-making in complex and crisis situations.	Understand
CO4	illustrate leadership principles to manage groups, teams, conflicts, and motivation effectively.	Understand
CO5	Explain leadership development and team-building strategies for high-performance, multicultural, and virtual teams.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	-	-	-	-	-	-	2	2	2	2	-	-
CO2	1	-	-	-	-	-	-	2	2	2	2	-	-
CO3	1	-	-	-	-	-	-	2	2	2	2	-	-
CO4	1	-	-	-	-	-	-	2	2	2	2	-	-
CO5	1	-	-	-	-	-	-	2	2	2	2	-	-
Avg.	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE533	**WASTE WATER ENGINEERING**	**L**	**T**	**P**	**C**
		3	0	2	4

Course Objective:

- To understand wastewater generation, collection, treatment, and disposal in urban and rural systems.
- To design and operate treatment units with emphasis on sustainability, reuse, and energy recovery.
- To gain hands-on experience in laboratory testing, monitoring, and performance evaluation of treatment systems.

Detailed Syllabus

UNIT I – PLANNING AND DESIGN OF SEWERAGE SYSTEM **9**

Characteristics of wastewater – Population equivalent – Sanitary sewage flow – Design period – Sewer materials – Hydraulics of flow – Sewer design – Storm runoff estimation – Sewer appurtenances – Pumping systems – Building drainage – Effluent standards – Smart sewer monitoring (IoT)

UNITIIPRIMARYTREATMENTPROCESSES **9** Objectives – Unit operations/processes – Selection of treatment – Onsite sanitation systems – Screens – Grit chambers – Sedimentation tanks – Operation & maintenance – Energy optimization.
UNIT III – SECONDARY BIOLOGICAL TREATMENT **9** Biological treatment principles – Activated Sludge Process and Extended Aeration – Sequencing Batch Reactor (SBR) – Rotating Biological Contactors – Trickling Filters – Waste Stabilization Ponds – Constructed Wetlands – Hybrid Biological Systems and Low-Energy Treatment Technologies
UNIT IV – ADVANCES IN WASTEWATER TREATMENT AND RESOURCE RECOVERY **9** Moving Bed Biofilm Reactor (MBBR) – Membrane Bioreactor (MBR) – UASB Process – Anaerobic digestion – Biogas recovery – Nutrient removal – Reuse systems – Circular water concept – Net zero discharge – Digital/online monitoring - Case study on modern wastewater treatment plant and resource recovery practices
UNIT V – SEWAGE DISPOSAL AND SLUDGE MANAGEMENT **9** Self-purification – Dilution & oxygen sag – Land disposal – Sewagefarming – Soil dispersion – Sludge treatment – Septage – Sludge- to-energy – Sustainable utilization

List of Experiments

Sl. No	List of Experiments
1	Sampling and preservation methods for water and wastewater (Demonstration only)
2	Measurement of Electrical conductivity and turbidity
3	Determination of fluoride in water by spectrophotometric method /ISE
4	Determination of iron in water (Demo).
5	Determination of Sulphate in water.
6	Determination of Optimum Coagulant Dosage by Jar test apparatus.
7	Determination of available Chlorine in Bleaching powder and residual chlorine in water.
8	Estimation of suspended, volatile and fixed solids.
9	Determination of Sludge Volume Index in waste water
10	Determination of Dissolved Oxygen
11	Estimation of B.O.D.
12	Estimation of C.O.D.
13	Determination of TKN and Ammonia Nitrogen in wastewater
	Total Periods: 45+30

Learning Resources

1	Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers, New Delhi, 2024
2	Duggal K.N., “Elements of Environmental Engineering” S.Chand and Co. Ltd., New Delhi, 2022
3	Punmia, B.C., Jain, A.K., and Jain.A.K.., Environmental Engineering, Vol.II, Laxmi Publications, 2020
4	Metcalf and Eddy- Wastewater Engineering–Treatment and Reuse, Tata Mc.Graw-Hill Company, New Delhi, 2014

5	Manual on Sewerage and Sewage Treatment Systems Part A,B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
6	Syed R. Qasim "Wastewater Treatment Plants"*Planning, Design, and Operation, Second Edition* CRC Press, Washington D.C.,2017
7	APHA, "Standard Methods for the Examination of Water and Wastewater", 23rdEd. Washington, 2017.
8	"Laboratory Manual for the Examination of water, wastewater soil Rump", H.H. and Krist,H. – Second Edition, VCH, Germany, 3rd Edition, 1999
9	https://onlinecourses.nptel.ac.in/noc26_ce72/preview

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the characteristics and composition of sewage and the principles involved in estimating sewage generation and sewer system design, including sewage pumping stations.	Understand
CO2	Describe the types of sewage treatment systems and the basic principles of unit operations used in sewage treatment.	Understand
CO3	Apply the principles of biological treatment to select suitable wastewater treatment processes.	Apply
CO4	Apply advanced treatment technologies for the reuse of treated sewage.	Apply
CO5	Apply the principles of stream self-purification and sludge and septage management in wastewater systems.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	2	3	-	3	3	-	-	1	3	-	3
CO2	3	-	3	2	2	3	3	-	2	-	-	3	3
CO3	3	-	3	2	-	-	3	-	2	-	-	3	2
CO4	2	-	3	2	3	-	3	-	-	-	2	3	2
CO5	2	2	3	2	2	3	3	3	-	-	2	3	3
Avg.	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**2**	**1**	**2**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE542	COMPUTER AIDED DRAFTING LABORATORY	L	T	P	C
		0	0	4	2

Course Objective:

To develop proficiency in using computer-aided drafting (CAD) software for precise 2D civil engineering documentation, spatial coordination, and attribute-based data extraction,

List of Experiments

S. No	List of Experiments
1	Setting up Workspaces, Units, Limits, and Layers
2	Drawing and Editing Basic Floor Plan Geometries using Modify Tools
3	Creating Standard CAD Blocks for Doors, Windows, and Fixtures
4	Assigning Text Attributes to Blocks and Extracting Material Schedules
5	Drafting a Complete 2BHK Residential Floor Plan
6	Projecting 2D Front and Side Elevations from the Floor Plan
7	Drafting a Detailed Cross-Section of the Building (Foundation to Roof)
8	Drafting Reinforcement Details for a Simple RCC Beam and Column
9	Combining Architectural and Structural Plans using External References (XREF)
10	Preparing Page Layouts, Title Blocks, and Plotting Drawings to Scale

Total Periods: 60

Detailed Syllabus

1. Setting up Workspaces, Units, Limits, and Layers

- Set up drawing units and workspace limits to match standard paper sizes.
- Create different layers for walls, dimensions, and text, giving each layer its own color and line thickness.
- Save these settings as a template file to use for all future drawings.

2. Drawing and Editing Basic Floor Plan Geometries using Modify Tools

- Draw outer and inner walls accurately using offset, coordinates, and object snaps.
- Use modify tools like trim, fillet, and extend to clean up wall corners and make space for doors.
- Add standard hatch patterns to clearly show different materials like brick and concrete.

3. Creating Standard CAD Blocks for Doors, Windows, and Fixtures

- Draw 2D doors, windows, and plumbing fixtures using standard real-world sizes.
- Group these drawn lines into reusable "Blocks" with a specific base point for easy placement.
- Insert and rotate these blocks to fit perfectly into the wall openings of a floor plan.

4. Assigning Text Attributes to Blocks and Extracting Material Schedules

- Add text tags (attributes) to blocks to store details like size, material, and manufacturer name.
- Place several of these data-filled blocks into a drawing to simulate a real project.
- Use the data extraction tool to automatically create a table (schedule) listing all the doors and windows in the drawing.



5. Drafting a Complete 2BHK Residential Floor Plan

- Draw a complete 2BHK floor plan following the minimum room sizes given in the National Building Code (NBC).
- Draw main walls and partition walls with correct thicknesses, making sure everything is on the right layer.
- Add clear dimensions and room area text to the entire plan.

6. Projecting 2D Front and Side Elevations from the Floor Plan

- Draw straight lines down from the floor plan to get the exact widths and window positions for the elevation.
- Mark standard height levels for the plinth, sill, lintel, and roof to build the front view.
- Use thicker lines for parts of the building that are closer to show depth in the drawing.

7. Drafting a Detailed Cross-Section of the Building (Foundation to Roof)

- Draw a vertical cut view of the building showing the foundation, plinth, lintel, and roof slab details.
- Draw a staircase side view by calculating the exact step heights and widths based on the floor height.
- Hatch the cut areas to clearly show the difference between concrete and masonry.

8. Drafting Reinforcement Details for a Simple RCC Beam and Column

- Draw the length-wise and cross-section views of a concrete beam and column.
- Show the exact placement of main steel bars, stirrups, and concrete cover following IS 456 rules.
- Label the steel bars clearly and create a simple Bar Bending Schedule (BBS) table on the sheet.

9. Combining Architectural and Structural Plans using External References (XREF)

- Keep the structural column plan and the architectural floor plan in two separate CAD files.
- Use the XREF tool to link and overlay the architectural plan onto the structural plan to check alignments.
- Spot and fix any mistakes, like a column blocking a doorway or resting in the middle of a room.

10. Preparing Page Layouts, Title Blocks, and Plotting Drawings to Scale

- Move from Model Space to Paper Space and insert a standard college title block.
- Create different view windows (viewports) to show the floor plan and the small details on the same printed page at different scales.
- Set up print styles to make sure layer colors print with the correct black line thickness, and save it as a PDF.

Learning Resources

1	Bhatt N.D. and Panchal V.M., Engineering Drawing (Plane and Solid Geometry), Charotar Publishing House, 55th Edition, 2025.
2	K. R. Gopalakrishna, Engineering Drawing (Vol. I & II), Subhas Stores, 32nd Edition, 2017.
3	Luzadder, W. J. and Duff, J. M., Fundamentals of Engineering Drawing, Prentice Hall of India, 11th Edition, 2011.
4	Sham Tickoo, AutoCAD 2023 for Engineers and Designers, CADCIM Technologies, 23rd Edition, 2024.
5	C. M. Agrawal, AutoCAD A to Z: A Concise Guide to Computer-Aided Design, S. Chand & Co., 1st Edition, 2020.
6	David Goetsch, Technical Drawing for Engineering Communication, Cengage Learning, 8th Edition, 2019.
7	https://www.autodesk.com/in/education/home
8	https://www.linkedin.com/learning/topics/autocad

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Configure CAD workspace templates, layer hierarchies, and precise geometrical settings for civil drafting.	Apply
CO2	Create and manage attributed CAD blocks to extract automated material schedules.	Apply
CO3	Draft complete 2D architectural floor plans, elevations, and cross-sections conforming to NBC standards.	Apply
CO4	Detail structural reinforcement for concrete members following Indian Standard (IS) codes.	Apply
CO5	Integrate multiple drawings using external references (XREF) and plot scaled drawing sets for professional submission.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	-	1	-	3	-	-	-	3	1	-	-	1
CO2	3	2	2	1	3	-	-	-	1	-	1	2	1
CO3	2	2	2	-	3	-	-	-	1	-	1	1	2
CO4	3	2	3	1	3	-	-	-	2	1	2	2	3
CO5	2	2	3	-	3	1	-	-	3	2	2	3	3
Avg.	**2**	**2**	**2**	**1**	**3**	**1**	**-**	**-**	**2**	**1**	**1**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24EM522	**Soft Skills and Personality Development – II**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

Course Objective:

- To improve written communication etiquette, covering email principles, netiquette, and proper messaging practices.
- To communicate effectively with clarity, active listening, and overcoming sender–receiver barriers.
- To develop non-verbal awareness, interpreting body language and cues, especially in high-stakes contexts (interviews, presentations).
- To enhance public speaking and presentation skills using visuals, confidence building, and anxiety management.
- To cultivate integrity-driven human relations, emphasizing listening, trust, and ethical communication

List of Exercises

Sl. No.	List of Exercises
1	Technology and Communication: Technological Personality, Mobile Personality
2	Communication Skills: Effective Communication
3	Barriers to Communication: Arising out of Sender/Receiver's Personality, Interpersonal Transactions, Miscommunication
4	Nonverbal Communication: Introduction And Importance, Issues and Types, Basics and Universals



5	Body Language: For Interviews, For Group Discussions
6	Presentation Skills: Overcoming Fear, Becoming A Professional, The Role of Body Language
7	Presentation Skills: Using Visuals
8	Reading Skills: Effective Reading
9	Human Relations: Developing Trust and Integrity
10	Visume
	Total Periods: 30

Learning Resources

1	Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.
2	Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.
3	Klaus, Peggy, Jane Rohman & Molly Hamaker. The Hard Truth about Soft Skills. London: HarperCollins E-books, 2007.
4	Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.
5	Enhancing Soft Skills and Personality, Dr. T. Ravichandran, IIT Kanpur NPTEL Course: https://onlinecourses.nptel.ac.in/noc26_hs47/preview
6	Developing Soft Skills and Personality, Dr. T. Ravichandran, IIT Kanpur NPTEL Course: https://nptel.ac.in/courses/109104107

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Write effective emails using email principles and etiquette	Apply
CO2	Design visuals using principles of clarity, readability, and relevance (graphs, slides, props).	Apply
CO3	Apply the communication model to real-world situations, accounting for tone, style, barriers	Apply
CO4	Compare self-assessed nonverbal behaviors to standardized benchmarks.	Understand
CO5	Apply confident body language techniques in interviews and group discussion simulations.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	1	2	-	2	-	-
CO2	-	-	-	-	-	-	-	1	2	-	2	-	-
CO3	-	-	-	-	-	-	-	1	2	-	2	-	-
CO4	-	-	-	-	-	-	-	1	2	-	2	-	-
CO5	-	-	-	-	-	-	-	1	2	-	2	-	-
Avg.	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**2**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
THEORY COURSES										
1	U24CE611	Design of Steel Structures	PCC	3	1	0	4	4	40	60
2	U24CE621	Irrigation Engineering	PCC	3	0	0	3	3	40	60
3	U24MG611	Project Management	HSMC	2	0	0	2	2	40	60
4	U24MG621	Entrepreneurship	EEC	2	0	0	2	2	40	60
5		Professional Elective – III	PEC					3		
6		Open Elective – 1	OEC					3		
7		Mandatory Course - II*	MC	3	0	0	3	0	100	-
THEORY CUM PRACTICAL COURSES										
8	U24CE633	Building Information Modelling	PCC	2	0	4	6	4	50	50
PRACTICAL COURSES										
9	U24CE642	Estimation and Costing Laboratory	PCC	0	0	4	4	2	60	40
				21	**1**	**8**	**30**	**23**		

ASSESSMENT SCHEME

Sl. No	Course Type	L	T	P	C	CIA Weightage (Theory)				CIA	ESE		CIA (W)	ESE (W)	Min. Marks to Pass for 100	
						T1	A1	T2	A2	Prac	Th	Prac			ESE	Total
1	U24CE611	3	1	0	4	60	40	60	40	-	100		40	60	45	50
2	U24CE621	3	0	0	3	60	40	60	40	-	100		40	60	45	50
3	U24MG611	2	0	0	2	60	40	60	40	-	100		40	60	45	50
4	U24MG622	2	0	0	2	-	-	-	-	-	-	-	100	-	-	50
5	PEC – III														45	50
6	OEC – 1														45	50
7	U24CE633	2	0	4	4	60	40	60	40	100	70	30	50	50	45	50
8	U24CE642	0	0	4	2	-	-	-	-	100	-	100	60	40	45	50
9	MC – II	3	0	0	0	-	-	-	-	-	-	-	100	-	-	50

(W) – Weightage

U24CE611	DESIGN OF STEEL STRUCTURES	L	T	P	C
		3	1	0	4

Course Objective:

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

Detailed Syllabus

UNIT I INTRODUCTION TO STRUCTURAL STEEL AND DESIGN OF CONNECTIONS	**12**
General - Types of Steel - Properties of structural steel - I.S. rolled sections - Concept of Limit State Design - Design of Simple and eccentric Bolted and welded connections - Types of failure (yielding, rupture, block shear) and efficiency of joint - prying action - Introduction to HSFG bolts.	
UNIT II DESIGN OF TENSION AND COMPRESSION MEMBERS	**12**
Behaviour and Design of simple tension members - Shear lag effect - Block shear failure - Behaviour of short and long columns - Buckling classes and Euler's column theory - Design of simple compression members - Design of built-up compression members with lacings and battens - Case study on bracing design for a steel structure.	
UNIT III COLUMN BASES, BEAMS, AND PLATE GIRDERS	**12**
Design of slab base - Design of laterally supported and unsupported beams - Web buckling and web crippling - Design of built-up beams - Proportioning and design of simple welded plate girders (without intermediate stiffeners).	
UNIT IV INDUSTRIAL STRUCTURES	**12**
Wind load calculations on roofs as per IS 875 (Part 3) - Design of roof trusses - loads on trusses - purlin design using angle and channel sections - Design of gantry girder - Introduction to pre-engineered buildings (PEB) framing systems.	
UNIT V PLASTIC ANALYSIS AND DESIGN	**12**
Introduction to plastic analysis - Shape factor - Plastic hinge formation - Collapse mechanism - Theory of plastic Analysis - Design of continuous beams and simple portal frames using plastic design approach. - Case Study on Failure of an Ordinary Moment Resisting Steel Structure	
	Total Periods: 60

Learning Resources

1	Duggal S.K., Design of Steel Structures, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2010
2	Bhavikatti S.S, Design of Steel Structures, Ik International Publishing House, New Delhi, 2017
3	Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India Pvt Limited, 2013
4	Jack C. McCormac and Stephen F Csernak, Structural Steel Design, Pearson Education Limited, 2013.
5	https://onlinecourses.nptel.ac.in/noc25_ce121/preview

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the design philosophy of steel structures and the behaviour of bolted and welded connections with respect to their design strengths.	Understand
CO2	Determine the suitable section shape and size for tension members, compression members, and beams based on given design criteria.	Apply
CO3	Apply the principles, procedures and current code requirements to the analysis and design of steel tension members, columns, column bases and beams	Apply
CO4	Compute and apply the design loads on Industrial structures, and gantry girder	Apply
CO5	Calculate ultimate load of steel beams and portal frames using plastic analysis	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	3	-	-	-	2	-	-	-	-	3	2
CO2	2	2	3	-	2	-	-	-	-	-	2	2	2
CO3	2	2	3	-	2	-	-	-	-	-	2	2	2
CO4	3	2	3	-	2	2	2	2	2	-	2	2	2
CO5	2	3	3	2	-	-	-	-	-	1	-	2	2
Avg.	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE621	IRRIGATION ENGINEERING	L	T	P	C
		3	0	0	3

Course Objective:

- To give an overview about the classification of Irrigation, water resources potential of our country and National water policy.
- To impart knowledge on the Different Irrigation Methods, Types of Dams & functions of Diversion components.
- To familiarize the students about the Classification of canals, its regulations & the different water management techniques utilized in Irrigation.

Detailed Syllabus

UNIT I CROP WATER REQUIREMENT **9**

Need and classification of irrigation - historical development and merits and demerits of irrigation types of crops - crop season - duty, delta and base period - consumptive use of crops - Requirement of water for various uses - National water policy - Impact of climate change on Water resources - Status of water resource potential of India and Tamil Nadu.

UNIT II IRRIGATION METHODS	**9**
Tank irrigation - Well irrigation - Irrigation methods: Surface and Sub - Surface and Micro Irrigation - design of drip and sprinkler irrigation - ridge and furrow irrigation - Irrigation scheduling - Water distribution system - Irrigation efficiencies	
UNIT III DIVERSION AND IMPOUNDING STRUCTURES	**9**
Types of Impounding structures - Gravity dam - Forces on a dam - Design of Gravity dams; Earth dams, Arch dams - Diversion Head works - Weirs and Barrages.	
UNIT IV CANAL IRRIGATION	**9**
Classification of canals - Canal regulations - direct sluice - Canal drop - Cross drainage works - Canal outlets - Design of prismatic canal - canal alignments - Canal lining - Kennedy's and Lacey's Regime theory - Design of unlined canal - Canal lining and canal maintenance.	
UNIT V WATER MANAGEMENT IN IRRIGATION	**9**
Modernization techniques - Rehabilitation - Optimization of water use - Minimizing water losses - On form development works - Participatory irrigation management - Farmers Association - Changing paradigms in water management - Performance evaluation - Economic aspects of irrigation - Automation of irrigation systems - Software in water resources.	
Total Periods: 45	

Learning Resources

1	Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2002.
2	Punmia B.C., et. al; Irrigation and water power Engineering, Laxmi Publications, 16th Edition, New Delhi, 2005
3	Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23rd Revised Edition, New Delhi, 2009
4	Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers, 2005
5	Linsley R.K. and Franzini J.B, "Water Resources Engineering", McGraw-Hill Inc, 2000
6	Sharma R.K.. "Irrigation Engineering", S.Chand & Co. 2007
7	https://nptel.ac.in/courses/126105010

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Explain the factors affecting crop water requirements.	Understand
CO2	Discuss the different irrigation methods and their processes.	Understand
CO3	Describe the various impounding structures used for water storage.	Understand
CO4	Discuss the different types of canals and its regulations.	Understand
CO5	Describe the different water management techniques utilized in Irrigation.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	-	2	-	2	2	-	2	2	3
CO2	2	2	2	1	-	2	-	3	2	-	2	2	3
CO3	2	2	2	2	-	3	-	2	2	-	2	2	3
CO4	2	2	2	1	-	3	2	2	2	-	3	2	3
CO5	2	2	2	1	-	3	2	2	2	-	2	2	3
Avg.	**2**	**2**	**2**	**1**	**-**	**2**	**2**	**2**	**2**	**-**	**2**	**2**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24MG611	PROJECT MANAGEMENT	L	T	P	C
		2	0	0	2

Course Objective:

- Understand the fundamentals of project management including project characteristics, life cycle phases, and key managerial issues involved in projects.
- Identify, screen, and evaluate projects using qualitative techniques and quantitative financial appraisal methods under certainty and uncertainty conditions.
- Understand project organizational structures and leadership concepts and analyze the roles and responsibilities of a project manager in different organizational settings.
- Apply project planning and control techniques for effective scope, time, and cost management using tools such as WBS, network diagrams, CPM, PERT, and earned value analysis.
- Recognize the importance of quality management in projects and apply quality assurance, quality control, and continuous improvement techniques for successful project execution.

Detailed Syllabus

UNIT I INTRODUCTION TO PROJECT MANAGEMENT **9**

Concept of project management - project definition and key features of projects - project life cycle phases - typical project management issues - basic project activities.

UNIT II PROJECT IDENTIFICATION AND SELECTION **9**

Identification and screening (brainstorming, strength and weakness in the system, Environmental opportunities and threats) - Project evaluation methods - Payback period - Net present value - internal rate of return and project evaluation under uncertainty.

UNIT III PROJECT ORGANIZATION **9**

Roles and responsibilities of a project manager, Project Organization- The project as Part of the Functional Organization - Pure Project Organization - The Matrix organization - leadership styles

UNIT IV SCOPE, TIME AND COST MANAGEMENT **9**

Scope Management-define the project-SOW, WBS - Time Management-Network diagram- forward and backward pass - critical path - PERT and CPM - AOA and AON methods - tools for project network - Cost management - earned value method.

UNIT V QUALITY MANAGEMENT **9**

Quality assurance and quality control - quality audit- methods of enhancing quality.

Total Periods: 45

Learning Resources

1	R. Panneerselvam and P. Senthil Kumar (2013), Project Management, PHI Learning Private Limited
2	Prasanna Chandra (2014), Projects: Planning, Analysis, Selection, Financing, implementation and Review
3	A Guide to the Project Management Body of Knowledge: (PMBOK Guide) by Project Management Institute, 2013.
4	Gopala Krishnan & Rama Murthy, A Text book of Project Management, McMillan India
5	S. Choudhary (2004), Project Management, Tata McGraw Hill Publication.
6	Clifford F Gray (2014), Project Management: The Managerial Process, (Special Indian Edit.), Oregon State University.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the concepts, characteristics, life cycle phases, and managerial issues of projects.	Understand
CO2	Identify, screen, and evaluate projects using financial appraisal techniques such as Payback Period, NPV, IRR, and evaluation under uncertainty.	Apply
CO3	Analyze different project organizational structures and leadership styles and assess the role of a project manager in achieving project objectives.	Understand
CO4	Develop project plans by defining scope, scheduling activities, identifying critical paths, and controlling cost using CPM, PERT, and earned value techniques.	Analyze
CO5	Apply quality management principles, quality assurance, quality control, and auditing techniques to enhance project performance and outcomes.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	2	2	2	2	-	-
CO2	3	2	2	-	-	-	-	2	2	2	2	-	-
CO3	3	-	-	-	-	-	-	2	2	2	2	-	-
CO4	3	2	2	-	-	-	-	2	2	2	2	-	-
CO5	3	2	2	-	-	-	-	2	2	2	2	-	-
Avg.	**3**	**2**	2	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24MG621	ENTREPRENEURSHIP	L	T	P	C
		2	0	0	2

Course Objective:

- Understand the fundamentals of entrepreneurship including motivation, leadership, social entrepreneurship, and the role of women entrepreneurs in economic development.
- Analyze the entrepreneurial process involved in identifying, evaluating, and selecting viable business opportunities through market research.
- Formulate innovative business ideas using creative problem-solving techniques and understand legal and ownership structures of business organizations.
- Develop and evaluate comprehensive business plans incorporating marketing, financial, organizational, and implementation strategies.
- Acquire knowledge of MSMEs and institutional support systems including government policies, incentives, subsidies, and industrial infrastructure for entrepreneurship development.

Detailed Syllabus

UNIT I INTRODUCTION	**9**
Understand entrepreneurship- need for entrepreneurship development - Theory of Entrepreneurial Motivation - Barriers to entrepreneurship - Qualities of a successful entrepreneur - Types of entrepreneurs, Entrepreneurial Leadership- Development of women entrepreneurs and the Future of entrepreneurship- Social Entrepreneurship.	
UNIT II ENTREPRENEURIAL PROCESS	**9**
Identification – Selection of a good Business opportunity - Market survey and Research – developing a business plan -Entrepreneurship Development Programme- Meaning - Objectives - Phases of EDP - Course contents, Target groups.	
UNIT III FORMULATION OF BUSINESS IDEA	**9**
Sources for new ideas & evaluation of new ideas for doing business - Creative problem-solving techniques used in entrepreneurial decision making. Formalities for registration of business units - Types of ownership in Business- merits and demerits - business incubators - types by valuation.	
UNIT IV THE BUSINESS PLAN	**9**
Nature and scope of Business plan - Writing Business Plan - Evaluating Business plans - sing and implementing business plans. Application BMC - Marketing plan - financial plan and the organizational plan - Launching formalities	
UNIT V MICRO SMALL MEDIUM ENTERPRISE (MSME)	**9**
Procedures and formalities for registration of business units and its benefits. Types of ownership in Business & its merits and demerits - Reason for business failures - causes and preventive measures. Institutional support to Entrepreneurship - Central and State Level Institutional support for business units. Industrial Estates & Special Economic Zones in India. Incentives and subsidies & bounties for businesses - Policy initiatives.	
	Total Periods: 45

Learning Resources

1	Anshuja Tiwari, (2015), Entrepreneurship Development in India, Himalaya Publishing House, New Delhi.
2	Nagaraja Prakasam, (2025) Back to Bharath in search of sustainable future, Penguin Business Published, New Delhi.

3	Vasant Desai, Dynamics of Entrepreneurial Development and Management Principles. Projects, Policies, Programmes – 2005, Himalaya Publishing House, New Delhi.
4	Poornima M Charantimath, (2016), Entrepreneurship Development Small Business Enterprises, Dorling Kindersley India Pvt. Ltd, New Delhi.
5	Anshuja Tiwari, (2015), Women Entrepreneurship and Economic Development, Himalaya Publishing House, New Delhi.
6	S. Anil Kumar, (2015), Small Businesses and Entrepreneurship, International Publishing House Private Ltd, New Delhi.
7	Dr. S.S. Khanka, (2012), Entrepreneurial Development, S.Chand, New Delhi.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the concepts, theories, and motivation behind entrepreneurship, including social and women entrepreneurship, and assess the qualities required for successful entrepreneurs.	Understand
CO2	Explain and evaluate business opportunities using market survey and research techniques and outline the stages of the entrepreneurial process	Understand
CO3	Describe innovative business ideas, apply creative problem-solving tools, and select appropriate ownership and registration procedures for business ventures.	Apply
CO4	Discuss a viable business plan using tools such as the Business Model Canvas, marketing, financial, and organizational plans.	Understand
CO5	Examine MSME policies, institutional support mechanisms, incentives, and causes of business failure to recommend strategies for sustainable entrepreneurial growth.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	2	2	2	2	-	-
CO2	3	-	-	-	-	-	-	2	2	2	2	-	-
CO3	3	2	2	-	-	-	-	2	2	2	2	-	-
CO4	3	-	-	-	-	-	-	2	2	2	2	-	-
CO5	3	-	-	-	-	-	-	2	2	2	2	-	-
Avg.	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE633	**BUILDING INFORMATION MODELLING**	**L**	**T**	**P**	**C**
		2	**0**	**4**	**4**

Course Objective:

- To learn the fundamental concepts and process of Building Information Modelling (BIM).
- To understand the workflow used in the industry for creating discipline-based and federated 3D models.



- To explain the process of model creation, coordination, and management across the project lifecycle.
- To comprehend the various emerging trends of BIM, including 5D, AIM, and the concept of a Digital Twin.

Detailed Syllabus

UNIT I INTRODUCTION TO BIM CONCEPTS AND DESIGN AUTHORING	**6**
Core BIM concepts, ISO 19650 standards, and the Federated Modeling workflow. Introduction to Design Authoring tools for discipline-based model creation. Overview of model-based engineering analysis and design review processes.	
UNIT II VISUALIZATION AND CLASH CHECK	**6**
Visualization techniques (Walkthrough, AR/VR/MR) and viewing modes (viewpoints, sections). Principles of model coordination, clash avoidance, and detection process. Generating priority matrices and clash detection reports.	
UNIT III DOCUMENTATION, COMMON DATA ENVIRONMENT (CDE) & LEVEL OF DEVELOPMENT (LOD)	**6**
Documentation standards: 2D drawing generation and report output from the model. Common Data Environment (CDE) setup, protocols, and information sharing workflows. Defining and applying Level of Development (LOD) and progression matrices.	
UNIT IV 4D FIELD BIM & ITS APPLICATIONS	**6**
4D BIM for construction sequencing, scheduling (Gantt chart), and progress monitoring. Field BIM applications: site logistics, safety analysis, and quality assurance. Introduction to Scan-to-BIM and As-built modeling processes.	
UNIT V 5D BIM, ASSET INFORMATION MODEL (AIM)	**6**
5D BIM: Quantity Take-Off (QTO), cost breakdown structures, and cost control integration. Asset Information Model (AIM), COBie, and information handover for Facility Management. Emerging trends: IoT, Data Analytics, and Digital Twin concepts.	

List of Experiments

S. No	List of Experiments
1	**Build the 3D Model** Create the main structural and architectural models with Level of Detail (LOD) applied.
2	**Organize Project Files** Set up naming conventions and folder structures for data exchange (CDE prep).
3	**Find and Fix Clashes** Combine models and run checks to resolve errors between systems (Clash Detection).
4	**Generate Visual Tours** Create walkthroughs, viewpoints, and 2D/3D sections (Visualization).
5	**Print Construction Drawings** Produce a complete set of annotated plans, sections, and sheets.
6	**Calculate Materials** Extract Quantity Take Off (QTO) data and prepare the output for cost linking (5D).
7	**Plan the Construction Schedule**

	Set up the work sequence and link the model for 4D review.
8	**Use BIM on Site** Plan the site layout and simulate construction activity/safety checks (Field BIM).
9	**Prepare for Handover** Add essential maintenance data to assets for future Facility Management (AIM/COBie).
10	**Prepare BIM for Smart Systems** Tag assets with essential data for monitoring and Digital Twin creation.
	Total Periods: 30+60

Learning Resources

1	K. V. Krishna, Building Information Modeling: Framework for Structural Design, New Delhi, India: Eastern Book Company, 2021.
2	C. Eastman, P. Teicholz, R. Sacks, and K. Liston, BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers, 3rd ed. Hoboken, NJ, USA: John Wiley & Sons, 2018.
3	P. Barnes and N. Davies, BIM in Principle and in Practice, 3rd ed. London, U.K.: ICE Publishing, 2019.
4	International Organization for Standardization, Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 1: Concepts and principles (ISO 19650-1:2018). Geneva, Switzerland: ISO, 2018.
5	A. Borrmann, M. König, C. Koch, and J. Beetz, Eds., Building Information Modeling: Technology Foundations and Industry Practice. Cham, Switzerland: Springer, 2018.
6	S.-H. Hsieh et al., Eds., Research Companion to Building Information Modeling. Cheltenham, U.K.: Edward Elgar Publishing, 2022.
7	https://www.autodesk.com/learn/ondemand/collection/bim-foundations-for-education

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply BIM standards and workflows for developing digital building models.	Apply
CO2	Construct BIM models and coordinate project information using design authoring tools.	Apply
CO3	Perform BIM-based information management and construction sequencing.	Apply
CO4	Apply 4D BIM for project sequencing and schedule review, and implement Field BIM techniques for construction logistics.	Apply
CO5	Evaluate projects using 5D BIM for cost and quantity analysis and recognize the applications of AIM and emerging digital technologies such as Digital Twins.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	-	3	-	-	1	2	3	2	1	3
CO2	3	2	3	1	3	1	-	1	1	1	1	2	3
CO3	2	1	2	-	3	-	-	1	3	3	2	1	3
CO4	2	2	3	2	3	2	-	1	2	3	2	2	3
CO5	3	3	2	2	3	3	-	1	1	3	3	2	3
Avg.	**2**	**2**	**2**	**1**	**3**	**1**	**-**	**1**	**2**	**3**	**2**	**2**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE642	ESTIMATION AND COSTING LABORATORY	L	T	P	C
		0	0	4	2

Course Objective:

- To understand and apply standard specifications (IS codes/CPWD/PWD) for various construction activities such as earthwork, concrete works, masonry, and finishing works.
- To apply estimation methods to prepare approximate and detailed estimates for residential buildings.
- To analyze and compute material requirements and rates include steel reinforcement estimation, Bar Bending Schedule (BBS), earthwork calculations, and rate analysis using Standard Schedule of Rates.
- To apply estimation and valuation techniques to prepare BOQ, abstract estimates, tender documents, and perform valuation of buildings through case studies.

List of Experiments

Sl No	List of Experiments
1	Study and application of Detailed Specifications (as per IS codes/CPWD/PWD) for major construction activities (e.g., Earthwork, PCC, RCC, Brickwork, Plastering etc)
2	Preparation of Approximate Estimates for a residential building project using the Plinth Area Method and Cubical Content Method.
3	Preparation of a Detailed Estimate for a single-story Load-Bearing Residential Building using the Long Wall - Short Wall (Individual Wall) Method
4	Preparation of a Detailed Estimate for a single-story Load-Bearing Residential Building using the Centre Line Method.
5	Preparation of a Detailed Estimate for an RCC Framed Structure.
6	Preparation of detailed estimate of Septic tank.
7	Estimation of Quantity of Steel Reinforcement and preparation of a Bar Bending Schedule (BBS) for RCC structural elements.
8	Estimation of Earthwork Quantity in cutting and embankment for a Road Project.
9	Rate Analysis for different types of concrete works.
10	Rate Analysis for various types of Masonry and Finishing Works using Standard Schedule of Rates (PWD)
11	Preparation of the final Abstract Estimate and Bill of Quantities (BOQ) for a detailed estimate.
12	Case Study and Report – Valuation of a Building
13	Case Study – Preparation of a Complete Tender Document
	Total Periods: 60

Learning Resources

1	Dutta B. N., Estimating and Costing in Civil Engineering: Theory and Practice, Including Specifications and Valuation, UBS Publishers' Distributors / CBS Publishers.
2	Chakraborti. M, Estimating, Costing, Specification & Valuation In Civil Engineering, Vikas Book House
3	Rangwala S. C., Estimating, Costing and Valuation, Charotar Publishing House.
4	Vazirani V. N., Chandola S. P., Civil Engineering: Estimating, Costing and Valuation Including Quantity Surveying, Contracting & Account, Khanna Publishers.
5	Govt of Tamil Nadu PWD - Standard Schedule of Rates SSR,
6	CPWD-DSR: Central Public Works Department - Delhi Schedule of Rates,
7	https://onlinecourses.swayam2.ac.in/e-learning/preview/nou20_cs11

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply estimation techniques to calculate approximate quantities and interpret detailed construction specifications.	Apply
CO2	Determine the quantities of construction materials for load-bearing and framed structures by applying suitable estimation methods.	Apply
CO3	Determine the quantities of reinforcement steel, earthwork, and construction materials for specialized structural components.	Apply
CO4	Perform rate analysis for concrete, masonry, and finishing works by applying the Standard Schedule of Rates	Apply
CO5	Construct project documentation for estimation, including Abstract Estimate and Bill of Quantities, utilizing estimation software	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	-	2	-	1	2	3	2	3	2
CO2	3	3	2	2	2	-	-	2	2	3	2	3	2
CO3	3	3	3	3	2	-	-	2	2	2	2	3	2
CO4	3	2	2	2	-	3	2	2	2	3	2	3	2
CO5	2	2	2	2	3	2	2	3	3	3	3	2	3
Avg.	**3**	**2**	**2**	**2**	**1**	**1**	**2**	**2**	**2**	**3**	**2**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
THEORY COURSES										
1	U24MG711	Human Values and Ethics	HSMC	2	0	0	2	2	40	60
2	U24MG721	Total Quality Management	HSMC	3	0	0	3	3	40	60
3		Professional Elective - IV	PEC					3		
4		Professional Elective - V	PEC					3		
5		Professional Elective - VI	PEC					3		
6		Open Elective II	OEC					3		
PRACTICAL COURSES										
7	U24CE712	Mini Project	EEC	0	0	4	4	2	60	40
8	U24CE722	Summer Internship*	EEC	0	0	4	4	2	100	-
				17	**0**	**8**	**25**	**21**		

ASSESSMENT SCHEME

Sl. No	Course Type	L	T	P	C	CIA Weightage (Theory)				CIA	ESE		CIA (W)	ESE (W)	Min. Marks to Pass for 100	
						T1	A1	T2	A2	Prac	Th	Prac			ESE	Total
1	U24MG711	2	0	0	2	60	40	60	40	-	100		40	60	45	50
2	U24MG721	3	0	0	3	60	40	60	40	-	100		40	60	45	50
3	PEC – IV														45	50
4	PEC – V														45	50
5	PEC – VI														45	50
6	OEC – 2														45	50
7	U24CE712	0	0	4	2	-	-	-	-	100	-	100	60	40	45	50
8	U24CE722	0	0	4	2	-	-	-	-	-	-	-	100	-	-	50

(W) – Weightage

U24MG711	HUMAN VALUES AND ETHICS	L	T	P	C
		2	0	0	2

Course Objective:

- To create awareness about values and ethics enshrined in the Constitution of India
- To sensitize students about the democratic values to be upheld in the modern society.
- To inculcate respect for all people irrespective of their religion or other affiliations.
- To install the scientific temper in the students' minds and develop their critical thinking.
- To promote a sense of responsibility and understanding of the duties of citizen.

Detailed Syllabus

UNIT I DEMOCRATIC VALUES	**6**
Understand Democratic values: Equality, Liberty, Fraternity, Freedom, Justice, Pluralism, Tolerance, Respect for All, Freedom of Expression, Citizen Participation in Governance – World Democracies: French Revolution, American Independence, Indian Freedom Movement.	
UNIT II SECULAR VALUES	**6**
Understand Secular values – Interpretation of secularism in Indian context - Disassociation of state from religion – Acceptance of all faiths – Encouraging non-discriminatory practices.	
UNIT III SCIENTIFIC VALUES	**6**
Scientific thinking and method: Inductive and Deductive thinking, Proposing and testing Hypothesis, validating facts using evidence-based approach – Skepticism and Empiricism – Rationalism and Scientific Temper.	
UNIT IV SOCIAL ETHICS	**6**
Application of ethical reasoning to social problems – Gender bias and issues – Gender violence – Social discrimination – Constitutional protection and policies – Inclusive practices.	
UNIT V SCIENTIFIC ETHICS	**6**
Transparency and Fairness in scientific pursuits – Scientific inventions for the betterment of society - Unfair application of scientific inventions – Role and Responsibility of Scientist in the modern society.	
Total Periods: 30	

Learning Resources

1	The Nonreligious: Understand Secular People and Societies, Luke W. Galen Oxford University Press, 2016.
2	Secularism: A Dictionary of Atheism, Bullivant, Stephen; Lee, Lois, Oxford University Press, 2016.
3	The Oxford Handbook of Secularism, John R. Shook, Oxford University Press, 2017.
4	The Civic Culture: Political Attitudes and Democracy in Five Nations by Gabriel A. Almond and Sidney Verba, Princeton University Press,
5	Research Methodology for Natural Sciences by Soumitro Banerjee, IISc Press, January 2022

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Explain the importance of democratic, secular, and scientific values for the harmonious functioning of social life.	Understand
CO2	Describe the role of democratic and scientific values in shaping responsible personal and professional behaviour.	Understand

CO3	Interpret social problems using rational and logical thinking approaches.	Understand
CO4	Explain the principles of ethical behaviour in societal contexts.	Understand
CO5	Discuss the significance of critical thinking and the pursuit of truth in decision-making.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	–	–	–	–	–	–	3	2	2	–	2	–	–
CO2	-	-	-	-	-	-	3	2	2	-	2	-	-
CO3	-	-	-	-	-	-	3	2	2	-	2	-	-
CO4	-	-	-	-	-	-	3	2	2	-	2	-	-
CO5	-	-	-	-	-	-	3	2	2	-	2	-	-
Avg.	-	-	-	-	-	-	**3**	**2**	**2**	-	**2**	-	-

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24MG721	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objective:

- Understand the fundamentals of quality and TQM philosophy, including its evolution, principles, frameworks, and contributions of quality gurus.
- Explain and apply core TQM principles such as leadership, customer focus, employee involvement, continuous improvement, and supplier partnership.
- Analyze and use TQM tools and techniques including traditional quality tools, Six Sigma, benchmarking, FMEA, QFD, TPM, and quality circles.
- Evaluate quality costs and improvement methodologies to enhance organizational performance and process efficiency.
- Understand and implement Quality Management Systems (QMS and EMS) based on ISO 9001 and ISO 14001 standards in manufacturing and service organizations.

Detailed Syllabus

UNIT I INTRODUCTION TO TOTAL QUALITY MANAGEMENT **9**

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

UNIT II TQM PRINCIPLES **9**

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

UNIT III TQM TOOLS & TECHNIQUES I **9**

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

UNIT IV TQM TOOLS & TECHNIQUES II	**9**
Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures- Cost of Quality - BPR.	
UNIT V QUALITY MANAGEMENT SYSTEM	**9**
Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation- Internal Audits-Registration-ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS.	
Total Periods: 45	

Learning Resources

1	Dale H. Besterfiled, Carol B. Michna, Glen H. Bester field, Mary B. Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.
2	James R. Evans and William M. Lindsay, “The Management and Control of Quality”, 6th Edition, South-Western (Thomson Learning), 2005.
3	Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
4	Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd.,2006.
5	Janakiraman,B and Gopal, R.K, “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd., 2006.

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Explain the concepts of quality, Total Quality Management, quality dimensions, TQM frameworks, benefits, and barriers.	Understand
CO2	Demonstrate TQM principles such as leadership, customer satisfaction models, employee involvement, continuous improvement, and supplier partnership in organizational contexts.	Understand
CO3	Describe TQM tools and techniques (Seven QC tools, Six Sigma, Benchmarking, FMEA, QFD, TPM) to analyze and solve quality-related problems.	Understand
CO4	Describe quality improvement strategies including cost of quality, BPR, Taguchi loss function, and performance measurement systems.	Understand
CO5	Explain Quality Management Systems and Environmental Management Systems, and outline the implementation and audit requirements of ISO 9001 and ISO 14001 standards.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	2	-	2	2	-	2	-	-
CO2	3	-	-	-	-	2	-	2	2	-	2	-	-
CO3	3	-	-	-	-	2	-	2	2	-	2	-	-
CO4	3	-	-	-	-	2	-	2	2	2	2	-	-
CO5	3	-	-	-	-	2	-	2	2	-	2	-	-
Avg.	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**2**	**2**	**2**	**-**	**-**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE712	MINI PROJECT	L	T	P	C
		0	0	4	2

Course Objective:

To familiarize the students of Civil Engineering to do an Innovative project, which allows the students to come up with designs, fabrication or algorithms and programs expressing their ideas in a novel way

Description:

- It is intended to provide early exposure to problem-solving, creativity, and hands- on learning.
- At the outset the department issues guidelines outlining objectives, scope, timelines and evaluation criteria.
- Students, typically working in small teams, identify a problem aligned with innovation, design, or societal needs, and submit a project proposal for approval.
- Faculty mentors are assigned to guide the teams throughout the project.
- During execution, students engage in activities such as ideation, design, prototyping, experimentation, and analysis, applying fundamental engineering concepts.
- Regular review meetings are conducted to monitor progress, provide feedback and ensure timely completion.
- For Socially relevant projects, emphasis is given to addressing real – world community challenges.
- Students maintain basic documentation, including progress records and design details.
- At the end, they submit a concise project report and demonstrate their work through a presentation or prototype evaluation.

Total periods – 60

Course Outcomes:

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

CO	Course Outcome Statement	Knowledge Level
CO1	Apply engineering knowledge to execute assigned tasks and solve practical problems	Apply
CO2	Analyze real-time industrial processes, systems, or workflows encountered during the internship	Apply
CO3	Demonstrate technical skills and professional practices relevant to their field	Apply
CO4	Evaluate their performance, learning outcomes, and industry practices through structured reports	Apply
CO5	Create comprehensive documentation and presentations summarizing internship experiences and outcomes	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2		2	2	2	2	2	3	3
CO2	2	3	2	2	2		2	2	2	2	2	3	3
CO3	2	-	2	2	2		2	2	2	2	2	3	3
CO4	2	2	2	2	2		2	2	2	2	2	3	3
CO5	2	-	2	2	2		2	2	2	2	2	3	3
Avg.	**2.2**	**2.3**	**2**	**2**	**2**		**2**	**2**	**2**	**2**	**2**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CE722	Summer Internship	L	T	P	C
		0	0	4	2

Course Objective:

- 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.

Description:

The 4-week summer internship for B.E./B.Tech students is implemented through a well-defined process to ensure both academic relevance and meaningful industry exposure. Internships may be secured through the institution's placement cell, faculty references, or by students themselves, subject to departmental approval. Prior to the internship, the department issues detailed guidelines specifying eligibility, duration, expected outcomes, and documentation formats. Students submit their internship details, including offer letters, which are reviewed and approved, and faculty mentors are assigned to guide and monitor their progress. A structured orientation program is conducted to familiarize students with internship objectives, professional ethics, workplace conduct, and reporting requirements. During the internship, students actively engage in assigned technical tasks, apply theoretical knowledge to practical situations, and develop professional skills. They are required to maintain a daily or weekly logbook and submit periodic progress updates. Faculty mentors track student performance through regular interactions, while industry supervisors oversee daily activities, provide technical guidance, and evaluate the student's learning and overall contribution.

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Apply engineering concepts and technical knowledge to perform assigned industrial tasks.	Apply
CO2	Analyze real-time problems, processes, and systems encountered during the internship.	Analyze
CO3	Demonstrate professional skills including teamwork, communication, and ethical practices.	Apply
CO4	Evaluate industrial practices, personal performance, and learning outcomes through structured reporting.	Evaluate
CO5	Create detailed internship reports, logbooks, and presentations summarizing their work and learning experience.	Create

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2		2		2	2	2		3	3	2
CO2	2	3	2		2		2	2	2		3	2	2
CO3	2	2	2		2		2	2	2		2	3	3
CO4	2	2	2		2		2	2	2		2	2	2
CO5	2	2	2		2		2	2	2		2	2	3
Avg.	**2.2**	**2.4**	**2**		**2**		**2**	**2**	**2**		**2.4**	**2.4**	**2.4**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
PRACTICAL COURSES										
1	U24CE812	Capstone Project / Industry internship	EEC	0	0	16	16	8	60	40
				0	**0**	**16**	**16**	**8**		

U24CE812	CAPSTONE PROJECT / INDUSTRY INTERNSHIP	L	T	P	C
		0	0	16	8

Course Objective:

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

Description:

The Capstone Project/Industry Internship in the final semester is designed as a comprehensive learning experience that integrates theoretical knowledge with practical application. Students may undertake the capstone either internally within the institution under faculty supervision or externally in an industry, research organization, or startup. The external project/internship may be secured through the institution's placement cell, faculty references, or by students themselves, subject to departmental approval. At the beginning, the department issues detailed guidelines covering project scope, duration, expected outcomes, and evaluation criteria. Students are required to identify a problem statement, submit a project proposal, and obtain approval. Faculty guides are assigned for internal projects, while external projects involve both a faculty mentor and an industry supervisor. During execution, students carry out design, development, analysis, or implementation work, with periodic reviews to monitor progress. For industry-based projects, regular interaction with the organization ensures alignment with real-world requirements. Students must maintain proper documentation, including progress reports and logs. Upon completion, they submit a detailed project report and present their work through a final review and viva voce evaluation.

Total periods - 240

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Identify and formulate a relevant engineering problem based on societal or industrial needs.	Understand
CO2	Conduct literature review and select appropriate methodologies to address the defined problem.	Apply
CO3	Design, develop, and implement a working model/solution using suitable engineering tools and techniques.	Analyse
CO4	Analyze, validate, and interpret results to evaluate the effectiveness of the proposed solution.	Analyse

CO5	Prepare a comprehensive technical report and effectively present the project findings.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3						2	2	2		2	3	3
CO2	3	3	3		3		2	2	2		2	3	3
CO3	3	3	3	2	3		2	2	2		2	3	3
CO4	3	3	3	2	3		2	2	2		2	3	3
CO5	3	3					2	2	2		2	3	3
Avg.	**3**	**3**	**3**	**2**	**3**		**2**	**2**	**2**		**2**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

PROFESSIONAL ELECTIVES

VERTICAL 1: STRUCTURAL ENGINEERING

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24CESE01	Advanced Design of Reinforced Concrete Structures	PEC	3	0	0	3	3	40	60
2	U24CESE02	Design of Steel Concrete Composite Structures	PEC	3	0	0	3	3	40	60
3	U24CESE03	Prefabricated Structures	PEC	3	0	0	3	3	40	60
4	U24CESE04	Prestressed Concrete Structures	PEC	3	0	0	3	3	40	60
5	U24CESE05	Maintenance, Repair and Rehabilitation of Structures	PEC	3	0	0	3	3	40	60
6	U24CESE06	Dynamics and Earthquake Resistant Structures	PEC	3	0	0	3	3	40	60
7	U24CESE07	Finite Element Method	PEC	3	0	0	3	3	40	60

U24CESE01	ADVANCED DESIGN OF REINFORCED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

Course Objective:

- To give an exposure to the design of continuous beams, slabs, staircases, Bridges and to introduce yield line theory.

Detailed Syllabus

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: SLABS AND FOUNDATION SYSTEMS	**9**
Design of flat slabs (with and without drops and column heads) – Design of combined footings (rectangular and trapezoidal) – Principles of design of mat foundation and box culverts.	
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: INTRODUCTION TO BRIDGE DESIGN	**9**
Introduction to bridge components and classification - IRC Loadings (Class AA and Class A) - Design of Solid Slab Bridges (Deck slab design only) for IRC loadings.	

Learning Resources

1	Reinforced Concrete Design – S. Unnikrishna Pillai & Devdas Menon, McGraw Hill Education, 2021
2	Limit State Design of Reinforced Concrete – P. C. Varghese, PHI Learning, 2013
3	Design of Reinforced Concrete Structures – N. Subramanian, Oxford University Press, 2013
4	Dynamics of Structures: Theory and Applications to Earthquake Engineering – Anil K. Chopra,

	Pearson Education, 2024
5	Unnikrishna Pillai, S., Devdas Menon, “Reinforced Concrete Design”, Tata McGraw Hill PublishingCompanyLtd.,2022
6	Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006
7	Krishnaraju. “Design of Reinforced Concrete Structures", CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2017
8	Sinha, S.N., “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., New Delhi,2002.
9	Punmia. B.C., AshokKuma rJain, Arun Kumar Jain,“Limit State Design of Reinforced Concrete”, Laxmi Publication Pvt. Ltd., New Delhi, 2023

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Design cantilever and counterfort retaining walls and draw the reinforcement detailing.	Apply
CO2	Design rectangular and circular water tanks (for above and below ground conditions) including circular slabs, and draw the detailing.	Apply
CO3	Design flat slabs and combined footings, and explain the design principles of mat foundations and box culverts.	Apply
CO4	Determine collapse loads and plastic moments for various slab geometries applying the virtual work method in yield line theory.	Apply
CO5	Classify bridge components and design the deck slab of solid slab bridges for standard IRC Class AA and Class A loadings.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	3	-	2	1	-	3	1	-	1	3	1
CO2	3	-	-	2	1	-	-	-	1	-	1	3	1
CO3	3	2	-	3	3	-	-	3	1	2	1	3	2
CO4	3	3	2	3	3	-	-	1	1	-	1	2	3
CO5	3	3	2	3	3	-	2	1	1	-	1	2	3
Avg.	**3**	**3**	**2**	**3**	**3**	**1**	**2**	**3**	**1**	**2**	**1**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CESE02	DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES	L	T	P	C
		3	0	0	3

Course Objective:

- To provide a comprehensive understanding of steel-concrete composite action and to enable the design of composite beams, columns, and floor systems in accordance with the latest IS:11384-2022 code provisions.



Detailed Syllabus

UNIT I: INTRODUCTION AND FUNDAMENTALS	**9**
Introduction to composite structures – Theory of composite structures – Modular ratio – Transformed section – Composite action – No interaction – Full interaction – Slip calculation – Types and load transferring mechanism of shear connectors – Sectional properties like moment of inertia.	
UNIT II: DESIGN PHILOSOPHIES AND IS:11384-2022	**9**
IS:11384-2022 Code provisions for steel-concrete composites design – Limit states for Strength and Serviceability – Local buckling and section classification – Partial Safety Factors for loads and materials – Load combinations – Stress block – Ultimate moment capacity with or without profiled decking steel sheet.	
UNIT III: COMPOSITE BEAMS	**9**
Introduction to composite beams – Ultimate moment behavior – Types, merits, and behavior of profiled decking – Design consideration for simply supported and continuous composite beams with or without profiled steel sheeting – Design problems.	
UNIT IV: COMPOSITE FLOORS AND SLABS	**9**
Introduction to composite floors – Shear transferring mechanism in profile deck system – Bending resistance of composite slab – Design consideration of composite floor – Design of composite floor and slab systems – Design problems.	
UNIT V: COMPOSITE COLUMNS AND BEAM-COLUMNS	**9**
Introduction to composite columns – Resistance of encased and infilled composite column cross-sections under axial compression – Interaction M-N curve – Estimation of plastic moment capacity of beam-column – Plastic capacity of encased and infilled composite column under uniaxial and biaxial bending – Design problems.	
Total Periods: 45	

Learning Resources

1	Teaching resource for, “Structural Steel Design,” Volume 2 of 3, Institute for Steel Development and Growth (INSDAG), 2002.
2	Johnson R.P (1994), “Composite Structures of Steel and Concrete”, volume I, Black well scientific publication, U.K.1999.
3	Narayanan R, “Composite steel structures – Advances, design and construction”, Elsevier, Applied science, UK, 1987
4	Handbooks of INSDAG (periodicals) Website: www.steel-insdag.org
5	IS 11384-2022, Code of Practice for Composite Construction in Structural Steel and Concrete
6	IS 11384-1985, Code of Practice for Composite Construction in Structural Steel and Concrete

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Calculate the sectional properties and slip of steel-concrete elements by implementing the principles of transformed sections and composite action.	Apply
CO2	Determine appropriate section classifications and partial safety factors for limit state design by following IS:11384-2022 specifications.	Apply
CO3	Estimate the ultimate moment capacity and design simply supported composite beams incorporating profiled steel decking.	Apply
CO4	Design composite floor systems by evaluating shear transfer mechanisms and bending resistance.	Apply
CO5	Construct M-N interaction curves to find the axial and flexural resistance of encased and infilled composite columns under uniaxial and biaxial bending.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	2	-	-	1	-	2	1	3	2
CO2	3	2	1	-	2	-	1	1	1	1	-	3	2
CO3	3	3	2	2	2	-	1	2	1	1	-	3	3
CO4	3	2	2	1	2	1	2	2	2	1	1	3	3
CO5	3	3	2	1	2	1	2	2	2	1	1	3	3
Avg.	**3**	**3**	**2**	**1**	**2**	**1**	**2**	**2**	**1**	**1**	**1**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CESE03	PREFABRICATED STRUCTURES	L	T	P	C
		3	0	0	3

Course Objective:

- To introduce the basic concepts of prefabrication
- To acquire the knowledge of prefabrication components and systems
- To understand the design principles in prefabrication
- To perceive the types of joints and connections in structural members
- To impart knowledge about structural stability.

Detailed Syllabus

UNIT I INTRODUCTION **9**

Prefabrication - Types - Need for prefabrication - Advantages and limitations – Principles of prefabrication – Modular coordination – Standardization– Loads and load combinations–Recent advanced Materials – Production – Transportation – Erection.

UNIT II PREFABRICATED COMPONENTS AND SYSTEMS **9**

Behaviour and types of structural components– roof and floor slabs – Walls panels - Shear walls - Beams - Columns – skeletal system- portal frame System-Large panel systems - block system

UNIT III DESIGN PRINCIPLES **9**

Design philosophy- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems - Design considerations for connections in seismic zones -Design for stripping, stacking, transportation and erection of elements.

UNIT IV JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS **9**

Types of Joints – based on action of forces - compression joints - shear joints - tension joints - based on function - construction joints, contraction joints, expansion joints. Design of expansion joints Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation - post-tensioned connections in precast structures

UNIT V DESIGN FOR ABNORMAL LOADS **9**

Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., Importance of avoidance of progressive collapse - Case Study: Progressive collapse of a precast concrete building due to abnormal loading.

Total Periods: 45

Learning Resources

1	Lewitt, M. " Precast Concrete- Materials, Manufacture, Properties And Usage, CRC Press, 2019
2	Alfred Steinle, Hubert Bachmann, Mathias Tillmann, Philip Thrift . "Precast Concrete Structures", Ernst & Sohn, Berlin, 2019.
3	Indian Concrete Institute, Handbook on Precast Concrete Buildings, 2016
4	Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers, USA,1991.
5	Precast/Prestressed Concrete Institute, PCI Design Handbook: Precast and Prestressed Concrete, 9th Edition, 2025.
6	Bureau of Indian Standards, IS 15916: Building Design and Erection Using Prefabricated Concrete, 2020.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Describe the principles of prefabrication, production, transportation, and erection.	Understand
CO2	Discuss the panel systems, slabs, beams, shear walls, and columns used in precast construction.	Understand
CO3	Explain the design of cross sections and joint flexibility.	Understand
CO4	Describe the joints and connections used in precast construction.	Understand
CO5	Explain the fundamentals of structural stability in precast structures.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	2	1	2	2	2
CO2	3	1	2	1	1	3	3	1	2	1	2	2	2
CO3	3	3	3	3	3	3	3	2	2	1	2	2	2
CO4	3	2	2	2	1	3	3	1	2	1	2	2	2
CO5	3	2	3	3	1	3	3	1	2	1	2	2	2
Avg.	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CESE04	PRESTRESSED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the fundamental principles, materials, methods, and anchorage systems of prestressing, along with stress analysis concepts for prestressed concrete members.
- To develop the ability to design prestressed concrete members for flexural and shear behaviour using standard design principles and engineering practices.
- To analyze the effects of prestress losses, deflections, and serviceability requirements, including anchorage zone stresses and bond characteristics.

- To apply prestressing concepts in the design of composite, continuous, and miscellaneous structures such as tanks, pipes, sleepers, and partially prestressed members.

Detailed Syllabus

UNIT I INTRODUCTION – THEORY AND BEHAVIOUR	**9**
Basic principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems – Analysis of sections of stresses by stress concept, strength concept and load balancing concept	
UNIT II DESIGN FOR FLEXURE AND SHEAR	**9**
Basic assumptions of flexural design – Permissible stresses in steel and concrete as per I.S.1343 Code – Different Types of sections - Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for flexural capacity based on I.S. 1343 Code – Influence of Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code	
UNIT III DEFLECTION AND SERVICEABILITY	**9**
Losses of Prestress in post -tensioned and pre-tensioned members. Factors influencing deflections – Short-term deflections of uncracked members – Prediction of longterm deflections due to creep and shrinkage – Check for serviceability limit states. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and I.S. 1343 code – design of anchorage zone reinforcement – Check for transfer bond length in pretensioned beams– design of anchorage zone reinforcement – Check for transfer bond length in pretensioned beams	
UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS	**9**
Analysis and design of composite beams – Shrinkage strain and its importance – Differential shrinkage - Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design. External Prestressing systems.	
UNIT V MISCELLANEOUS STRUCTURES	9
Role of prestressing in members subjected to Tensile forces and compressive forces – Design of Tension members and Compression members - Design of Tanks, Pipes, Sleepers and Poles – Partial prestressing – methods of achieving partial prestressing, merits and demerits of partial prestressing	
	Total Periods:45

Learning Resources

1	Krishna Raju N., *"Prestressed Concrete"*, 6th Edition, McGraw Hill Education India, New Delhi, 2025
2	Pandit G.S. and Gupta S.P., *"Prestressed Concrete"*, 5th Edition, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2022
3	Rajagopalan N., *"Prestressed Concrete"*, 3rd Edition, Alpha Science International Ltd., 2002
4	Dayaratnam P., *"Prestressed Concrete Structures"*, 2nd Edition, Oxford & IBH Publishing, New Delhi, 2018
5	Lin T.Y. and Burns N.H., *"Design of Prestressed Concrete Structures"*, 3rd Edition, Wiley India Pvt. Ltd., 2015
6	https://onlinecourses.nptel.ac.in/noc25_ce89/preview?utm_source=chatgpt.com

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Design a prestressed concrete beam accounting for losses	Apply



CO2	Determine flexural and shear for structural components.	Apply
CO3	Design the anchorage zone for post-tensioned members and estimate the deflection in beams	Apply
CO4	Determine the design parameters of composite members and continuous beams.	Apply
CO5	Design water tanks, pipes, poles and sleepers	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	1	1	1	1	2	1	1	1	2	3
CO2	3	2	3	1	1	1	1	2	1	1	1	2	3
CO3	3	2	3	1	1	1	1	2	1	1	1	2	3
CO4	2	2	3	1	1	1	1	2	1	1	1	2	3
CO5	2	2	3	1	1	1	1	2	1	1	1	2	3
Avg.	**3**	**2**	**3**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**2**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CESE05	MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the concepts of maintenance, repair, and rehabilitation of structures, including inspection methods and assessment of damaged structures.
- To study the strength, durability, and deterioration mechanisms of concrete, including cracking, corrosion, and environmental effects.
- To gain knowledge on special concrete and advanced materials used for improving performance and durability of structures.
- To develop the ability to evaluate, test, and apply appropriate techniques for strengthening, repair, and rehabilitation of distressed structures.

Detailed Syllabus

UNIT I MAINTENANCE AND REPAIR STRATEGIES	9
Maintenance, Repair and Rehabilitation - Importance of Maintenance - Various aspects of Inspection - Assessment procedure for evaluating a damaged structure - causes of deterioration.	
UNIT II STRENGTH AND DURABILITY OF CONCRETE	9
Quality assurance for concrete – Strength and Durability of concrete - Cracks, different types, causes- Effects due to climate, temperature, Sustained elevated Temperature, Corrosion – Alkali - Aggregate Reaction (AAR) in Concrete	
UNIT III SPECIAL CONCRETES	9
Polymer concrete - Sulphur infiltrated concrete - Fibre reinforced concrete - High strength concrete- High performance concrete - Self compacting concrete - Geopolymer concrete - Concrete made with industrial wastes.	
UNIT IV TESTING TECHNIQUES AND PROTECTION METHODS	9
Non-destructive Testing Techniques - Epoxy injection - Shoring - Underpinning - Corrosion protection	

techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection. Infrared Thermography (IRT) and Ground Penetrating Radar (GPR) for NDT
UNIT V STRENGTHENING, REPAIR AND REHABILITATION OF STRUCTURES 9 Strengthening of structural elements – Repair of structures distressed due to corrosion, fire, leakage and earthquake – Retrofitting techniques for structural safety and seismic resistance – Case studies.
Total Periods: 45

Learning Resources

1	Shetty M.S. and Jain A.K., *"Concrete Technology - Theory and Practice"*, 9th Edition, S. Chand Publishing, New Delhi, 2026
2	P.C. Varghese, *"Maintenance, Repair and Rehabilitation & Minor Works of Buildings"*, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2018
3	Dodge Woodson, *"Concrete Structures: Protection, Repair and Rehabilitation"*, 2nd Edition, Elsevier (Butterworth-Heinemann), 2017
4	Handbook on *"Seismic Retrofit of Buildings"*, Central Public Works Department (CPWD) and Indian Buildings Congress, Narosa Publishing House, New Delhi, 2019
5	B. Vidivelli, *"Rehabilitation of Concrete Structures"*, Latest Edition, Standard Publishers Distributors, New Delhi,2021

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the importance of inspection and maintenance of structures.	Understand
CO2	Discuss the impacts of cracks, corrosion, and climate on structures.	Understand
CO3	Describe the types and applications of various special concrete.	Understand
CO4	Explain the testing techniques and various protection measures for structures.	Understand
CO5	Discuss the repair of structures and restoration of heritage structures	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	-	-	-	1	2	-	-	1	2	1
CO2	3	2	3	-	-	-	1	1	-	-	1	2	2
CO3	3	2	3	-	-	-	1	1	-	-	1	2	2
CO4	2	2	3	-	-	-	1	1	-	-	1	2	2
CO5	2	2	3	-	-	-	1	1	-	-	1	2	2
Avg.	**3**	**2**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**1**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CESE06	DYNAMICS AND EARTHQUAKE RESISTANT STRUCTURES	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the fundamentals of structural dynamics
- To explore Element of seismology
- To study earthquake phenomena and their effects on structure
- To develop seismic design considerations according to Indian Standards

Detailed Syllabus

UNIT I INTRODUCTION TO DYNAMICS	**9**
Dynamics - Degree of freedom – Free and forced vibration - Single Degree of Freedom (SDOF) and Multi degree of freedom (MDOF) system - Formulation of equation of motion for SDOF system and MDOF system - Concept of damping - Types of Damping	
UNIT II ELEMENTS OF SEISMOLOGY	**9**
Elements of Engineering Seismology - Indian Seismicity - seismic waves - earthquake intensity and magnitude - earthquake ground motion - Liquefaction of soil - basic terminology	
UNIT III EARTHQUAKE EFFECTS ON STRUCTURES	**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 IV EARTHQUAKE LOAD ANALYSIS	**9**
Design spectra – Codal provision – Different methods of earthquake analysis – Analysis of structure by Equivalent static method – Analysis of structure by Response spectrum method – Introduction to time-history method of analysis	
UNIT V DESIGN METHODOLOGY	**9**
Seismic Design Concepts - design spectrum - Earthquake Resistant Design of simple framed structures - IS 1893 codal provisions - Ductile detailing of beam-column joints and footing – Concept and principle of shear wall - Base isolation techniques	
	Total Periods 45

Learning Resources

1	Anil K Chopra , "Dynamics of Structures - Theory and Applications to Earthquake Engineering", Prentice Hall of India (P) Ltd, New Delhi, 2024.
2	Pankaj Agarwal & Manish Shrikhande , "Earthquake Resistant Design and Structures", Prentice Hall of India, New Delhi, 2022.
3	Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition,2019.
4	Paz Mario, William Leigh , "Structural Dynamics - Theory and Computation", 5th Edition, Springer, New Delhi, 2019.
5	Craig, R.R, and Andrew J.K , "Structural Dynamics - An Introduction to computer Methods", John Wiley & Sons, 2015.

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Explain the fundamentals of structural dynamics, damping, and equations of motion.	Understand
CO2	Describe the basic principles of engineering seismology and Indian seismicity.	Understand

CO3	Apply knowledge to evaluate earthquake forces and analyze structural behavior under seismic loads.	Apply
CO4	Apply different methods like equivalent static and response spectrum for seismic analysis.	Apply
CO5	Apply seismic design concepts, codal provisions, and detailing techniques for structures.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	-	2	-	2	2	-	2	2	3
CO2	2	2	2	1	-	2	-	3	2	-	2	2	3
CO3	2	2	2	2	-	3	-	2	2	-	2	2	3
CO4	2	2	2	1	-	3	2	2	2	-	3	2	3
CO5	2	2	2	1	-	3	2	2	2	-	2	2	3
Avg.	**2**	**2**	**2**	**1**	**-**	**2**	**2**	**2**	**2**	**-**	**2**	**2**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CESE07	FINITE ELEMENT METHOD	L	T	P	C
		3	0	0	3

Course Objective:

- To develop a thorough understanding of the finite element analysis techniques with an ability to effectively use the tools of the analysis for solving practical problems arising in Civil Engineering

Detailed syllabus

UNIT I INTRODUCTION **9**

Mathematical Modeling of field problems in Engineering –Governing Equations – Discrete and continuous models – Variational Formulation of Boundary Value Problems – Basic concepts of the Finite Element Method.

UNIT II STIFFNESS MATRIX FORMULATION **9**

Introduction to Discrete and Continua elements–Discrete Elements - Direct stiffness method- Special characteristics of stiffness matrix- Assemblage of elements–Boundary condition & reaction - 2D – truss element – Basic steps in finite element analysis - strain displacement relation-linear constitutive relation

UNIT III ONE - DIMENSIONAL PROBLEMS **9**

One Dimensional Second Order Equations–Discretization- Element Types-Linear and Higher order 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.

UNIT IVTWO - DIMENSIONAL PROBLEMS **9**

Two-dimensional isoparametric elements-Four noded quadrilateral elements-triangular elements. Computation of stiffness matrix for isoparametric elements - numerical integration (Gauss quadrature)

UNIT V ANALYSIS OF PLATES **9**

Introduction to Plate Bending Problems - displacement functions – Analysis of Thin Plate - Analysis of Thick Plate - plane stress and plane strain analysis, Example problem using any general-purpose finite element software.

Total Periods 45

Learning Resources

1	Rao, S. S, "The Finite Element Method in Engineering", 6th Edition, Butterworth Heinemann, 2023.
2	Reddy, J. N, "Introduction to the Finite Element Method", 4th Edition, Tata McGraw Hill, 2020.
3	P. Seshu (2003), Textbook of Finite Element Analysis, PHI Learning (Prentice Hall of India)
4	P. N. Rao (2010), Finite Element Methods, Tata McGraw Hill Education, India
5	Krishnamoorthy, C. S, Finite Element Analysis-Theory and Programming, McGraw- Hill Pvt Ltd, New Delhi, 2024.
6	David Hutton, Fundamentals of Finite Element Analysis, Tata McGraw Hill Publishing Company Limited, New Delhi, 2005.
7	G.R. Liu and S. S. Quek, Finite Element Method: A Practical Course, Butterworth-Heinemann; 2nd edition, 2014.
8	Chennakesava R. Alavala Finite Element Methods: Basic Concepts and Applications, Prentice Hall Inc., 2010.
9	R. T. Chandrupatla and A. D. Belegundu, Introduction to Finite Elements in Engineering, PHI Learning
10	S.S.Bhavikatti, Finite Element Analysis, New Age Publishers,2015.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the basics of finite element formulation.	Understand
CO2	Compute the stiffness matrix for beam, truss, and framed structures.	Apply
CO3	Apply finite element formulations to solve one-dimensional problems.	Apply
CO4	Apply finite element methods to solve two-dimensional problems.	Apply
CO5	Determine the finite element analysis for plate bending problems.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1	1	1	1	-	-	3	-	1	3	2
CO2	3	3	2	1	1	1	-	-	3	-	1	3	2
CO3	3	3	1	2	2	1	-	-	3	-	2	3	2
CO4	2	3	1	1	2	1	-	-	3	-	1	3	2
CO5	3	3	2	1	3	2	-	-	3	-	1	3	2
Avg.	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**3**	**-**	**1**	**3**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

VERTICAL 2: CONSTRUCTION PROJECT MANAGEMENT

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24CECP01	Formwork Engineering	PEC	3	0	0	3	3	40	60
2	U24CECP02	Construction Equipment and Machinery	PEC	3	0	0	3	3	40	60
3	U24CECP03	Sustainable Construction and Lean Construction	PEC	3	0	0	3	3	40	60
4	U24CECP04	Structural Masonry	PEC	3	0	0	3	3	40	60
5	U24CECP05	Construction Management and Safety	PEC	3	0	0	3	3	40	60
6	U24CECP06	Advanced Construction Techniques	PEC	3	0	0	3	3	40	60
7	U24CECP07	Energy Efficient Buildings	PEC	3	0	0	3	3	40	60

U24CECP01	FORMWORK ENGINEERING	L	T	P	C
		3	0	0	3

Course Objective:

- On completion of this course the students will be able to know the detailed planning of formwork, design of forms and erection of form work

Detailed Syllabus

UNIT I FUNDAMENTALS, PLANNING & CODAL REQUIREMENTS 9

Introduction, classification, and planning, including overall and detailed planning, of formwork and falsework systems. Codal requirements, site constraints, and the basis of economical form construction and planning for maximum reuse.

UNIT II FORMWORK LOADS, PRESSURES & MATERIALS 9

Analysis of design loads and concrete pressures on formwork. Factors influencing pressure such as rate of placing, temperature, and vibration, along with hydrostatic adjustment. Selection of materials, accessories, consumables, and calculation of labour requirements.

UNIT III DESIGN & SAFETY CHECKS FOR HORIZONTAL FORMS 9

Design of horizontal formwork for slabs and beams, including decks and shores. Simple wood stresses, allowable loads, slenderness ratio, deflection, lateral stability, and shear checks. Safety practices and De- shuttering sequence.

UNIT IV DESIGN & DETAILING FOR VERTICAL FORMS & SPECIAL SYSTEMS 9

Design of vertical formwork for walls and columns. Application of special forms like climbing, slip, flying, and tunnel forms. Requirements for formwork detailing and preparation of drawings.

UNIT V TEMPORARY STRUCTURES, COSTING & FAILURES 9

Types of scaffolds (putlog, independent, system) and general safety requirements. Overall formwork cost estimation (material, labor, P&M) and cost optimization. Analysis of formwork failures and their causes.

Total Periods: 45

Learning Resources

1	Peurify R.L and Oberlender G.D, Formwork for Concrete Structures, McGraw Hill Education India ,2015
2	Jha K N, Formwork for Concrete Structures, Tata McGraw Hill Education, 2012.
3	Austin, C.K., Formwork for Concrete, Cleaver -Hume Press Ltd., London, 1996.
4	Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 2015
5	Michael P. Hurst, Construction Press, London and New York, 2003.
6	Christopher Souder, (2014), Temporary Structure Design, Wiley Publications, London.
7	IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS.

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Describe fundamentals, interpret codal requirements, and select formwork based on planning.	Understand
CO2	Calculate loads and pressures, and specify materials and accessories	Apply
CO3	Determine design for horizontal formwork and sequence de-shuttering	Apply
CO4	Apply formwork systems for vertical and special structures and prepare detailing guidelines	Apply
CO5	Determine failures and safety requirements and estimate costs for temporary works.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	1	1	-	-	3	-	1	3	2
CO2	3	3	2	2	1	1	-	-	3	-	1	3	3
CO3	3	3	3	2	2	1	-	-	3	-	2	3	3
CO4	2	3	2	2	2	1	-	-	3	-	1	3	3
CO5	3	3	2	3	3	2	-	-	3	-	3	3	3
Avg.	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**3**	**-**	**2**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CECP02	CONSTRUCTION EQUIPMENT AND MACHINERY	L	T	P	C
		3	0	0	3

Course Objective:

- To enable students to understand the principles, selection, and efficient management of modern construction equipment used in various engineering projects.
- To develop knowledge on the operation, maintenance, and cost optimization of equipment through digital tools and automation technologies.
- To promote awareness of safety, sustainability, and smart technologies in equipment planning and material handling for sustainable infrastructure development

Detailed Syllabus

UNIT I CONSTRUCTION EQUIPMENTS	**9**
Identification – Planning – Selection of equipment – Equipment management – Maintenance – Equipment cost – Operating cost – Cost control – Depreciation – Replacement analysis – Safety management.	
UNIT II EQUIPMENT FOR EARTHWORK	**9**
Earthwork operations – Earth moving principles – Types of earthwork equipment– Finish grading equipment – Case studies on earthwork equipment use.	
UNIT III OTHER CONSTRUCTION EQUIPMENT	**9**
Equipment for dredging – Trenching – Draglines – Clamshells – Tunneling equipment – Jacking equipment – Drilling and blasting equipment – Pile driving equipment – Erection equipment – Cranes – Pumps – Dewatering equipment – Demolition equipment.	
UNIT IV ASPHALT AND CONCRETE PLANTS	**9**
Aggregate production– Screening equipment – Handling equipment – Batching and mixing equipment – Ready-mix concrete equipment – Concrete pumping – Asphalt plants – Asphalt pavers – Asphalt compacting equipment.	
UNIT V MATERIALS HANDLING EQUIPMENT	**9**
Forklifts – Portable material bins – Conveyors – Handling cranes –Industrial trucks – Aerial transporting equipment.	
	Total Periods 45

Learning Resources

1	Peurifoy, R.L., Schexnayder, C., Schmitt, R.L. and Aviad Shapira., Construction Planning, Equipment and Methods, 10th Edn. McGraw Hill, Singapore, 2024.
2	Granberg G.,Popescu M Construction Equipment and Management for Engineers Estimators and Owners, Taylor and Francis Publishers, New York, 2022.
3	Deodhar, S.V. Construction Equipment and Job Planning, 5th Edn. Khanna Publishers, New Delhi, 2023.
4	Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, 2025.
5	Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 2022.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Describe the planning of equipment and selection of equipment	Understand
CO2	Explain the knowledge on fundamentals of earth work operations, earth moving operations and types of earth work equipment	Understand
CO3	Explain the special construction equipment used in construction.	Understand
CO4	Apply the knowledge on asphalt and concrete plants	Apply
CO5	Apply the knowledge and select the proper materials handling equipment	Apply



Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	3	2	2	3	2	2	3	2	2	3	3
CO2	3	3	2	2	3	2	2	2	2	2	3	2	2
CO3	2	3	2	2	2	3	2	2	3	2	2	2	3
CO4	2	2	3	3	2	3	3	2	3	2	2	3	2
CO5	3	2	3	2	3	2	3	3	3	2	2	2	2
Avg.	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CECP03	SUSTAINABLE CONSTRUCTION AND LEAN CONSTRUCTION	L	T	P	C
		3	0	0	3

Course Objective:

- To impart knowledge on the principles and practices of sustainable construction, including **LCA** and green ratings, and to apply Lean tools and techniques for enhanced construction productivity.

Detailed Syllabus

UNIT I: FUNDAMENTALS OF SUSTAINABILITY AND MATERIALS **9**

Introduction to Sustainability, Three Dimensions Environment Economy Social Aspects, Building Life Cycle. CO2 contribution from construction materials, Recycled and Manufactured Aggregates, Durability. Social Aspects of Sustainability, Occupational Health and Safety OHS, Principles of Green Engineering.

UNIT II: LIFE CYCLE ASSESSMENT AND ENERGY IN BUILDINGS **9**

Life Cycle Assessment LCA, Process EIO Hybrid LCA methods, Carbon Footprint calculation, Carbon Calculators. Energy concept, Life Cycle Energy Use LCEU, Embodied Operational Demolition Energy. Methods to Reduce LCEU, Introduction to Net-Zero Energy Buildings NZEB.

UNIT III: CODES AND GREEN BUILDING RATING SYSTEMS 9

Control of energy use, National Building Code NBC, ECBC Code, OTTV concepts and calculations. Green Building Ratings Overview, LEED, GRIHA, BREEAM, Green Globes, CASBEE. Role of insulation, Thermal Properties of construction materials, influence of moisture content.

UNIT IV: LEAN CONSTRUCTION CORE CONCEPTS AND PRODUCTIVITY **9**

Introduction to Lean Thinking, TQM Six Sigma Lean, Manufacturing vs Construction Supply Chains. Introduction to Value and Waste, Types of Waste Muda in Construction. Construction Productivity Measurement, Factors Affecting Productivity, Productivity Improvement Approach.

UNIT V: LEAN TOOLS AND IMPLEMENTATION **9**

Core Lean Tools, Value Stream Mapping, 5S, Work Sampling, Foreman Delay Surveys, Crew Balance Chart. Collaborative Systems, Last Planner System LPS, Big Room Approach. Implementation in Project Sites, Lean Culture, Integrated Project Delivery IPD Strategy, Lean in Design and Supply Chain Management.

Total Periods 45

Learning Resources

1	M. Bauer, P. Mösle, and M. Schwarz, Green Building: Guidebook for Sustainable Architecture. Heidelberg: Springer-Verlag, 2010.
2	C. J. Kibert, Sustainable Construction: Green Building Design and Delivery, 5th ed. Hoboken, NJ: John Wiley & Sons, 2022.
3	L. Koskela, B. Ballard, G. Howell, and R. L. R. W. D. Tommelein, The Handbook of Lean Construction. New York: ASCE Press, 2024.
4	Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.
5	Ballard, G., Tommelein, I., Koskela, L. and Howell, G., Lean construction tools and techniques, 2002.
6	Salem, O., Solomon, J., Genaidy, A. and Luegring, M., Site implementation and Assessment of Lean Construction Techniques, Lean Construction Journal, 2005

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Describe the three dimensions of sustainability and the various sustainable and recycled materials used in construction.	Understand
CO2	Apply the principles of Life Cycle Assessment (LCA) to calculate the Carbon Footprint and distinguish between different types of building energy use.	Apply
CO3	Apply the criteria of major green building rating systems (LEED, GRIHA, BREEAM) and energy codes (ECBC, NBC) to assess the sustainability performance of a building.	Apply
CO4	Explain the core concepts of Lean Construction, including Value, Waste (Muda), and the factors affecting construction productivity.	Understand
CO5	Apply key lean tools like the Last Planner System (LPS) and Value Stream Mapping (VSM) to design improvement strategies for project productivity and sustainability.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2	-	-	2	2	-	2	2	2
CO2	3	2	2	2	2	-	-	2	2	-	2	2	2
CO3	3	2	2	2	2	-	-	2	2	-	2	2	2
CO4	3	2	2	2	2	-	-	2	2	-	2	2	3
CO5	3	2	2	2	2	-	-	2	2	-	2	2	3
Avg.	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**2**	**2**	**-**	**2**	**2**	**2.4**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CECP04	STRUCTURAL MASONRY	L	T	P	C
		3	0	0	3

Course Objective:

- To impart the engineering properties of masonry units, mortar, grout and reinforcement and the relevant codes and standards.
- To familiarize the Design practice of brick masonry solid and cavity walls with or without pilasters under uniformly distributed / concentrated loads /concentrated with eccentric also the design of columns
- To Describe the brick masonry solid wall with an opening considering or not considering the pilaster under uniformly distributed load or concentrated load
- To Explore the different strength aspects of brick masonry shear walls and compound walls with or without pilasters under lateral loads
- To Impart the behaviour of masonry against seismic effect and also comprehend the best practices and Indian standard provisions on the construction aspects of brick masonry

Detailed Syllabus

UNIT I Introduction about masonry	**9**
Overview of brick masonry in historic and modern buildings – Types of bricks - Methods of design – Codes and standards – Material properties and testing of components – Masonry units clay and concrete blocks, mortar, grout and reinforcement – Bond pattern, shrinkage and differential movements	
UNIT II: Strength of Brick Masonry under compression	**9**
Principles - Design of solid and cavity walls with or without stiffener - uniformly distributed loads – concentric and eccentric concentrated loads as per IS: 1905 – column, Pier and foundation. Design of masonry with or without opening.	
UNIT III: Strength of Brick Masonry under Lateral loads	**9**
Masonry under lateral loads – design of shear wall – design of compound walls with or without pilasters – retaining wall	
UNIT IV: Design of reinforced brick masonry	**9**
limit states -Basic design variables – partial safety factors – Design of reinforced brick masonry flexural members – reinforced brick lintels – reinforced brickwork slabs	
UNIT V Earthquake resistance design of brick masonry	**9**
Seismic behaviour of masonry building – Behaviour of brick masonry wall – Improvement of the behaviour of masonry walls – Masonry building with simple configuration - box action of masonry buildings – Role of the horizontal band – design of lintel bands – Response of masonry with vertical reinforcement – protection of opening in walls – Design Consideration of confined brick masonry - Failure of masonry building – the strength of masonry – General construction aspects	
	Total periods: 45

Learning Resources

1	A.W. Hendry, B.P. Sinha and Davis, S. R, “Design of Masonry Structures”, E & FN Spon, UK, 2017.
2	R.S. Schneider and W.L. Dickey, “Reinforced Masonry Design”, Prentice Hall, 3rd edition, 1994. Paulay, T. and Priestley, M. J. N., “Seismic Design of Reinforced Concrete and Masonry

	Buildings", John Wiley, 1992
3	https://www.nicee.org.
4	IS 1905-1987n, Code of Practice for Structural Use of Unreinforced Masonry
5	IS 875-1987, (Part-1,2 &3) Code of Practice for Design Load (other than Earthquake)
6	IS 456-2000 Code of Practice for general construction in RCC.
7	IS:17848 -2022 Code of Practice for confined masonry for earthquake resistance

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the fundamentals of brick masonry, including types of bricks, materials, bond patterns, and relevant codes and standards	Understand
CO2	Describe the behavior and design principles of brick masonry under compression, including walls, columns, piers, and foundations as per IS: 1905.	Understand
CO3	Explain the response of masonry structures under lateral loads and the design concepts of shear walls, compound walls, and retaining walls.	Understand
CO4	Discuss the principles of reinforced brick masonry design, including limit states, safety factors, and flexural members such as lintels and slabs.	Understand
CO5	Describe the seismic behavior of masonry buildings and explain methods to improve earthquake resistance, including bands, reinforcement, and construction practices.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	-	-			-	-	1	2
CO2	1	2	1	-	-	-	-	1	3	-	-	2	2
CO3	3	2	1	-	-	-	-	1	3	-	-	2	2
CO4	3	2	1	-	-	-	-	1	3	-	-	2	3
CO5	2	2	1	-	-	-	-	1	3	-	-	1	3
Avg.	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**-**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CECP05	**CONSTRUCTION MANAGEMENT AND SAFETY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

- To give an overview about the Project organization & Execution steps in a construction.
- To impart knowledge on the concepts of Estimation & Smart planning systems in a construction
- To familiarize the students about the different safety procedures, standards & demolition techniques involved in a construction.

Detailed Syllabus

UNIT I GENERAL OVERVIEW AND PROJECT ORGANIZATION	**9**
Introduction - Interdisciplinary nature of modern construction projects – execution of project – evaluation of bits – resource management - Team Structure and Role Allocation in Project Execution - Risk Management and Quality Assurance Plan.	
UNIT II ESTIMATION OF PROJECT COST AND ECONOMICS	**9**
Estimating quantities – description of items - Estimation of project cost – running account bills - Types of Project Costs - Budget Planning and Resource Allocation - Funding and Financial Resources - decision making in construction projects – depreciation of construction equipment – Sensitivity Analysis – case study	
UNIT III SUSTAINABLE AND SMART PLANNING	**9**
Sustainable Project Planning for Green Construction - Smart City Project Planning and Time Management energy - Planning and Scheduling for Disaster-Resilient Infrastructure – Safety - Oriented Scheduling and Risk Reduction - Use of GIS in Infrastructure Project Planning and Scheduling.	
UNIT IV SAFETY DURING CONSTRUCTION & STANDARDS	**9**
Basic terminology in safety - types of injuries - Accident patterns - Planning for safety budget, safety culture - Introduction to OSHA regulations - Site safety programs - Job hazard analysis, accident investigation & accident indices-violation, penalty – ISO45001 Standard for health & safety at work – safety procedures – Safety checklists and inspection reports – safety laws & legal requirements.	
UNIT V SAFE OPERATING PROCEDURES & DEMOLITION TECHNIQUES	**9**
Safety during alteration – Safety Environmental & Regulatory Considerations, Emerging Techniques & Technologies in Demolition - Deconstruction Techniques for Modern Infrastructure, cutting & welding - Construction equipment, materials handling - disposal & hand tools - Other hazards – fire, confined spaces, electrical safety - case study	
Total Periods: 45	

Learning Resources

1	Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan India Ltd.,2019.
2	Construction Safety Management - Kumar Neeraj Jha/ Dilip A Patel/ Amarjit Singh, Pearson Education; First Edition (1 March 2022)
3	Patrick X.W. Zou, Riza YosiaSunindijo, Strategic Safety Management in Construction and Engineering John Wiley & Sons, Ltd 2025.
4	Jimmy W. Hinze, "Construction Safety", Prentice Hall Inc., 2006 second edition
5	Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and health Management, Edition, illustrated; Publisher, Prentice Hall, 2000
6	https://onlinecourses.nptel.ac.in/noc24_ce57/preview

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Describe the different steps involved in project execution.	Understand



CO2	Explain the estimation of project costs involved in construction.	Understand
CO3	Discuss the different smart planning systems in a project	Understand
CO4	Explain the knowledge on safety procedures & standards	Understand
CO5	Describe the safe operating procedures & different demolition techniques involved in modern construction.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	-	2	-	2	2	-	2	2	3
CO2	2	2	2	1	-	2	-	3	2	-	2	2	3
CO3	2	2	2	2	-	3	-	2	2	-	2	2	3
CO4	2	2	2	1	-	3	2	2	2	-	3	2	3
CO5	2	2	2	1	-	3	2	2	2	-	2	2	3
Avg.	**2**	**2**	**2**	**1**	-	**2**	**2**	**2**	**2**	**-**	**2**	**2**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CECP06	ADVANCED CONSTRUCTION TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objective:

- To understand modern construction methods, materials, and advanced technologies used in complex projects.
- To explore automation, prefabrication, and sustainable practices in construction.
- To gain insight into rehabilitation, strengthening, and safe demolition techniques using emerging tools

Detailed Syllabus

UNIT I – SUBSTRUCTURE CONSTRUCTION TECHNIQUES **9**

Construction methodology – Box jacking – Pipe jacking – Underwater construction of diaphragm walls and basement – Tunneling and piling techniques – Driving well and caisson – Sinking cofferdam – Cable anchoring and grouting – Driving diaphragm walls – Sheet piles – Micro- tunneling – Trenchless technology – Laying operations for built-up offshore structures – Well points – Dewatering for underground excavations.

UNIT II – SUPERSTRUCTURE CONSTRUCTION AND AUTOMATION **9**

Vacuum dewatering of concrete flooring – Concrete pumping – Continuous concreting – Erection of tall buildings – Erection of large- span structures – Launching techniques – Pre-tensioning and post-tensioning–Pre-stressing systems–Modular construction– Prefabricated building systems – 3D printed concrete construction.

UNIT III – CONSTRUCTION OF SPECIAL STRUCTURES **9**

Erection of lattice towers – Rigging of transmission line structures – Construction in silos, chimneys, skyscrapers – Construction of bridges (bows, cable-stayed) – Jetties, breakwaters, and marine

structures – Erection of domes – Space structures – Formwork systems – Slip-form systems.
UNIT IV – REHABILITATION AND STRENGTHENING TECHNIQUES 9 Seismic retrofitting – Strengthening of beams, columns, slabs, masonry walls – Protection methods – Waterproofing – Soil stabilization – Grouting – NDT techniques – Monitoring techniques.
UNIT V – DEMOLITION AND DECONSTRUCTION 9 Demolition by machines – Demolition using explosives – Demolition sequence – Dismantling techniques – Safety precautions.
Total Periods 45

Learning Resources

1	Sarkar, S.K. and Saraswati, S., Construction Technology, Oxford University, New Delhi, 2014
2	Jerry Irvine, “Advanced Construction Techniques”, CA Rocket, 1984.
3	Patrick Powers J., “Construction Dewatering: New Methods and Applications”, John Wiley & Sons, 2007.
4	Peter H. Emmons, “Concrete Repair and Maintenance Illustrated”, Galgotia Publications Pvt. Ltd., 2008.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the modern construction techniques used in substructure construction.	Understand
CO2	Discuss the principles and concepts relevant to superstructure construction for buildings.	Understand
CO3	Explain the concepts used in the construction of special structures.	Understand
CO4	Discuss various strengthening and repair methods for different cases.	Understand
CO5	Describe suitable demolition techniques used for demolishing buildings.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	3	3	2	2	-	1	1	2	1	3
CO2	1	-	-	2	2	2	3	-	1	1	2	1	2
CO3	2	3	3	2	3	3	2	1	2	2	3	2	3
CO4	2	3	3	3	2	1	2	1	1	1	2	1	3
CO5	1	3	3	3	2	2	1	1	2	2	3	2	2
Avg.	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**2**	**1**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CECP07	ENERGY EFFICIENT BUILDINGS	L	T	P	C
		3	0	0	3

Course Objective:

- To provide an understanding of the concept of energy consumption in buildings and design an energy efficient building.

Detailed Syllabus

UNIT I INTRODUCTION	**9**
Climate adapted and climate rejecting buildings – Heat Transfer– Thermal Storage– The Greenhouse Effect – Convection– Psychrometry Chart – Thermal Comfort –, Site Planning and Development – Temperature – Humidity – Wind – Sun Path Diagrams – Sun Protection – Types of Shading Devices – Design responses to energy conservation strategies.	
UNIT II PASSIVE SOLAR HEATING AND COOLING	**9**
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 - Room Organization Strategies for Cross and Stack Ventilation– Wind Catchers – Mass Effect – Zoning.	
UNIT III DAY LIGHTING AND ELECTRICAL LIGHTING	**9**
Materials, components sand details – Glazing materials Daylighting – Source sand concepts – Building Design Strategies – Case Studies – Daylight apertures – Light Shelves – Codal requirements – Day lighting design – Electric Lighting – Light Distribution – Electric Lighting control for daylighted buildings – Coefficient of utilization – Electric Task Lighting.	
UNIT IV HEAT CONTROL AND VENTILATION	**9**
Orientation of buildings – Building characteristics for various climates – Thermal Design of buildings – Influence of Design Parameters –. Ventilation – Requirements – Minimum standards for ventilation – Ventilation Design – Energy Conservation in Ventilating systems – Design for Natural Ventilation.	
UNIT V DESIGN FOR CLIMATIC ZONES	**9**
Energy efficiency – An Overview of Design Concepts and Architectural Interventions– Design of Energy Efficient Buildings for Various Zones – Cold and cloudy – Cold and sunny – Composite – Hot and dry – Moderate – Warm and humid – Commonly used software packages in energy efficient building analysis and design - Energy Audit.	
	Total Periods: 45

Learning Resources

1	G. N. Tiwari & R. K. Mishra (2012), Energy Efficient Buildings in India, Narosa Publishing House, India.
2	M. R. Panwar & R. K. Sharma (2015), Energy Efficient Building Design, New Age International Publishers, India
3	R. K. Jain & S. K. Dhariwal (2013), Energy Efficiency in Buildings, PHI Learning, India
4	B. G. Prasad (2011), Passive and Low-Energy Architecture, CBS Publishers & Distributors, India
5	Energy Conservation Building Code, cause of Energy Efficiency, New Delhi,2024.
6	Handbook on Functional Requirements of Buildings Part 1 to 4 SP:41(S and T) 2021

7	Residential Energy: Cost Savings and Comfort for Existing Buildings by John Krigger and Chris Dorsi, Published by Saturn Resource Management, 2013.
8	Brown, G.Z. and DeKay,M., Sun, Wind and Light – Architectural Design Strategies, John Wiley and Sons Inc,3rd Edition, 2014
9	Majumdar, M(Ed), Energy-Efficient Buildings in India, Tata Energy Research Institute, Ministry of Non-Conventional Energy Sources, 2026.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain environmental energy supplies on buildings	Understand
CO2	Discuss the passive solar heating, cooling system	Understand
CO3	Describe the various aspects of daylighting and electrical lighting in a building.	Understand
CO4	Determine and design ventilation and heat control for indoor comfort	Apply
CO5	Design a building for climatic zone and apply simulation programs of buildings to perform energy calculations	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	2	-	-	1	-	3	2	3	-	3	2
CO2	3	-	2	-	-	-	-	3	-	3	-	3	2
CO3	3	-	2	-	-	-	-	3	-	3	-	3	2
CO4	3	3	3	-	-	-	1	3	-	3	-	3	3
CO5	3	3	3	1	2	-	1	3	2	3	-	2	3
Avg.	**3**	**2**	**3**	**2**	**1**	**1**	**1**	**3**	**2**	**3**	**-**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

VERTICAL 3: GEO INFORMATICS

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24CEGI01	Total Station and GPS Surveying	PEC	3	0	0	3	3	40	60
2	U24CEGI02	Remote Sensing Concepts	PEC	3	0	0	3	3	40	60
3	U24CEGI03	Satellite Image Processing	PEC	3	0	0	3	3	40	60
4	U24CEGI04	Cartography and GIS	PEC	3	0	0	3	3	40	60
5	U24CEGI05	Photogrammetry	PEC	3	0	0	3	3	40	60
6	U24CEGI06	Airborne and Terrestrial laser mapping	PEC	3	0	0	3	3	40	60
7	U24CEGI07	Hydrographic Surveying	PEC	3	0	0	3	3	40	60

24CEGI01	TOTAL STATION AND GPS SURVEYING	L	T	P	C
		3	0	0	3

Course Objective:

- To introduce the working principles of modern Total Stations (Robotic & Reflector less) and GNSS, focusing on coordinate systems and practical site applications for civil engineering projects.

Detailed Syllabus

UNIT I FUNDAMENTALS OF TOTAL STATION AND EMR **9**

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, Applications of Electromagnetic waves, Propagation properties. Refractive index (RI) - factors affecting RI. Computation of RI for light and near infrared waves at standard and ambient conditions. Atmospheric corrections: First and Second velocity corrections, Temperature and Pressure sensors.

UNIT II ADVANCED TOTAL STATION SYSTEMS **9**

Electro-optical system: Measuring principle, Working principle, Sources of Error. Robotic Total Stations: Automatic Target Recognition (ATR), Power Search. Reflector less Technology: Phase shift vs Time of Flight. Integrated Surveying: Smart Stations (GNSS + TS integration). Care, maintenance, and calibration of instruments.

UNIT III SATELLITE SYSTEM (GNSS) **9**

Basic concepts of GPS/GNSS - Geoid and Ellipsoid - Satellite orbital motion - Keplerian motion - GNSS Segments (Space, Control, User). Signal structure. GPS, GLONASS, GALILEO, BEIDOU. IRNSS (NavIC). SBAS: GAGAN and WAAS. Sources of Error: Ionosphere, Troposphere, Multipath. Dilution of Precision (DOP)

UNIT IV COORDINATE SYSTEMS AND PROJECTIONS **9**

Coordinate Systems: Geographic (Lat/Long) vs Projected (Grid). Map Projections: UTM Projection concepts, Zones, Scale Factors. Transformation from Local Grid to UTM. GNSS Data Processing: RINEX Format, Differential Positioning (DGPS), Relative Positioning. Baseline processing.

UNIT V SURVEYING METHODS AND APPLICATIONS **9**
Total Station: Traversing, Resection, Missing Line Measurement (MLM), Remote Elevation Measurement (REM). GNSS Methods: Static, Rapid Static, Kinematic, and Real-Time Kinematic (RTK). Topography Mapping using PPK and RTK methods. Setting out works for construction.
Total Periods 45

Learning Resources

1	Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 4th Edition, 1996.
2	Satheesh Gopi, Advanced Surveying: Total Station, GPS, GIS & Remote Sensing, Pearson,2025.
3	Hofmann-Wellenhof, B., GPS: Theory and Practice, Springer, 2001.
4	R.Subramanian, Surveying and Levelling, Oxford University Press, 2022.
5	Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1983.
6	Guocheng Xu, GPS Theory, Algorithms and Applications, Springer-Verlag, 2022.
7	Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 4th Edition, 2018.

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Describe the fundamental physics of electromagnetic waves and total stations.	Understand
CO2	Apply knowledge of modern Robotic and Reflector less total station systems.	Apply
CO3	Discuss the segments and signal structure of Global Navigation Satellite Systems	Understand
CO4	Determine coordinate systems and map projections for accurate data processing.	Apply
CO5	Select and apply appropriate surveying methods (RTK, Traversing) for field tasks.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	-	3	2
CO2	3	2	2	-	3	-	-	-	1	-	-	3	3
CO3	3	2	-	-	2	-	-	-	-	-	-	3	2
CO4	3	3	2	2	3	-	-	-	-	-	-	3	3
CO5	3	3	3	2	3	1	-	1	2	1	1	3	3
Avg.	**3**	**2**	**2**	**2**	**3**	**1**	**-**	**1**	**2**	**1**	**1**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CEGI02	REMOTE SENSING CONCEPTS	L	T	P	C
		3	0	0	3

Course Objective:

- To introduce the concepts of remote sensing processes, sensor characteristics, and elements of data interpretation, focusing on modern high-resolution and open-source data platforms.

Detailed Syllabus

UNIT I REMOTE SENSING AND EMR	**9**
Definition components of RS - History - Merits and demerits. Electromagnetic Spectrum - Radiation principles - Wave theory, Planck's law, Wien's Displacement Law, Stefan's Boltzmann law. Radiation sources: active & passive - Radiation Quantities	
UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH	**9**
Atmospheric regions and characteristics - Interaction of radiation with atmosphere (Scattering, absorption, refraction) - Atmospheric windows. Energy balance equation. Specular and diffuse reflectors. Spectral Signature concepts - Typical spectral reflectance curves for vegetation, soil and water.	
UNIT III ORBITS AND PLATFORMS	**9**
Kepler's laws - Orbital elements - Types of Orbits: Sun synchronous, Geosynchronous. Orbital perturbations. Platforms: Ground based, Airborne, and Space borne. Satellite Constellations.	
UNIT IV SENSING TECHNIQUES	**9**
Resolution concepts: spatial, spectral, radiometric, temporal. Scanners: Whiskbroom vs Push broom. Thermal sensors - Microwave sensors. Modern Trends: High Resolution Sensors (Planet, Maxar) - UAV/Drone Sensors - Hyperspectral Sensing basics. Indian Earth Observation Satellites.	
UNIT V DATA PRODUCTS AND INTERPRETATION	**9**
Data Products: Levels of processing. Open Data Platforms: USGS Earth Explorer, Copernicus (Sentinel). Visual interpretation: Elements and keys. Digital Interpretation basics. Concepts of Image rectification and Enhancement.	
	Total Periods 45

Learning Resources

1	Thomas M. Lillesand, Ralph W. Kiefer, Remote Sensing and Image interpretation, John Wiley, 2015.
2	George Joseph, Fundamentals of Remote Sensing, Universities Press, 2018.
3	Manual of Remote Sensing. Vol.I, American Society of Photogrammetry, 2019.
4	Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, 2021.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Discuss the fundamental laws of electromagnetic radiation.	Understand
CO2	Determine the interaction of EMR with atmosphere and earth surface	Apply

	materials.	
CO3	Explain the classification of satellite orbits and platforms for specific applications.	Understand
CO4	Apply different sensing techniques, including modern high-resolution systems.	Apply
CO5	Apply visual interpretation keys to extract information from satellite data.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	-	3	3
CO2	3	3	-	2	2	-	2	-	-	-	-	3	3
CO3	3	2	-	-	2	-	-	-	-	-	-	3	2
CO4	3	3	2	2	3	-	-	-	-	-	-	3	3
CO5	3	3	2	3	3	1	2	-	1	1	-	3	3
Avg.	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**-**	**1**	**1**	**-**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CEGI03	SATELLITE IMAGE PROCESSING	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the concepts of digital image processing, including restoration, enhancement, and modern classification techniques suitable for civil engineering applications

Detailed syllabus

UNIT I FUNDAMENTALS OF IMAGE PROCESSING **9**

Information Systems - Encoding and decoding - Acquisition, storage, and retrieval - Data products - Satellite data formats (BSQ, BIL, BIP). Digital Image Processing Systems: Hardware and software considerations. Structure of Digital Image.

UNIT II PRE-PROCESSING AND RESTORATION **9**

Image Fundamentals - Sensor models - Spectral and Spatial response. Sources of Image degradation. Correction procedures: Atmospheric Correction (Dark Object Subtraction), Radiometric Correction, Geometric Correction (GCPs, Resampling: NN, Bilinear, Cubic Convolution).

UNIT III IMAGE ENHANCEMENT **9**

Image Characteristics - Histograms - Scattergrams. Contrast Enhancement: Linear/Non-linear stretching. Spatial Filtering: Low pass, High pass, Edge detection. Frequency domain transformations (Fourier basics). PCA (Principal Component Analysis).

UNIT IV IMAGE CLASSIFICATION **9**

Spectral discrimination - Pattern recognition concepts. Supervised Classification: Parallelepiped, Minimum distance, Maximum Likelihood. Unsupervised classifiers: ISODATA, K-means. Accuracy Assessment: Confusion Matrix, Kappa Coefficient, Overall Accuracy.

UNIT V ADVANCED ANALYSIS TECHNIQUES Object-Based Image Analysis (OBIA) **9**

Segmentation, Feature extraction (Shape, Texture). Change Detection: Image differencing, post-

classification comparison. Urban Sprawl Analysis. Introduction to Machine Learning classifiers (Random Forest, SVM) basics.
Total Periods 45

Learning Resources

1	John, R. Jensen, Introductory Digital Image Processing, Prentice Hall, 4th Edition, 2015.
2	Robert, A. Schowengergt, Techniques for Image Processing and Classification, Academic Press, 2012.
3	Richards, Remote Sensing Digital Image Analysis, Springer, 2022.
4	Digital Image Processing by Rafael C. Gonzalez, Pearson, 2018.

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Discuss the data formats and systems used in digital image processing.	Understand
CO2	Apply geometric and radiometric corrections to restore satellite images.	Apply
CO3	Apply image enhancement techniques to improve interpretability.	Apply
CO4	Determine classification accuracy using classification techniques	Apply
CO5	Apply OBIA and change detection techniques for civil engineering monitoring.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	3	-	-	-	-	-	-	3	3
CO2	3	3	2	2	3	-	-	-	-	-	-	3	3
CO3	3	3	2	-	3	-	-	-	-	-	-	3	3
CO4	3	3	2	3	3	-	-	-	1	1	-	3	3
CO5	3	3	3	3	3	2	2	1	1	1	1	3	3
Avg.	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CEGI04	CARTOGRAPHY AND GIS	L	T	P	C
		3	0	0	3

Course Objective:

- To introduce concepts of Cartography and GIS, focusing on modern data models, web-based data input, and integration with Building Information Modeling (BIM).

Detailed Syllabus

UNIT I ELEMENTS OF CARTOGRAPHY **9**

Definition of Cartography - Maps - Functions - Uses and Types of Maps. Map Scales. Map Projections: Shape, Distance, Area and Direction Properties. Perspective and mathematical Projections. Map Co-ordinate System - UTM and UPS References.

UNIT II MAP DESIGN AND PRODUCTION **9**

Elements of a Map - Map Layout Principles - Map Design Fundamentals, Symbols and Conventional

Signs. Color Theory. Map Generalization. Geometric Transformations: Bilinear and Affine Transformations.
UNIT III FUNDAMENTALS OF GIS **9** Components of GIS - Hardware, Software, Data, People, Methods. Types of data: Spatial, Attribute data. Scales/levels of measurements. Spatial Data Models: Raster Data Structures, Vector Data Structures. TIN and GRID models. Geodatabases.
UNIT IV DATA INPUT AND WEBGIS **9** Raster Data Input (Scanners). Vector Data Input: On-screen Digitizing, Mobile GIS Data Collection (GPS integration). Georeferencing. Coordinate Transformation. Topology: Adjacency, Connectivity, Containment. Web Mapping Services (WMS/WFS).
UNIT V DATA QUALITY AND EMERGING TRENDS **9** Data Quality: Completeness, Logical Consistency, Positional Accuracy. Metadata. OGC Standards. BIM - GIS Integration: Concept of Digital Twins. 3D GIS basics. Data Output: Map Compilation, Charts, Graphs.
Total Periods 45

Learning Resources

1	Arthur H. Robinson et al, "Elements of Cartography", 7th Edition, Wiley, 2002.
2	Kang Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill, 2017.
3	John Campbell, "Introductory Cartography", Wm. C.Brown Publishers, 2023.
4	Chor Pang LO, "Concepts and Techniques of Geographic Information Systems", Pearson, 2022.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply suitable map projections and coordinate systems for map production	Apply
CO2	Design maps using standard cartographic principles and color theory.	Apply
CO3	Discuss raster and vector data models used in spatial data storage.	Understand
CO4	Apply modern methods for data input including Mobile GIS and Web Services.	Apply
CO5	Describe the BIM-GIS integration and assess spatial data quality.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	2	-	-	-	-	-	-	3	2
CO2	2	1	3	-	3	1	-	-	-	1	-	3	3
CO3	3	2	-	-	3	-	-	-	-	-	-	3	2
CO4	3	2	2	-	3	-	-	-	1	-	-	3	3
CO5	3	2	2	1	3	-	-	-	-	-	-	3	3
Avg.	**3**	**2**	**2**	**1**	**3**	**1**	**-**	**-**	**1**	**1**	**-**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CEGI05	PHOTOGRAMMETRY	L	T	P	C
		3	0	0	3

Course Objective:

- To introduce optics, aerial photography, and specifically UAV (Drone) Photogrammetry for modern mapping, including mission planning, regulations, and 3D modelling.

Detailed Syllabus

UNIT I PRINCIPLES OF PHOTOGRAPHY AND UAVs	**9**
History - Types of Photographs - Photographic overlaps. Cameras: Metric vs non-metric. Digital Aerial cameras. Introduction to UAVs: Types (Fixed Wing, Rotary), Components, Sensors. Flight Planning principles (Crab & Drift).	
UNIT II GEOMETRIC PROPERTIES	**9**
Photo coordinate measurement. Vertical photographs: Geometry, Scale, Coordinate system. Relief displacement. Stereoscopy basics: Parallax equations, Measurement of Parallax. Height determination.	
UNIT III UAV MISSION PLANNING AND OPERATIONS	**9**
Flight Planning Software (Mission Planner, Pix4Dcapture). Ground Control Points (GCPs): Importance, distribution, and measurement. Regulations**:** DGCA guidelines for drones (Visual Line of Sight, Zones). Field operations checklist	
UNIT IV AEROTRIANGULATION AND SfM	**9**
Strip and block adjustment concepts. Structure from Motion (SfM**):** Principle, Keypoint detection, Matching, Point Cloud generation. Comparison of SfM with traditional Photogrammetry. Interior and Exterior Orientation.	
UNIT V DIGITAL PHOTOGRAMMETRY PRODUCTS	**9**
DEM and DSM generation. Orthomosaic Generation**:** Rectification process, Mosaicking. 3D Modeling (Mesh, Texture). Volume calculation from Drone data. Applications in Construction monitoring and Mining.	
	Total Periods 45

Learning Resources

1	Paul. R Wolf., Bon A. De Witt, Elements of Photogrammetry, McGraw Hill, 4th Edition, 2014.
2	E. M. Mikhail, Introduction to Modern Photogrammetry, Wiley, 2001.
3	Gollfried Konecny, Geoinformation: Remote Sensing, Photogrammetry and GIS, CRC Press, 2024.
4	Karl Kraus, Photogrammetry: Geometry from Images and Laser Scans, Walter de Gruyter, 2016.
5	Wilfried Linder, Digital Photogrammetry - A practical course, Springer, 2016.

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Discuss the fundamental geometry of aerial and UAV photographs.	Understand
CO2	Calculate scale, relief displacement, and heights from stereo pairs.	Apply
CO3	Conduct a UAV survey mission with appropriate flight paths and GCP placement.	Apply
CO4	Describe the Structure from Motion (SfM) processing pipeline.	Understand
CO5	Construct and interpret Digital Elevation Models and orthomosaics.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	-	3	2
CO2	3	3	2	-	2	-	-	-	-	-	-	3	3
CO3	3	3	3	2	3	2	-	2	2	1	1	3	3
CO4	3	2	-	2	3	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	1	-	1	1	1	1	3	3
Avg.	**3**	**3**	**3**	**2**	**3**	**2**	**-**	**2**	**2**	**1**	**1**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CEGI06	AIRBORNE AND TERRESTRIAL LASER MAPPING	L	T	P	C
		3	0	0	3

Course Objective:

- To introduce the concepts of LiDAR (Light Detection and Ranging) systems, specifically Airborne, Terrestrial, and Mobile mapping for topographic modeling.

Detailed Syllabus

UNIT I PRINCIPLES OF LASER AND LIDAR **9**

Principle and Properties of LASER - Components of LIDAR. Types of LiDAR: Range Finder, Doppler. Platforms: Terrestrial, Airborne, Spaceborne. Comparison of LiDAR vs Photogrammetry.

UNIT II AIRBORNE LASER SCANNERS (ALS) **9**

Components of ALS: GPS, IMU, Laser Scanner. Ranging Principle: Pulse vs Continuous Wave. First Return and Last Return. Scanning Mechanisms: Oscillating Mirror, Rotating Polygon. Specifications of Commercial ALS.

UNIT III DATA ACQUISITION AND PRE-PROCESSING **9**

Flight Planning parameters: Swath Width, Point Density, No. of Strips, Point Spacing. Eye Safety (Class I to IV). Synchronization of GPS, IMU and ALS Data. Determination of optimal flight trajectory.

UNIT IV POST PROCESSING OF LIDAR DATA **9**

Geo-location of Laser Foot Prints. Co-ordinate Transformations. Filtering: Ground Point filtering. DSM and DEM generation. LIDAR data file formats (LAS/LAZ). Software for processing. Applications: Corridor Mapping, Forestry.

UNIT V TERRESTRIAL AND MOBILE LASER SCANNERS **9**

Terrestrial Laser Scanners (TLS): Static vs Dynamic. Mobile Mapping Systems (MMS): Vehicle mounted TLS for Highway survey. SLAM (Simultaneous Localization and Mapping). Indoor Mapping. Applications in Tunnel Surveying and Asset Management.

Total Periods 45

Learning Resources

1	Jie Shan, Charles K. Toth, "Topographic Laser Ranging and Scanning", 2nd Edition, CRC Press, 2018.
2	George Vosselman, Airborne and Terrestrial Laser Scanning, Whittles Publishing, 2010.
3	Michael Renslow, Manual of Airborne Topographic LiDAR, ASPRS, 2012.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Discuss the components and physics of Laser scanning systems.	Understand
CO2	Describe Airborne, Terrestrial, and Mobile LiDAR platforms.	Understand
CO3	Determine flight planning parameters for effective data acquisition.	Apply
CO4	Create Digital Elevation Models from raw LiDAR data.	Apply
CO5	Conduct Mobile Mapping and TLS for infrastructure and corridor surveys.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	-	3	2
CO2	3	2	-	-	3	-	-	-	-	-	-	3	3
CO3	3	3	3	2	3	-	-	-	1	-	1	3	3
CO4	3	3	2	3	3	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	1	-	1	1	1	1	3	3
Avg.	**3**	**3**	**3**	**3**	**3**	**1**	**-**	**1**	**1**	**1**	**1**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CEGI07	**HYDROGRAPHIC SURVEYING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

- To provide necessary knowledge on bathymetric surveying, acoustic signal processing, and navigation for marine construction and dredging projects.

Detailed Syllabus

UNIT I INTRODUCTION, TIDES AND DATUMS	**9**
Overview of hydrographic surveying - Bathymetric and nautical charts. Basic tidal theory - Tidal observations and predictions. Vertical Datums: Chart Datum vs MSL. Indian Tides.	
UNIT II SOUNDINGS	**9**
Overview of depth data. Working principle of Echo sounders: Single Beam vs Multibeam Echo Sounders (MBES). Transducers. Sound Velocity in water. Error sources and calibration (Patch Test).	
UNIT III NAVIGATION AND POSITION FIXING	**9**
Horizontal positioning methods. Concept of Line of Position. Navigation using GNSS. DGPS and RTK in Hydrography. Motion Sensors (Heave, Pitch, Roll).	
UNIT IV PLANNING AND DATA PROCESSING	**9**
Planning of inshore hydrographic survey: Line spacing, cross-lines. Data Processing: Spike removal, Tide correction. Chart compilation. Dredging Volume Computations. Hydrographic software packages.	

UNIT V MARINE ENVIRONMENTAL MEASUREMENTS	**9**
Methods of measuring Currents (ADCP). Sea bed sampling. Side Scan Sonar (SSS) basics. Sub-bottom Profiling. Case Studies: Port construction surveys.	
	Total Periods 45

Learning Resources

1	U.S. Army Corps of Engineers, Hydrographic Surveying, Document No. EM 1110-2-1003, 2013.
2	De Jong, C. D., Hydrography, Delft University Press, 2010.
3	Ingham, A. E., Hydrography for the Surveyor and Engineer, Blackwell Science, 1992.
4	IHO Standards for Hydrographic Surveying (S-44), IHB Monaco.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Describe the tidal theory and vertical datums for hydrographic works.	Understand
CO2	Discuss the difference of Single Beam and Multibeam echo sounding systems.	Understand
CO3	Apply DGPS and RTK for precise marine navigation and positioning.	Apply
CO4	Conduct a bathymetric survey and calculate dredging volumes.	Apply
CO5	Demonstrate the application of acoustic sensors in monitoring seabed and ocean currents.”	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	1	-	-	-	-	-	-	3	2
CO2	3	2	-	-	3	-	-	-	-	-	-	3	3
CO3	3	2	2	-	3	-	-	-	-	-	-	3	3
CO4	3	3	3	2	3	-	-	-	1	-	2	3	3
CO5	3	2	2	3	3	-	2	1	1	1	1	3	3
Avg.	**3**	**2**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**1**	**2**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



VERTICAL 4: ENVIRONMENTAL ENGINEERING

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24CEEE01	Climate Change Adaptation and Mitigation	PEC	3	0	0	3	3	40	60
2	U24CEEE02	Air and Noise Pollution Control Engineering	PEC	3	0	0	3	3	40	60
3	U24CEEE03	Environmental Impact Assessment	PEC	3	0	0	3	3	40	60
4	U24CEEE04	Industrial Wastewater Management	PEC	3	0	0	3	3	40	60
5	U24CEEE05	Solid and Hazardous Waste Management	PEC	3	0	0	3	3	40	60
6	U24CEEE06	Environmental Policy and Legislations	PEC	3	0	0	3	3	40	60
7	U24CEEE07	Environment, Health and Safety	PEC	3	0	0	3	3	40	60

U24CEEE01	CLIMATE CHANGE ADAPTATION AND MITIGATION	L	T	P	C
		3	0	0	3

Course Objective:

- To impart knowledge on the global warming, the impact of climate change on society and the adaptation and mitigation measures to the students

Detailed syllabus

UNIT I INTRODUCTION **9**

Atmosphere – weather and Climate - climate parameters – Temperature, Rainfall, Humidity, Wind – Global Ocean circulation – El Nino and its effect - Carbon cycle

UNIT II ELEMENTS RELATED TO CLIMATE CHANGE **9**

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 **9**

Effects of Climate Changes on living things – health effects, malnutrition, human migration, socioeconomic impacts- tourism, industry and business, vulnerability assessment- infrastructure, population and sector – Agriculture, forestry, human health, coastal areas

UNIT IV MITIGATING CLIMATE CHANGE **9**

IPCC Technical Guidelines for Assessing Climate Change Impact and Adaptation -Identifying adaption options – designing and implementing adaption measures – surface albedo environment-reflective roofing and reflective paving – enhancement of evapotranspiration - tree planting programme – green roofing strategies – energy conservation in buildings – energy efficiencies – carbon sequestration.

UNIT V ALTERNATE FUELS AND RENEWABLE ENERGY	**9**
Energy source – coal, natural gas – wind energy, hydropower, solar energy, nuclear energy, geothermal energy – biofuels – Energy policies for a cool future - Energy Audit.	
	Total Periods: 45

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the carbon cycle, the natural greenhouse effect, radiative forcing, climate change, global warming, and measures to adapt to and mitigate their impacts.	Understand
CO2	Explain the scientific consensus on climate change established through the IPCC, including associated complexities and uncertainties.	Understand
CO3	Discuss the different methods for implementing climate change mitigation and adaptation projects with renewable energy and alternate fuels.	Understand
CO4	Describe climate models and their uses.	Understand
CO5	Describe the processing of model outputs for climate impact assessment and discuss adaptation strategies.	Understand

Learning Resources

1	Ruddiman W. F, Freeman W.H. and Company, “Earth‟s Climate Past and Future”, 2001
2	Velma. I. Grover “Global Warming and Climate Change”. Vol I an II. Science Publishers, 2005.
3	Dash Sushil Kumar, “Climate Change – An Indian Perspective”, Cambridge University Press India Pvt. Ltd, 2007
4	IPCC Fourth Assessment Report, Cambridge University Press, Cambridge, UK, 2007
5	Thomas E, Lovejoy and Lee Hannah “Climate Change and Biodiversity”, TERI Publishers, 2005
6	Jan C. van Dam, Impacts of “Climate Change and Climate Variability on Hydrological Regimes”, Cambridge University Press, 2003.

Course Articulation Matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	-	3	-	-	-	-	-	-	-	1	-	-	-
CO2	2	-	-	-	-	2	3	-	-	-	-	2	-
CO3	2	3	-	2	3	-	-	-	-	-	-	-	-
CO4	-	-	2	2	3	-	-	-	3	-	-	-	-
CO5	-	3	-	-	3	2	-	-	3	2	3	-	2
Avg.	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**-**	**3**	**2**	**3**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



U24CEEE02	AIR AND NOISE POLLUTION CONTROL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objective:

- To impart knowledge on the sources, effects and control techniques of air pollutants and noise pollution

Detailed syllabus

UNIT I GENERAL	**9**
Atmosphere as a place of disposal of pollutants – Air Pollution – Definition - Air Pollution and Global Climate - Units of measurements of pollutants - Air quality criteria - emission standards - National ambient air quality standards - Air pollution indices - Air quality management in India.	
UNIT II SOURCES, CLASSIFICATION AND EFFECTS	**9**
Sources and classification of air pollutants - Man made - Natural sources - Type of air pollutants - Pollution due to automobiles - Analysis of air pollutants - Chemical, Instrumental and biological methods. Air pollution and its effects on human beings, plants and animals - Economic effects of air pollution - Effect of air pollution on meteorological conditions - Changes on the Meso scale, Micro scale and Macro scale.	
UNIT III SAMPLING, METEOROLOGY AND AIR QUALITY MODELLING	**9**
Sampling and measurement of particulate and gaseous pollutants - Ambient air sampling - Stack sampling. Environmental factors - Meteorology - temperature lapse rate and stability – Adiabatic lapse rate -Wind Rose - Inversion – Wind velocity and turbulence - Plume behavior -Dispersion of air pollutants- Air Quality Modeling	
UNIT IV AIR POLLUTION CONTROL MEASURES	**9**
Control - Source correction methods - Control equipment - Particulate control methods – Bag house filter - Settling chamber - cyclone separators - inertial devices - Electrostatic precipitator - scrubbers - Control of gaseous emissions - Absorption - Absorption equipment - adsorption and combustion devices	
UNIT V NOISE POLLUTION AND ITS CONTROL	**9**
Sources of noise – Units and Measurements of Noise - Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise – General Control Measures – Effects of noise pollution – auditory effects, non-auditory effects. Noise Menace – Prevention and Control of Noise Pollution – Control of noise at source, control of transmission, protection of exposed person - Control of other types of Noise Sound Absorbent	
	Total Periods 45

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Describe the various types and sources of air pollution and its effects	Understand
CO2	Discuss the dispersion of air pollutants and their modeling	Understand
CO3	Explain the principles and design of control of particulate pollutants	Understand
CO4	Describe the principles and design of control of gaseous pollutant	Understand
CO5	Explain the sources, effects and control of vehicular, indoor air and noise pollution.	Understand



Learning Resources

1	C. S. Rao, “Environmental Pollution Control Engineering”, Wiley Eastern Limited, 2006.
2	M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 2017
3	Dr. Y. Anjaneyulu, “Air Pollution and Control Technologies”, Allied publishers Pvt. Ltd., 2019.
4	Noel De Nevers, "Air pollution control Engineering", McGraw Hill International Edition, McGraw Hill Inc, New Delhi, 2000.
5	Air Pollution act, India, 1987
6	Peterson and E.Gross Jr., “Hand Book of Noise Measurement”, 7th Edition, 1974
7	Mukherjee, "Environmental Pollution and Health Hazards", causes and effects, 1986
8	Antony Milne, “Noise Pollution: Impact and Counter Measures”, David & Charles PLC, 1979

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	3	-	-	2	1	2	-	2	-
CO2	2	-	-	3	-	2	-	-	-	-	-	1	2
CO3	2	-	3	-	3	-	1	-	-	-	2	2	2
CO4	2	-	3	-	3	-	1	-	-	-	-	2	2
CO5	3	3	3	3	2	-	-	-	-	2	2	2	-
Avg.	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**2**	**2**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

24CEEE03	ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

Course Objective:

- 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.
- To participate in the performance of an environmental assessment process (EIA or SEA), given the disciplinary knowledge and skills in natural sciences and engineering the student has achieved in other courses.

Detailed Syllabus

UNIT I INTRODUCTION **9**

Historical development of Environmental Impact Assessment (EIA)- Environmental Clearance- EIA in project cycle. legal and regulatory aspects in India – types and limitations of EIA –EIA process screening – scoping - terms of reference in EIA- setting – analysis – mitigation. Cross sectoral issues –public hearing in EIA- EIA consultant accreditation

UNIT II IMPACT INDENTIFICATION AND PREDICTION **9**

Matrices – networks – checklists – cost benefit analysis – analysis of alternatives – expert systems in EIA. prediction tools for EIA – mathematical modelling for impact prediction – assessment of impacts – air – water – soil – noise – biological – cumulative impact assessment

UNIT III SOCIO-ECONOMIC IMPACT ASSESSMENT 9 Socio-economic impact assessment - relationship between social impacts and change in community and institutional arrangements. factors and methodologies - individual and family level impacts. communities in transition - rehabilitation
UNIT IV EIA DOCUMENTATION AND ENVIRONMENTAL MANAGEMENT PLAN 9 Environmental management plan - preparation, implementation and review – mitigation and rehabilitation plans – policy and guidelines for planning and monitoring programmes – post project audit – documentation of EIA findings – ethical and quality aspects of environmental impact assessment
UNIT V CASE STUDIES 9 Mining, power plants, cement plants, highways, petroleum refining industry, storage & handling of hazardous chemicals, common hazardous waste facilities, CETPs, CMSWMF, building and construction projects
Total Periods: 45

Learning Resources

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
3	World Bank –Source book on EIA
4	Cutter, S.L., "Environmental Risk and Hazards", Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
5	Kolluru Rao, Bartell Steven, Pitblado R and Stricoff “Risk Assessment and Management Handbook”, McGraw Hill Inc., New York,1996.
6	K. V. Raghavan and A A. Khan, "Methodologies in Hazard Identification and Risk Assessment", Manual by CLRI, 1990.
7	Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification, Assessment and Control, 4th Edition, Butterworth Heineman, 2012.

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Explain the scoping and screening of developmental projects for environmental and social assessments	Understand
CO2	Describe the different methodologies for environmental impact prediction & Assessments.	Understand
CO3	Discuss socio-economic studies conducted for environmental assessments in project	Understand
CO4	Explain the process of environmental impact assessments and the preparation of environmental management plans.	Understand
CO5	Describe the key elements and structure of environmental impact assessment reports	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	2	3	3	-	-	-	2	-
CO2	3	2	3	2	2	-	-	3	2	-	-	-	2
CO3	-	2	3	2	2	-	-	3	2	-	-	-	2
CO4	-	-	3	-	3	2	2	3	2	1	1	-	2
CO5	3	-	-	2	-	-	-	2	-	-	-	-	-
Avg.	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CEEE04	INDUSTRIAL WASTEWATER MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objective:

- To impart knowledge on the concept and application of Industrial pollution prevention, cleaner technologies, industrial wastewater treatment and residue management.
- Understand principles of various processes applicable to industrial wastewater treatment
- Identify the best applicable technologies for wastewater treatment from the perspective of yield production

Detailed Syllabus

UNIT I INTRODUCTION **9**

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 **9**

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 **9**

Flow and Load Equalisation – Solids Separation – Removal of Fats, Oil & Grease- Neutralisation-Removal of Inorganic Constituents – Precipitation, Heavy metal removal, Nitrogen & Phosphorus removal, Ion exchange, Adsorption, Membrane Filtration, Electro dialysis & Evaporation –Removal of Organic Constituents–Biological treatment Processes, Chemical Oxidation Processes, Advanced Oxidation processes – Treatability Studies..

UNIT IV WASTEWATER REUSE AND RESIDUAL MANAGEMENT **9**

Individual and Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse Industrial reuse, Present status and issues - Disposal on water and land – Residuals of industrial wastewater treatment – Quantification and characteristics of Sludge – Thickening, digestion, conditioning, dewatering and disposal of sludge – Management of RO rejects

UNIT V CASE STUDIES **9**

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 Periods: 45

Learning Resources

1	"Industrial wastewater management, Treatment & disposal, Water Environment" Federation Alexandria Virginia, Third Edition, 2008
2	Lawrance K. Wang, Yung Tse Hung, Howard H.Lo and Constantine Yapijakis “Handlook of Industrial and Hazardous waste Treatment”, Second Edition, 2004.
3	Metcalf & Eddy, Inc., George Tchobanoglous, Franklin L. Burton and H. David Stensel, Wastewater engineering, treatment and reuse, Fourth Edition, McGraw-Hill, 2017
4	Nelson Leonard Nemerow, “Industrial waste Treatment”, Elsevier, 2007.
5	Wesley Eckenfelder W., “Industrial Water Pollution Control”, Second Edition, Mc Graw Hill, 2000.
6	Paul L. Bishop, Pollution Prevention: - Fundamentals and Practice", Mc-Graw Hill International, Boston, 2000.
7	https://onlinecourses.nptel.ac.in/noc26_ce40/preview

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the source and types of industrial wastewater and their environmental impacts and choose the regulatory laws pertaining to environmental protection	Understand
CO2	Describe the industrial wastewater pollution and implement pollution prevention, waste minimization in industries	Understand
CO3	Explain the different design of industrial wastewater treatment schemes	Understand
CO4	Discuss the environmental performance of industries to internal, external client, regulatory bodies and design water reuse management techniques	Understand
CO5	Explain the different effective management systems for industrial wastewater that are technically sound, economically feasible and socially acceptable	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	3	2	3
CO2	-	3	2	2	-	-	-	3	3	2	-	-	-
CO3	2	3	3	-	-	-	-	-	3	2	2	-	3
CO4	2	-	3	-	2	-	2	3	3	-	-	-	-
CO5	2	3	2	3	-	1	2	-	-	2	3	3	3
Avg.	**2**	**3**	**3**	**2**	**2**	**1**	**2**	**3**	**3**	**2**	**3**	**2**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CEEE05	**SOLID AND HAZARDOUS WASTE MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

- To impart knowledge and skills relevant to minimization, storage, collection, transport, recycling, processing and disposal of solid and hazardous wastes including the related regulations, engineering principles, design criteria, methods and equipment.

Detailed Syllabus

UNIT I WASTE CLASSIFICATION AND REGULATORY REQUIREMENTS 9
Sources and types of solid and hazardous wastes - need for solid and hazardous waste management – salient features of latest Indian legislations on management and handling of solid wastes, hazardous wastes, biomedical wastes, electronic wastes, construction and demolition wastes, plastics and discarded lead acid batteries – elements of integrated waste management and roles of stakeholders - seven elements and seven step approach to integrated solid waste management planning.
UNIT II WASTE CHARACTERIZATION SOURCE REDUCTION AND RECYCLING 9
Waste sampling and characterization plan - waste generation rates and variation – physical composition, chemical and biological properties – hazardous characteristics – ignitability, corrosivity and TCLP tests – source reduction, segregation and onsite storage of wastes – waste exchange - extended producer responsibility - recycling of plastics, C&D wastes and E wastes
UNIT III WASTE COLLECTION TRANSPORT AND MATERIAL RECOVERY 9
Door to door collection of segregated solid wastes - analysis of hauled container and stationery container collection systems - compatibility, storage, labeling and handling of hazardous wastes – principles and design of transfer and transport facilities - hazardous waste transport and manifests - mechanical processing and material separation technologies – Size reduction – size separation - density separation - magenetic separation – compaction – principles and design of material recovery facilities – physico chemical treatment of hazardous wastes - solidification and stabilization – case studies on waste collection and material recovery
UNIT IV BIOLOGICAL AND THERMAL PROCESSING OF WASTES 9
Biological and thermos-chemical conversion technologies – composting – biomethanation – incineration – pyrolysis- plasma arc gasification – principles and design of biological and thermal treatment facilities - MSW processes to energy with high-value products and specialty By-products - operation of facilities and environmental controls - treatment of biomedical wastes – case studies and emerging waste processing technologies.
UNIT V WASTE DISPOSAL 9
Sanitary and secure landfills - components and configuration– site selection - liner and cover systems - geo synthetic clay liners and geo membranes - design of sanitary landfills and secure landfills-leachate collection, treatment and landfill gas management – landfill construction and operational controls - landfill closure and environmental monitoring – landfill bioreactors – rehabilitation of open dumps and biomining of dumpsites-remediation of contaminated sites- Case studies
Total Periods: 45

Learning Resources

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

6	Gary C. Young, Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons, Wiley, 2010
7	Cherry P M, Solid and Hazardous Waste Management, CBS publishers and distributors Pvt Ltd, 2018.
8	Rao M.N, Razia Sultana, Sri Harsha Kota, solid and hazardous waste management – Science and Engineering, Butterworth-Heinemann, 2016

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
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	Understand
CO2	Discuss the different factors affecting waste variation and the assessment of waste treatment and disposal systems.	Understand
CO3	Explain the different Design of systems and processes to meet specified needs of waste minimization, storage, collection, transport, recycling, processing and disposal.	Understand
CO4	Describe the appropriate methods for processing and disposal of solid and hazardous wastes, taking into account the impact of the solutions in a Sustainability Context.	Understand
CO5	Explain the various research pertinent to solid and hazardous waste management and communicate effectively to different stakeholders as well as engage in independent lifelong learning	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	3	-	-	-	2	2	-	-	-	-	3	2
CO2	3	2	-	2	2	-	-	-	2	-	-	2	2
CO3	-	-	3	-	-	-	-	-	2	-	-	3	2
CO4	-	2	-	-	2	2	2	2	-	-	2	3	2
CO5	-	2	-	2	-	-	-	-	-	1	-	-	2
Avg.	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**3**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CEEE06	ENVIRONMENTAL POLICY AND LEGISLATIONS	L	T	P	C
		3	0	0	3

Course Objective:

- 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

Detailed Syllabus

UNIT I INTRODUCTION TO ENVIRONMENTAL LEGISLATIONS AND INTERNATIONAL SCENARIO 9 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 Transboundary 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 9 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 (Sections269,270,277,284,285,286,425 to 440) Section 133 of Cr.P.C.
UNIT III REMEDIES FOR ENVIRONMENTAL POLLUTION 9 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 9 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 9 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 - Opium 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 Periods: 45

Learning Resources

1	Leelakrishnan P., Environmental Law in India, Butterworths,1998
2	Leelakrishnan P., Environmental Case Book, Lexis Nexis, 2000
3	Shanthakumar S. , Environmental Law – An Introduction, Butterworths,2004
4	Shyam Diwan and Armin Rosencranz, Environmental Law and Policy in India, Oxford, 2001

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the role of various sources in environmental legislation	Understand
CO2	Describe the key principles of, and actors within, environmental laws	Understand

CO3	Explain the National Environmental Policy and Various Legislations enacted in line with Policy	Understand
CO4	Discuss the different environmental laws within various contexts and to evaluate laws against procedural and substantive criteria	Understand
CO5	Describe the Legal system operating in India and will be in a position to prepare compliance reports for getting environmental clearance	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2						2		2	1		3	
CO2	1					1	2		2	1		3	
CO3	2		2	3		2	3	3		2		3	
CO4	2		2			2	3	3		1			
CO5		3	2	3	3	2	3	3		2	1	3	
Avg.	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**3**		**1**	**1**	**3**	

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CEEE07	ENVIRONMENT, HEALTH AND SAFETY	L	T	P	C
		3	0	0	3

Course Objective:

- To educate overview of EHS in industries and related Indian regulations, types of Health hazards, effect, assessment and control methods and EHS Management System

Detailed syllabus

UNIT I INTRODUCTION **9**

Need for developing Environment, Health and Safety systems in work places- International initiatives, National Policy and Legislations on EHS in India - Regulations and Codes of Practice - Role of trade union safety representatives - Ergonomics.

UNIT II OCCUPATIONAL HEALTH AND HYGIENE **9**

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 9

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 **9**

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 **9**

Concept of Environmental Health and Safety Management – Elements of Environmental Health and Safety Management Policy and implementation and review – ISO 45001- Structure and Clauses-Case Studie**s**

Total Periods: 45

Learning Resources

1	Industrial Health and Safety Acts and Amendments, by Ministry of Labour and Employment, Government of India
2	Fundamentals of Industrial Safety and Health by Dr.K.U.Mistry, Siddharth Prakashan, 2012
3	The Facility Manager's Guide to Environmental Health and Safety by Brian Gallant, Government Inst Publ., 2007
4	Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services, 2005.
5	Environmental and Health and Safety Management by Nicholas P.Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the need for Environment, Health, and Safety (EHS) in industries and describe the related Indian regulations."	Understand
CO2	"Describe various types of health hazards in industrial environments, their effects, and the methods for assessment and control."	Understand
CO3	Explain the various safety systems used in working environments to prevent accidents and ensure occupational safety."	Understand
CO4	Discuss the methodology used for emergency preparedness and accident analysis in industries	Understand
CO5	Summarize the elements of an EHS Management System and their role in workplace safety and environmental protection."	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	3	-	3	-	3	-	3	2	-	1	-	2
CO2	2	2	2	3	-	-	-	-	2	-	-	2	2
CO3	-	-	2	-	3	3	1	1	2	-	2	-	-
CO4	-	-	3	2	-	1	2	-	-	-	-	2	2
CO5	1	-	-	-	2	-	-	-	1	-	1	1	-
Avg.	**2**	**3**	**2**	**3**	**3**	**3**	**1**	**2**	**2**	**-**	**1**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)



VERTICAL 5: TRANSPORTATION ENGINEERING

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24CETE01	Airports and Harbours	PEC	3	0	0	3	3	40	60
2	U24CETE02	Traffic Engineering and Management	PEC	3	0	0	3	3	40	60
3	U24CETE03	Urban Planning and Development	PEC	3	0	0	3	3	40	60
4	U24CETE04	Smart Cities	PEC	3	0	0	3	3	40	60
5	U24CETE05	Intelligent Transport Systems	PEC	3	0	0	3	3	40	60
6	U24CETE06	Pavement Engineering	PEC	3	0	0	3	3	40	60
7	U24CETE07	Transportation Planning Process	PEC	3	0	0	3	3	40	60

24CETE01	AIRPORTS AND HARBOURS	L	T	P	C
		3	0	0	3

Course Objective:

- To familiarize the students about planning, design and construction of an airport
- To impart knowledge on the students regarding the components, construction & Regulations of an seaports

Detailed Syllabus

UNIT I AIRPORT PLANNING **9**

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

UNIT II AIRPORT COMPONENTS **9**

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

UNIT III AIRPORT DESIGN **9**

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

UNIT IV SEAPORTS COMPONENTS AND CONSTRUCTION **9**

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

UNIT V SEAPORT REGULATIONS AND EIA **9**

Wave action on Coastal Structures and Shore Protection and Reclamation – case study - Coastal

Regulation Zone, 2011 - Seaport regulations - International regulations (MARPOL) - EIA - methods of impact analysis and its process
Total Periods:45

Learning Resources

1	Khanna.S.K. Arora.M.G and Jain.S.S, Airport Planning and Design, Nemachand and Bros, RoMcGraw Hill, New York,2003
2	Robert Honjeff and Francis X.Mckelvey, "Planning and Design of Airports", McGraw Hill, New York,1996 2. Richard De Neufille and Amedeo Odoni, "Airport Systems Planning and Design",
3	Subramanian K.P., Highways, Railways, Airport and Harbour Engineering,Scitech Publications (India), Chennai, 2010
4	Venkatramaiah. C., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels.,Universities Press (India) Private Limited, Hyderabad, 2015.
5	Mundrey J S, Railway Track Engineering, McGraw Hill Education (India) Private Ltd, New Delhi, 2013.
6	https://nptel.ac.in/courses/114106025

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the factors involved in planning an airport and selecting a suitable site.	Understand
CO2	Describe the different design features and components of an airport.”	Understand
CO3	Discuss the basic elements required for orientation of runways and passenger facility systems.	Understand
CO4	Explain the key operational and structural features of a seaport	Understand
CO5	Describe the main features of a seaport regulations.”	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	-	2	-	2	2	-	2	2	3
CO2	2	2	2	1	-	2	-	3	2	-	2	2	3
CO3	2	2	2	2	-	3	-	2	2	-	2	2	3
CO4	2	2	2	1	-	3	2	2	2	-	3	2	3
CO5	2	2	2	1	-	3	2	2	2	-	2	2	3
Avg.	**2**	**2**	**2**	**1**	-	**2**	**2**	**2**	**2**	**-**	**2**	**2**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CETE02	TRAFFIC ENGINEERING AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objective:

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

Detailed Syllabus

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, 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 CAPACITY9

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; 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.

UNIT V DESIGN OF PARKING AND PEDESTRIAN FACILITIES AND CYCLE TRACKS **9**

Parking: Need for parking studies and its ill effects - Parking Standards for different land uses, different types of parking - Conceptual plans for different types of parking; Pedestrians: Importance, Barriers, Behaviour, Pedestrian facilities – Principles of planning, Level of Service (LoS), Design standards.; Cycle Tracks: Principles of design, Design criteria, Design standards for Rural Expressways

Total Periods: 45

Learning Resources

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	Papacosta.P.S and Prevedouros.P.D, " Transportation Engineering and Planning, third edition, 2015
4	Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHI Learning Pvt. Ltd., 2011.
5	Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
6	Khanna S. K, and others, Highway Engineering, Nam Chand & Bros, Roorkee, 2014
7	C. JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
8	Taylor MAP and Young W, Traffic Analysis – New Technology and New Solutions, Hargreen Publishing Company , 1998.
9	Roger P.Roess, William R.Mcshane and Elena S.Prassas, Traffic Engineering-Second Edition, Prentice Hall Publishers,, Upper Saddle River, New Jersey 1998

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Apply the knowledge of science and engineering fundamentals in conducting traffic surveys, analyze the problems and relating it with standards	Apply
CO2	Explain the principles of traffic flow characteristics and their relationships	Understand
CO3	Summarize the various traffic management measures in addressing the demand Pricing and ITS applications	Understand
CO4	Describe the various types of control and regulatory measures to meet an efficient traffic network.	Understand
CO5	Discuss the various type of facilities and plan for Non-Motorised Transport	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	1	1	1	2	2	3	1	3	3
CO2	3	3	3	3	3	2	1	3	3	3	1	2	2
CO3	3	2	3	2	1	1	1	2	3	2	1	2	2
CO4	2	3	3	3	3	2	2	2	1	3	1	3	3
CO5	2	2	1	1	1	2	3	1	2	2	1	2	2
Avg.	**3**	**2**	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**3**	**1**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CETE03	URBAN PLANNING AND DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objective:

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



Detailed Syllabus

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, 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.	
UNIT V URBAN AND REGIONAL PLANNING LEGISLATIONS, REGULATIONS AND DESIGNS	**9**
Town and Country Planning, Local Bodies and Land Acquisition Acts, Development and Building Rules, Site analyses, Layouts and Buildings Design.	
	Total Periods: 45

Learning Resources

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
5	Tamil Nadu Town and Country Planning Act 1971, and Rules made thereunder, Government of Tamil Nadu, Chennai.
6	Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005
7	Chennai City Municipal Corporation Act, 1919 and Tamil Nadu District Municipalities Act, 1920
8	https://onlinecourses.nptel.ac.in/noc25_ar14/preview

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the basic issues and meaning of terminologies in urban planning	Understand



CO2	Describe the different types of theories of urban planning and city development.	Understand
CO3	Discuss the different types of plans, their strategies and their preparation process.	Understand
CO4	Describe the planning standards, evaluate the constraints and the financial mechanism	Understand
CO5	Explain the various town and country planning acts and their functions.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3					3	3	3		3		3	2
CO2	2		3	2		3	2	2		3	2	3	3
CO3	3		3			2	3	2	2	2	1	2	2
CO4			2	2			2	3		3	2	2	1
CO5	3	2	1	2	2	3	2	2	2	3	2	1	1
Avg.	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CETE04	SMART CITIES	L	T	P	C
		3	0	0	3

Course Objective:

- To help the learners to understand the concepts of smart city and to introduce the students about application of technologies in smart cities

Detailed Syllabus

UNIT I INTRODUCTION	**9**
Urbanization, 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-use development, Transit oriented development (TOD); Smart City Management-Transportation Unified governance structure (UMTA). Smart public transportation, Smart parking, Intelligent traffic management, Detour management; Low emission vehicles, Electric Mobility - Environmental projects	
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, AI-Based Adaptive Traffic Signal Control	
UNIT V SMART CITIES PROJECT MANAGEMENT	**9**
Need for project management, Philosophy and concepts; Project phasing and stages; Project organizational structuring: Planning and Scheduling: Project cost analysis; Procurement and Contracting: PPP: Project Monitoring and Evaluation: Risk Management; Case studies.	
	Total Periods: 45

Learning Resources

1	Sameer Sharma,"Smart Cities Unbounded- Ideas and Practice of Smart Cities in India", Bloomsbury India, 2018
2	P Sharma , "Sustainable Smart cities in India, Challenges and Future Perspectives", Springer Link, 2017
3	Binti Singh, ManojParmar, "Smart City in India Urban Laboratory, Paradigm or Trajectory Routledge India,2019
4	https://onlinecourses.nptel.ac.in/noc26_ce11/preview

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the basics of urbanization and the role of smart cities.	Understand
CO2	Describe the implementation of smart physical infrastructure.	Understand
CO3	Explain the role of smart planning for sustainable development.	Understand
CO4	Discuss the different Technologies in Smart City planning	Understand
CO5	Summarize the case studies of smart city projects	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	2	1	3	2	3	1	2	2	1	3	3
CO2	3	3	3	2	1	3	3	3	1	3	1	3	3
CO3	3	1	3	2	1	1	3	2	2	3	2	3	3
CO4	3	2	2	2	3	2	3	3	1	3	2	3	2
CO5	2	2	3	3	2	2	2	3	3	2	2	2	2
Avg.	**3**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CETE05	**INTELLIGENT TRANSPORT SYSTEMS**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objective:

- To give an overview about the fundamentals of Intelligent Transport Systems (ITS).
- To impart knowledge on the concepts of Data collection and traffic Management
- To familiarize the students about the role of ITS in transportation planning and its applications.

Detailed Syllabus

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 Traveler Information systems (ATIS), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS)- Autonomous Vehicles - Autonomous Intersections.
UNIT IV ITS IN TRANSPORTATION PLANNING **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.; Transportation network operations – public transportation applications - Weight – in Motion
UNIT V ITS APPLICATION IN LOGISTICS **9** Commercial vehicle operations and intermodal freight -Fleet Management - IT application in freight - logistics - E commerce - Ai Defined routing lanes (ADRL).
Total Periods: 45

Learning Resources

1	R. Srinivasa Kumar,"Intelligent Transportation Systems", Universities Press P Ltd, Telangana, 2022.
2	Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US,2001.
3	Henry F.Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill,1992.
4	TurbanE.,"Decision Support and Export Systems Management Support Systems", Maxwell Macmillan,1998.
5	https://onlinecourses.nptel.ac.in/noc21_ce74/preview

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Explain the fundamentals of ITS and its benefits.	Understand
CO2	Summarize the different data collection processes involved in ITS	Understand
CO3	Describe the role of ITS in Traffic Management	Understand
CO4	Explain the role of ITS in Transportation Planning	Understand
CO5	Discuss the different applications of ITS in Logistics	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2	1	3	2	3	1	2	2	2	2	2
CO2	2	3	3	2	1	3	3	3	1	3	2	2	2
CO3	2	1	3	2	1	1	3	2	2	3	2	2	2
CO4	2	2	2	2	3	2	3	3	1	3	2	2	2
CO5	2	2	3	3	2	2	2	3	3	2	2	2	2
Avg.	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CETE06	PAVEMENT ENGINEERING	L	T	P	C
		3	0	0	3

Course Objective:

- To give an overview about the different Pavement Materials
- To impart knowledge on the design features of flexible and rigid pavements as per IRC guidelines.
- To familiarize the students about the evaluation methods and Maintenance of pavements.

Detailed Syllabus

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).	
UNIT V STABILIZATION OF PAVEMENTS	**9**
Stabilization with special reference to highway pavements – Choice of stabilizers – Testing and field control - Stabilization for rural roads in India – Use of Geosynthetics in roads - use of latest techniques (nano technology & Intelligent Compaction) - case studies.	
	Total Periods: 45

Learning Resources

1	Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, “Highway Engineering”, New Chand and Brothers, Revised 10th Edition,2014.
2	Kadiyali, L.R., “Principles and Practice of Highway Engineering”, Khannatech. Publications,New Delhi,2015.
3	Yoder, R.J. and Witchak M.W. “Principles of Pavement Design”, John Wiley2000.
4	Guidelines for the Design of Flexible Pavements, IRC-37–2012, The Indian roads Congress, NewDelhi.
5	Guideline for the Design of Rigid Pavements for Highways, IRC 58-2018, The Indian Road Congress, NewDelhi.
6	https://onlinecourses.nptel.ac.in/noc25_ce81/preview

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the different types of Pavement Materials	Understand
CO2	Describe the design features of Flexible pavements as per IRC guidelines	Understand
CO3	Describe the design features of Rigid pavements as per IRC guidelines	Understand
CO4	Discuss the different distresses in pavements	Understand
CO5	Describe the different evaluation procedure of pavements	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	-	2	-	2	2	-	2	2	2
CO2	2	2	2	1	-	2	-	3	2	-	2	2	2
CO3	2	2	2	2	-	3	-	2	2	-	2	2	2
CO4	2	2	2	1	-	3	2	2	2	-	3	2	2
CO5	2	2	2	1	-	3	2	2	2	-	2	2	2
Avg.	**2**	**2**	**2**	**1**	**-**	**2**	**2**	**2**	**2**	**-**	**2**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CETE07	**TRANSPORTATION PLANNING PROCESS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

- To impart knowledge in the rudiments and stages in Transportation Planning Process

Detailed Syllabus

UNIT I TRANSPORTATION PLANNING PROCESS **9**

Importance of transportation planning, Integration of Land Use and Transport;; 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, Modern Machine Learning

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

UNIT V TRAFFIC ASSIGNMENT STAGE **9**

Meaning and objective; General principles; Assignment Techniques- all- or-nothing assignments,

multiple route assignment, capacity restraint, diversion curves, Trip assignment route selection; Mode-wise trip matrices; element of transportation network, nodes and links, speed flow curves, minimum path trees
Total Periods: 45

Learning Resources

1	Kadiyali. L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2019.
2	C.S. Papacostas and P.D. Prevedouros, Transportation Engineering and Planning, Prentice Hall of India Pvt. Ltd., 2009
3	Michael J.Bruton, Introduction to Transportation Planning, Hutchinson, London, 1995.
4	J D Ortuzar and L G Willumnsen. Modeling Transport. John Wiley and Sons, New York, 2011.
5	John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1990.
6	JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
7	Juan de Dios Ort zar and Luis G. Willumsen, Modelling Transport, John Wiley & Sons 2001
8	Chennai Comprehensive Traffic Study, Chennai Metropolitan Development Authority, 2007
9	James H.Banks, Introduction to Transportation Engineering, Tata McGraw Hill Education Pvt Ltd, 2010
10	https://onlinecourses.nptel.ac.in/noc26_ce48/preview

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Describe the principles of the transportation planning process and methods of data collection.	Understand
CO2	Explain the concepts of trip production and trip attraction models and their calibration methods.	Understand
CO3	Describe trip distribution models and their applications in transportation planning	Understand
CO4	Explain mode choice behavior and the use of mode split models in transport planning."	Understand
CO5	Discuss the different Assignments techniques of traffic.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2	2	3	2	2	3	3	1	3	1	3	3
CO2	2	3	3	3	2	1	2	1	1	2	1	2	2
CO3	2	3	3	3	2	1	2	2	1	3	1	-	1
CO4	2	2	3	3	2	2	2	2	2	3	1	1	1
CO5	-	-	2	-	2	3	2	-	-	2	1	-	-
Avg.	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**3**	**1**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

OPEN ELECTIVES

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24CEOE01	Fire Safety Engineering	OEC	3	0	0	3	3	40	60
2	U24CEOE02	Geographical Information System	OEC	3	0	0	3	3	40	60
3	U24CEOE03	Nanomaterials And Applications	OEC	3	0	0	3	3	40	60
4	U24CEOE04	Biodiversity Conservation	OEC	3	0	0	3	3	40	60
5	U24CEOE05	Drinking Water Supply & Treatment	OEC	3	0	0	3	3	40	60

U24CEOE01	FIRE SAFETY ENGINEERING	L	T	P	C
		3	0	0	3

Course Objective:

- To familiarize the students about the knowledge of Fire and Safety Studies
- To impart the effect of fire on materials used for construction, the method of test for non-combustibility & fire resistance
- To learn about fire area, fire stopped areas and different types of fire-resistant doors
- To impart the method of fire protection of structural members and their repair due to fire damage.
- To introduce safety professionals for both technical and management through systematic and quality-based study programme

Detailed Syllabus

UNIT I INHERENT SAFETY CONCEPTS **9**

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 **9**

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 elements- standard heating condition, Indian standard test method, performance criteria.

UNIT III WORKING CONDITIONS **9**

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 **9**

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 **9** 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 periods:45

Learning Resources

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.
3	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.
4	Butcher, E. G. and Parnell, A. C," Designing of fire safety". John Wiley and Sons Ltd., New York, U.S.A.1983.
5	https://onlinecourses.nptel.ac.in/noc20_ce09/preview

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the the effect of fire on materials used for construction	Understand
CO2	Describe 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 rating of a building.	Understand
CO3	Explain thethe design concept of fire walls, fire screens, local barriers and fire doors and able to select them appropriately to prevent fire spread	Understand
CO4	Discuss the method of fire protection to RCC, steel, and wooden structural elements and their repair methods if damaged due to fire.	Understand
CO5	Describe the safety techniques and improve the analytical and intelligence to take the right decision at right time.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	1	1	3	2	2	3	3	1	3	3
CO2	2	3	2	2	1	3	2	3	3	2	1	3	3
CO3	2	2	2	2	1	2	2	2	3	2	1	3	3
CO4	3	3	3	2	2	3	2	2	-	2	1	3	3
CO5	3	2	3	2	2	3	2	2	3	2	2	3	3
Avg.	**3**	**3**	**3**	**2**	**1**	**3**	**2**	**2**	**3**	**2**	**1**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (low)

U24CEOE02	GEOGRAPHICAL INFORMATION SYSTEM	L	T	P	C
		3	0	0	3

Course Objective:

- To familiarize the students about the basic components & fundamentals of GIS.
- To Explore the different spatial data preparations and implementation of Geographical Information System.
- To impart the different data Inputs & topography
- To familiarize the students about different data quality & standards
- To Introduce the students about the different data management systems

Detailed Syllabus

UNIT I FUNDAMENTALS OF GIS	**9**
Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open-source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements.	
UNIT II SPATIAL DATA MODELS	**9**
Database Structures – Relational, Object Oriented – Entities – ER diagram - data models - conceptual, logical and physical models - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID data models.	
UNIT III DATA INPUT AND TOPOLOGY	**9**
Scanner - Raster Data Input – Raster Data File Formats – Georeferencing – Vector Data Input – 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	**9**
Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards –Interoperability - OGC - Spatial Data Infrastructure	
UNIT V DATA MANAGEMENT AND OUTPUT	**9**
Import/Export – Data Management functions- Raster to Vector and Vector to Raster Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS-distributed GIS.	
	Total Periods: 45

Learning Resources

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.
3	Lo. C. P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 2006
4	https://nptel.ac.in/courses/105107206

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the basic idea about the fundamentals of GIS.	Understand
CO2	Describe the types of data models.	Understand
CO3	Discuss the knowledge about data input and topology	Understand
CO4	Explain the data quality and standards	Understand
CO5	Discuss the data management functions and data output	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	1	1	3	2	2	3	3	1	3	3
CO2	2	3	2	2	1	3	2	3	3	2	1	3	3
CO3	2	2	2	2	1	2	2	2	3	2	1	3	3
CO4	3	3	3	2	2	3	2	2	-	2	1	3	3
CO5	3	2	3	2	2	3	2	2	3	2	2	3	3
Avg.	**3**	**3**	**3**	**2**	**1**	**3**	**2**	**2**	**3**	**2**	**1**	**3**	**3**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CEOE03	**NANOMATERIALS AND APPLICATIONS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

- To impart the evolution of nanomaterials in the scientific era and make them to understand different types of nanomaterials for the future engineering applications
- To familiarize the dimensionality effects on different properties of nanomaterials
- To Explore the different processing techniques employed for fabricating nanomaterials
- To impart knowledge on the different characterization techniques employed to characterise the nanomaterial
- To Introduce the different applications of nanomaterials in different disciplines of engineering.

Detailed Syllabus

UNIT I NANOMATERIALS	**9**
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	**9**
Size and interface/interphase effects, interfacial thermodynamics, phase diagrams, diffusivity, grain growth, and thermal stability of nanomaterials.	
UNIT III PROCESSING	**9**
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	**9**

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
UNIT V APPLICATIONS **9**
Applications of nanoparticles, quantum dots, nanotubes, nanowires, nanocoatings; applications in electronic, electrical and medical industries
Total Periods: 45

Learning Resources

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.
3	Nalwa H.S., Encyclopedia of Nanoscience and Nanotechnology, American Scientific Publishers 2004
4	https://nptel.ac.in/courses/118104008

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Explain the different types of nanomaterials	Understand
CO2	Describe the effects of dimensionality of materials on the properties	Understand
CO3	Discuss the different nanomaterials and use them in engineering applications.	Understand
CO4	Explain the appropriate techniques for characterizing nanomaterials.	Understand
CO5	Discuss the different nanomaterials for applications in different engineering fields.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	3	-	-	2	2	-	-	-	1	2
CO2	3	1	2	2	-	-	2	2	-	-	-	2	2
CO3	3	2	1	2	-	-	2	2	-	-	-	2	2
CO4	3	1	2	2	-	-	2	2	-	-	-	2	2
CO5	3	2	2	2	-	-	2	2	-	-	-	2	2
Avg.	**3**	**2**	**2**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**2**	**2**

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CEOE04	BIODIVERSITY CONSERVATION	L	T	P	C
		3	0	0	3

Course Objective:

- To familiarize the students about the identification of different aspects of biological diversity.
- To Impart the students about different conservation techniques
- To Explore the different radiography testing among biodiversity conservation

Detailed Syllabus

UNIT I INTRODUCTION	**9**
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	**9**
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	
UNITIII MICROBIAL DIVERSITY	**9**
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	
UNITIV MEGA DIVERSITY	**9**
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.	
UNIT V RADIOGRAPHY TESTING	**9**
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 Period: 45

Learning Resources

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.
3	Microbiology, MacGraw Hill Companies Inc, Prescott, L.M., Harley, J.P., and Klein D.A. (2022).
4	https://onlinecourses.swayam2.ac.in/ini26_bt06/preview

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the insights of the structure and function of diversity for ecosystem stability	Understand
CO2	Describe the concept of animal diversity and taxonomy	Understand
CO3	Explain the socio-economic issues pertaining to biodiversity	Understand
CO4	Describe the biodiversity in community resource management	Understand
CO5	Discuss the fundamentals of biodiversity conservation to solve problems associated with infrastructure development	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3							2	2		2	3	
CO2	3							2	2		2	3	
CO3	3							2	2		2	3	
CO4	3							2	2		2	3	
CO5	3							2	2		2	3	
Avg.	3							2	2		2	3	

For CO-PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

U24CEOE05	DRINKING WATER SUPPLY AND TREATMENT	L	T	P	C
		3	0	0	3

Course Objective:

- Understand sources, demand and quality of water supply.
- Explain conveyance systems and pipe network design.
- Apply principles of water treatment processes.
- Understand advanced water treatment technologies.
- Analyze water distribution systems and plumbing design.

Detailed Syllabus

UNIT I SOURCES OF WATER **9**

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

UNIT II CONVEYANCE FROM THE SOURCE **9**

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

UNIT III WATER TREATMENT **9**

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 **9**

Water softening – Desalination- R.O. Plant – demineralization – Adsorption - Ion exchange– Membrane Systems - Iron and Manganese removal - Defluoridation - Construction and Operation and Maintenance aspects

UNIT V WATER DISTRIBUTION AND SUPPLY **9**

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 Periods: 45

Learning Resources

1	Garg. S.K., "Water Supply Engineering", Khanna Publishers, Delhi, 2019.
2	Punmia B.C, Arun K.Jain, Ashok K.Jain, “Water supply Engineering” Lakshmi publication private limited, New Delhi, 2016.
3	Rangwala "Water Supply and Sanitary Engineering", February 2022
4	Birdie.G.S., "Water Supply and Sanitary Engineering", Dhanpat Rai and sons, 2018.
5	Fair. G.M., Geyer.J.C., "Water Supply and Wastewater Disposal", John Wiley and Sons, 2010 3rd Edition.
6	Babbit.H.E, and Donald.J.J, "Water Supply Engineering" , McGraw Hill book Co, 6th edition
	Steel. E.W.et al., "Water Supply Engineering" , Mc Graw Hill International book Co, 2013
8	Duggal. K.N., “Elememts of public Health Engineering”, S.Chand and Company Ltd, New Delhi,
9	https://nptel.ac.in/courses/105105201

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statements**	**Knowledge Level**
CO1	Explain water demand estimation and characteristics of water sources.	Understand
CO2	Describe principles of water conveyance systems and components.	Understand
CO3	Explain conventional water treatment processes and their functions.	Understand
CO4	Explain advanced water treatment methods and their applications.	Understand
CO5	Describe water distribution networks and building plumbing systems.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	2	2	-	2	-	-
CO2	3	-	-	-	-	-	-	2	2	-	2	-	-
CO3	3	-	-	-	-	-	-	2	2	-	2	-	-
CO4	3	-	-	-	-	-	-	2	2	-	2	-	-
CO5	3	-	-	-	-	-	-	2	2	-	2	-	-
Avg.	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**-**

For CO,PO/PSO Mapping: 3 – Substantial (High), 2 – Moderate (Medium), 1 – Slight (Low)

MANDATORY COURSES

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24MC11	Disaster Risk Reduction and Management	MC	3	0	0	3	0	100	-
2	U24MC21	Environmental Science	MC	3	0	0	3	0	100	-
3	U24MC31	History Of Science and Technology in India	MC	3	0	0	3	0	100	-
4	U24MC41	Personal Finance	MC	3	0	0	3	0	100	-
5	U24MC51	Well-Being with Traditional Practices- Yoga, Ayurveda and Siddha	MC	3	0	0	3	0	100	-

U24MC11	DISASTER RISK REDUCTION AND MANAGEMENT	L	T	P	C
		3	0	0	0

Course Objective:

- To introduce the basic concepts of disasters, hazards, vulnerability, and disaster risks.
- To understand different types of disasters and their impacts on society and the environment.
- To study the principles and strategies of disaster risk reduction (DRR).
- To learn the disaster management framework, policies, and institutional mechanisms in India.
- To understand the use of modern tools, technology, and case studies in disaster management.

Detailed Syllabus

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

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

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

Sendai Framework for Disaster Risk Reduction, Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System – Advisories from Appropriate Agencies. -Relevance of indigenous Knowledge, appropriate technology and Local resources.

UNIT III DISASTER MANAGEMENT **9**

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

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

Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role

of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disaster Management.
UNIT V DISASTER MANAGEMENT: CASE STUDIES **9** Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters-Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field work related to disaster management. - Field Work-Mock drill.
Total Periods: 45

Learning Resources

1	Taimpo (2016), Disaster Management and Preparedness, CRC Publications
2	Singh R (2017), Disaster Management Guidelines for earthquakes, Landslides, Avalanches and tsunami, Horizon Press Publications
3	Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN13:978-9380386423
4	Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the concepts of disasters, hazards, vulnerability, and disaster risks.	Understand
CO2	Describe different types of disasters and their impacts on society and the environment.	Understand
CO3	Explain the principles and strategies of disaster risk reduction.	Understand
CO4	Discuss disaster management policies, institutions, and frameworks in India.	Understand
CO5	Describe the disaster management tools, technologies, and case study knowledge to disaster situations.	Understand

U24MC21	**ENVIRONMENTAL SCIENCE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**0**

Course Objective:

- To introduce the basic concepts and importance of Environmental Science and natural resources.
- To understand ecosystem structure, energy flow, and the importance of biodiversity.
- To study different types of environmental pollution and their control measures.
- To understand major environmental issues and the concept of sustainable development.
- To understand environmental laws, policies, and the role of public participation in environmental protection.

Detailed Syllabus

UNIT I INTRODUCTION TO ENVIRONMENT AND NATURAL RESOURCES	**8**
Definition, scope, and importance of Environmental Science. Components of the environment: lithosphere, hydrosphere, atmosphere, and biosphere. Structure and functions of the environment. Natural resources: renewable and non-renewable resources. Resource distribution and utilization. Resource depletion and conservation strategies. Sustainable use of natural resources and the concept of equitable resource sharing. Importance of environmental awareness and responsibility.	
UNIT II ECOSYSTEMS AND BIODIVERSITY	**10**
Concept, structure, and functions of ecosystems. Types of ecosystems: terrestrial and aquatic ecosystems. Food chains, food webs, and ecological pyramids. Energy flow in ecosystems. Biogeochemical cycles: water cycle, carbon cycle, and nitrogen cycle. Biodiversity: definition, types (genetic, species, and ecosystem diversity), values of biodiversity. Threats to biodiversity such as habitat destruction, overexploitation, pollution, and climate change. Biodiversity conservation methods: in-situ and ex-situ conservation strategies.	
UNIT III ENVIRONMENTAL POLLUTION	**10**
Definition and types of environmental pollution: air pollution, water pollution, soil pollution, noise pollution, thermal pollution, and radioactive pollution. Sources, causes, effects, and control measures for different types of pollution. Solid waste management: types of waste, waste segregation, recycling, and disposal methods. Management of e-waste and plastic waste. Importance of pollution prevention and environmental protection practices.	
UNIT IV ENVIRONMENTAL ISSUES AND SUSTAINABLE DEVELOPMENT	**9**
Major environmental issues: climate change, global warming, ozone layer depletion, acid rain, deforestation, land degradation, urbanization, and population growth. Impact of environmental issues on ecosystems and human health. Concept of sustainable development and sustainable lifestyles. Sustainable Development Goals (SDGs). Sustainable agriculture, renewable energy sources, and green buildings. Carbon footprint, life cycle assessment (LCA), environmental ethics, and green campus initiatives.	
UNIT V ENVIRONMENTAL POLICIES, LEGISLATION AND FIELDWORK	**8**
Environmental policies and legislation in India: Environmental (Protection) Act, 1986; Air (Prevention and Control of Pollution) Act; Water (Prevention and Control of Pollution) Act; Forest Conservation Act; Biological Diversity Act. Role of National Green Tribunal (NGT). Environmental Impact Assessment (EIA). Role of government agencies, NGOs, and public participation in environmental protection. Fieldwork/Project component: campus environmental audit, biodiversity survey, waste segregation activity, case study analysis, or visit to a pollution control facility.	
	Total Periods: 45

Learning Resources

1	Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2	Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3	R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38. Edition 2010.
4	Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
5	Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005
6	https://moef.gov.in — Ministry of Environment, Forest and Climate Change, India
7	https://sdgs.un.org/goals — UN Sustainable Development Goals
8	https://niti.gov.in — NITI Aayog's SDG India Index

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the basic concepts of environment and natural resources.	Understand
CO2	Describe ecosystem structure, functions, and biodiversity conservation.	Understand
CO3	Identify different types of environmental pollution and their control methods.	Understand
CO4	Discuss major environmental issues and principles of sustainable development.	Understand
CO5	Explain environmental policies, legislation, and apply environmental practices through field activities.	Understand

U24MC31	**HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**0**

Course Objective:

- To introduce the basic concepts and perspectives of the history of science and technology.
- To understand the contributions of important scholars in the study of science and technology in India.
- To study the development of science and technology in ancient and medieval India.
- To understand the influence of colonial rule on science and technology in India.
- To understand the growth and impact of science and technology in post-independent India.

Detailed Syllabus

UNIT-I CONCEPTS AND PERSPECTIVES	**9**
Meaning of History Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, concept of historical inevitability, Historical Positivism. Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.	
UNIT-II HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA	**9**
Introduction to the works of D.D. Kosambi, Dharmpal, Debiprasad Chattopadhyay, Rehman, S. Irfan Habib, Deepak Kumar, Dhruv Raina, and others.	
UNIT-III SCIENCE AND TECHNOLOGY IN ANCIENT INDIA	**9**
Technology in pre-historic period- Beginning of agriculture and its impact on technology- Science and Technology during Vedic and Later Vedic times - Science and technology from 1st century AD to C-1200.	
UNIT-IV SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA	**6**
Legacy of technology in Medieval India, Interactions with Arabs- Development in medical knowledge, interaction between Unani and Ayurveda and alchemy- Astronomy and Mathematics: interaction with Arabic Sciences- Science and Technology on the eve of British conquest.	
UNIT-V SCIENCE AND TECHNOLOGY IN COLONIAL INDIA	**6**
Science and the Empire- Indian response to Western Science- Growth of techno-scientific institutions.	
UNIT-VI SCIENCE AND TECHNOLOGY IN A POST-INDEPENDENT INDIA	**6**
Science, Technology and Development discourse- Shaping of the Science and Technology Policy- Developments in the field of Science and Technology- Science and technology in globalizing India- Social implications of new technologies like the Information Technology and Biotechnology.	
Total Periods: 45	

Learning Resources

1	Deepak Kumar, Science and the Raj: A Study of British India, Oxford University Press, New Delhi, 1995.
2	S. Irfan Habib and Dhruv Raina, Social History of Science in Colonial India, Oxford University Press, New Delhi, 2007.
3	D. D. Kosambi, The Culture and Civilization of Ancient India in Historical Outline, Vikas Publishing House, New Delhi, 1997.
4	Dhruv Raina, Images and Contexts: The Historiography of Science and Modernity in India, Oxford University Press, 2003.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the basic concepts and sources of the history of science and technology.	Understand
CO2	Identify the contributions of major scholars in the historiography of science and technology in India.	Understand
CO3	Describe the development of science and technology in ancient and medieval India.	Understand
CO4	Discuss the impact of colonial rule on scientific development in India.	Understand
CO5	Explain the role of science and technology in post-independent India.	Understand

U24MC41	**PERSONAL FINANCE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**0**

Course Objective:

- To introduce students to the principles and importance of financial planning, goal setting, risk–return relationship, and informed financial decision-making.
- To develop the ability to apply time value of money concepts, compounding principles, and asset allocation strategies in evaluating savings and investment alternatives.
- To familiarize students with various financial assets and investment avenues such as bank deposits, mutual funds, equity, bonds, gold, real estate, and small savings instruments.
- To create awareness about responsible borrowing, credit management, loan evaluation, and debt control strategies.
- To enable students to design a comprehensive personal financial plan incorporating insurance, retirement planning, tax planning, and periodic review mechanisms for long-term financial security.

Detailed Syllabus

Unit I Financial Planning	**9**
Importance of Financial Planning – Steps involved in Financial Planning – SMART Goals – Achieving Goals – Risk & Returns – Savings & Investment – Loans & Investment.	
Unit II Analyse Saving & Investment	**9**
Time value of money – Power of Compounding – Rule of 72 and other rules like 69, 70, 144 – Personal Balance sheet and net worth – Inflation effect on Investment – Asset Allocation –	

Systematic Investment Planning.
Unit III Financial Assets **9** Investment avenues, Small Savings – Post Office Savings Schemes – Company Fixed Deposits – Bank Deposits –Gold – Gold ETF – Mutual Funds – ELSS – Investing in Equity - Investment in Commodities – Government and Corporate Bonds – Collecting Antiques and artifacts – Real Estate – Chit Funds.
Unit IV Managing Loans **9** Personal Loan – Housing Loan – Reverse Mortgage – Education Loan – Gold Pledging – Basics & dangers of Credit Card Debts –CIBIL Score – Steps to avoid excess debt
Unit V Protection Related Products **9** Insurance – Life Insurance – Importance of Term Life Insurance – Pension Schemes – Health Insurance - start early and peaceful retirement – Tracking and reviewing financial plan – Danger of Dipping your retirement savings, Basic of tax planning income tax.
Total Periods: 45

Learning Resources

1	Tyco Press (2014), “Personal Finance Simplified”, Callisto Publishing, 20th Edition
2	Robert Kiyosaki, Rich Dad Poor Dad (2017), Plata Publishing, New Delhi
3	Madura, Jeff. (2013), ‘Personal Finance’, Pearson Education, 5th Edition
4	Jack Kapoor, Les Dlabay, Rober J. Huges, (2010), ‘Personal Finance’, McGraw Hill

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the importance of financial planning, goal setting, risk-return relationship, and the role of savings and investment in personal finance.	Understand
CO2	Apply time value of money concepts, compounding principles, and asset allocation strategies to evaluate personal financial decisions.	Apply
CO3	Analyze various financial assets and investment avenues (bank deposits, mutual funds, equity, bonds, gold, real estate, etc.) to select suitable options based on risk profile and financial goals.	Analyze
CO4	Evaluate loan options, credit management practices, and debt risks to make responsible borrowing decisions and maintain financial stability.	Evaluate
CO5	Develop a comprehensive personal financial plan incorporating insurance, retirement planning, tax planning, and periodic review mechanisms.	Create

U24MC51	**WELL-BEING WITH TRADITIONAL PRACTICES-YOGA, AYURVEDA AND SIDDHA**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**0**

Course Objective:

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

Detailed Syllabus

UNIT I HEALTH AND ITS IMPORTANCE **2+4**

Health: Definition - Importance of maintaining health - More importance on prevention than treatment Ten types of health one has to maintain - Physical health - Mental health - Social health -Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health - Occupational/Professional heath.

Present health status - The life expectancy-present status - mortality rate - dreadful diseases - non-communicable diseases (NCDs) the leading cause of death - 60% - heart disease – cancer – diabetes chronic pulmonary diseases - risk factors – tobacco – alcohol - unhealthy diet - lack of physical activities.

Types of diseases and disorders - Lifestyle disorders – Obesity – Diabetes - cardiovascular diseases – Cancer – Strokes – COPD - Arthritis - Mental health issues.

Causes of the above diseases / disorders - Importance of prevention of illness - Takes care of health Improves quality of life - Reduces absenteeism - Increase satisfaction - Saves time

Simple lifestyle modifications to maintain health - Healthy Eating habits (Balanced diet according to age) Physical Activities (Stretching exercise, aerobics, resisting exercise) – Maintaining BMI-Importance and actions to be taken.

UNIT II DIET **4+6**

Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes – arthritis – hypertension – PCOD –infertility – ADHD – sleeplessness -helps to reduce the risk of heart diseases - keeps the teeth and bones strong.

Balanced Diet and its 7 Components - Carbohydrates – Proteins – Fats – Vitamins – Minerals - Fibre and Water.

Food additives and their merits & demerits - Effects of food additives - Types of food additives -Food additives and processed foods - Food additives and their reactions

Definition of BMI and maintaining it with diet - Importance - Consequences of not maintaining BMI - different steps to maintain optimal BM

Common cooking mistakes - Different cooking methods, merits and demerits of each method.

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

AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as a soft therapy.

Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of Personal and Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life.

Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Pancheekarana Theory / (Five Element Theory) 96 fundamental Principles - Uyir Thathukkal (TriDosha Theory) - Udal Thathukkal

Prevention of illness with our traditional system of medicine - Primary Prevention - To decrease the number of new cases of a disorder or illness - Health promotion/education, and - Specific protective measures - Secondary Prevention - To lower the rate of established cases of a disorder or illness in the population (prevalence) - Tertiary Prevention - To decrease the amount of disability associated with an existing disorder.

UNIT IV MENTAL WELLNESS **3+4**

Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life -short term and long-term effects of emotional disturbances - Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion - Expressing a full range of emotions.

Stress management - Stress definition - Stress in daily life - How stress affects one's life - Identifying the cause of stress - Symptoms of stress - Managing stress (habits, tools, training, professional help) - Complications of stress mismanagement. Sleep - Sleep and its importance for mental wellness - Sleep and digestion. Immunity - Types and importance - Ways to develop immunity
UNIT V YOGA **2+12** Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders - What yoga can bring to our life.
Total Periods: 45

Learning Resources

1	Nutrition and Dietetics - Ashley Martin, Published by White Word Publications, New York, NY 10001, USA
2	Yoga for Beginners_ 35 Simple Yoga Poses to Calm Your Mind and Strengthen Your Body, by Cory Martin, Copyright © 2015 by Althea Press, Berkeley, California
3	WHAT WE KNOW ABOUT EMOTIONAL INTELLIGENCE How It Affects Learning, Work, Relationships, and Our Mental Health, by Moshe Zeidner, Gerald Matthews, and Richard D. Roberts, A Bradford Book, The MIT Press, Cambridge, Massachusetts, London, England
4	The Mindful Self-Compassion Workbook, Kristin Neff, Ph.D Christopher Germer, Ph.D, Published by The Guilford Press A Division of Guilford Publications, Inc.370 Seventh Avenue, Suite 1200, New York, NY 10001
5	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4799645/
6	Simple lifestyle modifications to maintain healthhttps://www.niddk.nih.gov/health-information/diet-nutrition/changing-habits-better-health#:~:text=Make%20your%20new%20healthy%20habit,t%20have%20time%20to%20cook.
7	Read more: https://www.legit.ng/1163909-classes-food-examples-functions.html
8	https://www.yaclass.in/p/science-state-board/class-9/nutrition-and-health-5926
9	Benefits of healthy eating https://www.cdc.gov/nutrition/resources-publications/benefitsof-healthy-eating.html
10	Food additives https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/foodadditives

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the meaning of health, its types, and common lifestyle diseases.	Understand
CO2	Describe the importance of diet, balanced nutrition, and BMI for maintaining good health.	Understand
CO3	Explain the basic principles of Ayurveda and Siddha systems for disease prevention.	Understand
CO4	Discuss the importance of mental wellness, stress management, sleep, and immunity.	Understand
CO5	Describe the importance of yoga and practice simple yogasanas for a healthy life.	Understand

MINORS COURSES

VERTICAL – I BUSINESS DATA ANALYTICS

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24MNBA01	Statistics for Management	PEC	3	0	0	3	3	40	60
2	U24MNBA02	Datamining for Business Intelligence	PEC	3	0	0	3	3	40	60
3	U24MNBA03	Human Resource Analytics	PEC	3	0	0	3	3	40	60
4	U24MNBA04	Marketing and Social Media Web Analytics	PEC	3	0	0	3	3	40	60
5	U24MNBA05	Operation and Supply Chain Analytics	PEC	3	0	0	3	3	40	60
6	U24MNBA06	Financial Analytics	PEC	3	0	0	3	3	40	60

U24MNBA01	STATISTICS FOR MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objective:

- To explain the role of statistics in managerial decision-making.
- To summarize the methods of data collection and presentation.
- To classify measures of central tendency and dispersion.
- To illustrate probability concepts and distributions.
- To interpret statistical inference techniques for business applications.

Detailed Syllabus

UNIT I: INTRODUCTION TO STATISTICS **9**

Meaning, Nature and Scope of Statistics – Importance in Business Decision Making – Types of Data – Data Collection Methods – Classification and Tabulation of Data – Diagrammatic and Graphical Presentation.

UNIT II: MEASURES OF CENTRAL TENDENCY **9**

Mean, Median and Mode – Properties and Uses – Weighted Mean – Measures of Central Tendency for Grouped and Ungrouped Data – Practical Applications in Business.

UNIT III: MEASURES OF DISPERSION AND SKEWNESS **9**

Range, Quartile Deviation, Mean Deviation and Standard Deviation – Coefficient of Variation – Skewness and Kurtosis – Interpretation and Applications.

UNIT IV: PROBABILITY AND DISTRIBUTIONS **9**

Concept of Probability – Laws of Probability – Conditional Probability – Theorem of Total Probability – Bayes' Theorem – Probability Distributions: Binomial, Poisson and Normal Distribution.

UNIT V: STATISTICAL INFERENCE **9**

Sampling Techniques – Sampling and Non-Sampling Errors – Estimation – Hypothesis Testing – t-test, Chi-square test and ANOVA – Applications in Business Decision Making.

Total: 45 Periods

Learning Resources

1	Statistics for Management – Richard I. Levin & David S. Rubin, Pearson, Latest Edition, 2021.
2	Business Statistics – S. P. Gupta, Sultan Chand & Sons, Latest Edition, 2020.
3	Statistics for Business and Economics – Paul Newbold, Pearson, Latest Edition, 2022.
4	Business Statistics Using Excel – David M. Levine, Pearson, Latest Edition, 2021.
5	Fundamentals of Statistics – S. C. Gupta & V. K. Kapoor, Sultan Chand & Sons, Latest Edition, 2020.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the role and importance of statistics in management.	Understand
CO2	Summarize methods of data collection and presentation.	Understand
CO3	Classify measures of central tendency and dispersion.	Understand
CO4	Illustrate probability concepts and statistical distributions.	Understand
CO5	Interpret basic statistical inference techniques for business decisions.	Understand

U24MNBA02	**DATAMINING FOR BUSINESS INTELLIGENCE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

- To describe the concepts and significance of data mining in business intelligence.
- To outline the data preprocessing and data warehousing techniques.
- To explain classification and clustering methods used in data mining.
- To examine association rules and pattern discovery techniques.
- To discuss applications of data mining in business decision-making.

Detailed Syllabus

UNIT I: INTRODUCTION TO DATA MINING **9**

Data Mining – Meaning and Importance – Data Mining vs Data Analytics – Knowledge Discovery in Databases (KDD) Process – Business Intelligence Concepts – Applications of Data Mining in Business.

UNIT II: DATA PREPROCESSING AND WAREHOUSING **9**

Data Cleaning – Data Integration – Data Transformation – Data Reduction – Data Warehousing – Architecture of Data Warehouse – OLAP Operations – Data Marts.

UNIT III: CLASSIFICATION TECHNIQUES **9**

Classification – Decision Trees – Naïve Bayes Classification – K-Nearest Neighbor (KNN) – Model Evaluation Methods – Accuracy, Precision and Recall.

UNIT IV: CLUSTERING AND ASSOCIATION RULES **9**

Clustering – K-Means Clustering – Hierarchical Clustering – Association Rule Mining – Apriori Algorithm – Market Basket Analysis.

UNIT V: DATA MINING APPLICATIONS IN BUSINESS **9**

Customer Relationship Management (CRM) – Fraud Detection – Sales and Marketing Analysis – Risk Management – Web Mining – Ethical Issues in Data Mining.

Total: 45 Periods

Learning Resources

1	Data Mining: Concepts and Techniques – Jiawei Han, Morgan Kaufmann, Latest Edition, 2022.
2	Introduction to Data Mining – Pang-Ning Tan, Pearson, Latest Edition, 2021.
3	Data Mining for Business Analytics – Galen Shmueli, Wiley, Latest Edition, 2020.
4	Business Intelligence Guidebook – Rick Sherman, Morgan Kaufmann, Latest Edition, 2015 (Reprint).
5	Fundamentals of Data Mining in Genomics and Proteomics – Werner Dubitzky, Springer, Latest Edition, 2021.

Course Outcomes

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

CO	Course Outcome Statement	Knowledge Level
CO1	Describe the concepts and importance of data mining in business intelligence.	Understand
CO2	Outline data preprocessing and data warehousing techniques.	Understand
CO3	Explain classification methods used in data mining.	Understand
CO4	Examine clustering and association rule techniques.	Understand
CO5	Discuss applications of data mining in business contexts	Understand

U24MNBA03	HUMAN RESOURCE ANALYTICS	L	T	P	C
		3	0	0	3

Course Objective:

- To recognize the role of analytics in human resource management.
- To explain HR metrics and data-driven decision-making in organizations.
- To illustrate techniques used in workforce analytics.
- To examine employee performance and retention analytics.
- To appraise the application of HR analytics in strategic management.

Detailed Syllabus

UNIT I: INTRODUCTION TO HR ANALYTICS **9**

Meaning and Scope of HR Analytics – Evolution of HR Analytics – Role of Analytics in HRM – HR Analytics vs HR Metrics – Importance in Organizational Decision Making.

UNIT II: HR DATA AND METRICS **9**

Sources of HR Data – Types of HR Data – HR Metrics: Turnover Rate, Absenteeism, Cost per Hire – Data Collection and Management – HR Dashboards and Reporting.

UNIT III: WORKFORCE ANALYTICS **9**

Workforce Planning – Talent Analytics – Recruitment Analytics – Training and Development Analytics – Competency Mapping – Workforce Optimization.

UNIT IV: PERFORMANCE AND RETENTION ANALYTICS **9**

Employee Performance Analysis – Performance Appraisal Data – Predicting Employee Attrition – Retention Strategies – Employee Engagement Analytics.

UNIT V: STRATEGIC HR ANALYTICS AND APPLICATIONS **9**

HR Analytics in Strategic Decision Making – Predictive HR Analytics – HR Scorecards – Ethical Issues in HR Analytics – Future Trends in HR Analytics.

Total: 45 Periods

Learning Resources

1	HR Analytics: The What, Why and How – Tracey Smith, Kogan Page, Latest Edition, 2021.
2	Predictive HR Analytics – Kirsten Edwards, Kogan Page, Latest Edition, 2019.
3	Human Resource Analytics – Dipak Kumar Bhattacharyya, Sage Publications India, Latest Edition, 2017 (Reprint).
4	HR Analytics Handbook – Sharma and Sharma, McGraw Hill Education India, Latest Edition, 2020.
5	People Analytics for Dummies – Mike West, Wiley, Latest Edition, 2018 (Reprint).

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Recognize the importance of analytics in human resource management.	Understand
CO2	Explain HR data sources and key metrics used in organizations.	Understand
CO3	Illustrate workforce analytics techniques in HR functions.	Understand
CO4	Examine employee performance and retention analytics.	Understand
CO5	Appraise the role of HR analytics in strategic decision-making.	Understand

U24MNBA04	**MARKETING AND SOCIAL MEDIA WEB ANALYTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

- To identify the role of analytics in digital marketing and social media.
- To explain web analytics tools and techniques used in marketing.
- To differentiate key performance indicators and metrics in online marketing.
- To examine social media analytics and consumer engagement.
- To assess the application of web analytics in marketing strategies.

Detailed Syllabus

UNIT I: INTRODUCTION TO DIGITAL MARKETING ANALYTICS **9**

Digital Marketing – Concepts and Importance – Role of Analytics in Marketing – Web Analytics: Meaning and Scope – Types of Digital Data – Overview of Marketing Analytics.

UNIT II: WEB ANALYTICS TOOLS AND TECHNIQUES **9**

Web Analytics Tools – Google Analytics – Data Collection Techniques – Traffic Analysis – User Behaviour Analysis – Conversion Tracking – A/B Testing.

UNIT III: MARKETING METRICS AND KPIs **9**

Key Performance Indicators (KPIs) – Click Through Rate (CTR) – Cost per Click (CPC) – Conversion Rate – Customer Acquisition Cost – Return on Investment (ROI) – Campaign Performance Analysis.

UNIT IV: SOCIAL MEDIA ANALYTICS **9**

Social Media Platforms and Data – Engagement Metrics – Sentiment Analysis – Influencer Analytics – Social Media Monitoring Tools – Content Performance Evaluation.

UNIT V: APPLICATIONS AND STRATEGIES IN WEB ANALYTICS **9**
Marketing Strategy Development using Analytics – Customer Segmentation – Personalization Techniques – Predictive Marketing Analytics – Ethical Issues in Digital Analytics.
Total: 45 Periods

Learning Resources

1	Web Analytics 2.0 – Avinash Kaushik, Wiley, Latest Edition, 2020 (Reprint).
2	Digital Marketing Analytics – Chuck Hemann & Ken Burbary, Que Publishing, Latest Edition, 2018 (Reprint).
3	Marketing Analytics – Wayne L. Winston, Wiley, Latest Edition, 2020.
4	Social Media Analytics – Marshall Sponder, McGraw Hill Education, Latest Edition, 2019.
5	Digital Marketing – Dave Chaffey, Pearson, Latest Edition, 2022.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Identify the role of analytics in digital marketing and social media.	Understand
CO2	Explain web analytics tools and techniques used in marketing.	Understand
CO3	Differentiate key performance metrics and KPIs in online marketing.	Understand
CO4	Examine social media analytics and user engagement patterns.	Understand
CO5	Assess the application of web analytics in marketing strategies.	Understand

U24MNBA05	**OPERATION AND SUPPLY CHAIN ANALYTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

- To outline the role of analytics in operations and supply chain management.
- To explain demand forecasting and inventory analysis techniques.
- To describe analytical models used in logistics and distribution.
- To examine performance measurement in supply chains.
- To summarize the application of analytics in optimizing operations.

Detailed Syllabus

UNIT I: INTRODUCTION TO OPERATIONS AND SUPPLY CHAIN ANALYTICS **9**
Operations Management – Supply Chain Management: Concepts and Importance – Role of Analytics in Operations – Components of Supply Chain – Data-Driven Decision Making in Operations.
UNIT II: DEMAND FORECASTING AND INVENTORY ANALYTICS **9**
Demand Forecasting – Qualitative and Quantitative Methods – Time Series Basics – Inventory Management – EOQ Model – Safety Stock – Reorder Point – Inventory Control Techniques.
UNIT III: LOGISTICS AND DISTRIBUTION ANALYTICS **9**
Logistics Management – Transportation Models – Distribution Network Design – Warehouse Analytics – Routing and Scheduling – Cost Optimization in Logistics.

UNIT IV: SUPPLY CHAIN PERFORMANCE MEASUREMENT	**9**
Supply Chain Performance Metrics – Key Performance Indicators – Benchmarking – Service Level Measurement – Balanced Scorecard in Supply Chain – Risk Assessment in Supply Chain.	
UNIT V: OPTIMIZATION AND APPLICATIONS IN OPERATIONS	**9**
Optimization Techniques in Operations – Linear Programming Basics – Capacity Planning – Lean Operations – Supply Chain Analytics Applications in Manufacturing and Services – Emerging Trends.	
	Total: 45 Periods

Learning Resources

1	Supply Chain Management: Strategy, Planning, and Operation – Sunil Chopra & Peter Meindl, Pearson, Latest Edition, 2022.
2	Operations Management – William J. Stevenson, McGraw Hill Education, Latest Edition, 2021.
3	Designing and Managing the Supply Chain – David Simchi-Levi, McGraw Hill Education, Latest Edition, 2020.
4	Supply Chain Analytics – Nada R. Sanders, Pearson, Latest Edition, 2020.
5	Operations Research – Hamdy A. Taha, Pearson, Latest Edition, 2019.

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Outline the role of analytics in operations and supply chain management.	Understand
CO2	Explain demand forecasting and inventory analysis techniques.	Understand
CO3	Describe logistics and distribution analytics models.	Understand
CO4	Examine supply chain performance measurement methods.	Understand
CO5	Summarize optimization approaches in operations and supply chain analytics.	Understand

U24MNBA06	**FINANCIAL ANALYTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

- To explain the significance of analytics in financial decision-making.
- To interpret financial data using analytical tools and techniques.
- To describe models used in investment and risk analysis.
- To examine financial market behaviour using analytical approaches.
- To summarize applications of analytics in corporate finance and investments.

Detailed Syllabus

UNIT I: INTRODUCTION TO FINANCIAL ANALYTICS	**9**
Financial Analytics – Meaning and Scope – Role of Analytics in Finance – Types of Financial Data – Financial Statements Analysis – Ratio Analysis – Introduction to Financial Modelling.	
UNIT II: CORPORATE FINANCE ANALYTICS	**9**
Cash Flow Analysis – Cost of Capital – Capital Budgeting Techniques – Payback Period – Net Present Value (NPV) – Internal Rate of Return (IRR) – Break-even Analysis.	

UNIT III: FINANCIAL MARKET ANALYTICS	**9**
Risk and Return – Measurement of Risk – Time Series Basics in Finance – Stock and Bond Analysis – Market Indicators – Introduction to Volatility Concepts.	
UNIT IV: PORTFOLIO AND INVESTMENT ANALYTICS	**9**
Portfolio Analysis – Diversification – Capital Asset Pricing Model (CAPM) – Sharpe Ratio – Basics of Derivatives – Option Pricing Concepts – Investment Decision Analysis.	
UNIT V: RISK ANALYSIS AND APPLICATIONS	**9**
Financial Risk – Types of Risk – Credit Risk Concepts – Value at Risk (VaR) – Risk Management Techniques – Applications of Financial Analytics in Business.	
	Total: 45 Periods

Learning Resources

1	Financial Analytics *with R* – Mark J. Bennett & Dirk L. Hugen, Cambridge University Press, Latest Edition, 2020.
2	Python for Finance – *Yuxing Yan, Packt Publishing, Latest Edition, 2017 (Reprint).*
3	Quantitative Financial Analytics – *Edward E. Williams & John A. Dobelman, World Scientific, Latest Edition, 2017 (Reprint).*
4	Investment Analysis and Portfolio Management – *Prasanna Chandra, McGraw Hill Education India, Latest Edition, 2021.*
5	Financial Management – *I. M. Pandey, Vikas Publishing, Latest Edition, 2022.*

Course Outcomes

At the end of the course, the students will be able to		
CO	**Course Outcome Statement**	**Knowledge Level**
CO1	Explain the role and importance of financial analytics.	Understand
CO2	Interpret financial data using analytical techniques.	Understand
CO3	Describe models used in corporate finance and investment analysis.	Understand
CO4	Examine financial market behaviour and portfolio concepts.	Understand
CO5	Summarize risk analysis methods and financial applications.	Understand

VERTICAL – II PUBLIC ADMINISTRATION

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	ASSESSMENT	
				L	T	P			CIA	ESE
1	U24MNPA01	Principles of Public Administration	PEC	3	0	0	3	3	40	60
2	U24MNPA02	Constitution of India	PEC	3	0	0	3	3	40	60
3	U24MNPA03	Public Personnel Administration	PEC	3	0	0	3	3	40	60
4	U24MNPA04	Administrative Theories	PEC	3	0	0	3	3	40	60
5	U24MNPA05	Indian Administrative System	PEC	3	0	0	3	3	40	60
6	U24MNPA06	Public Policy Administration	PEC	3	0	0	3	3	40	60

U24MNPA01	PRINCIPLES OF PUBLIC ADMINISTRATION	L	T	P	C
		3	0	0	3

Course Objective:

- To understand the meaning, nature, scope, and evolution of public administration.
- To learn the classical and modern administrative theories.
- To familiarize about the structure and principles of administrative organization.
- To understand the basic functions of personnel and financial administration.
- To describe about the development of administration and emerging trends in public administration.

Detailed Syllabus

UNIT I: INTRODUCTION TO PUBLIC ADMINISTRATION **9**

Meaning, Nature and Scope of Public Administration – Evolution of Public Administration – Public and Private Administration – New Public Administration (NPA) – New Public Management (NPM) – Governance: Concept and Dimensions.

UNIT II: ADMINISTRATIVE THOUGHT **9**

Classical Theories – Woodrow Wilson, Henri Fayol, Max Weber – Neo-Classical Theory: Human Relations Approach – Modern Theories: Systems Theory, Decision-Making Theory – Criticism of Classical Theories.

UNIT III: ADMINISTRATIVE STRUCTURE AND ORGANIZATION **9**

Principles of Organization – Hierarchy, Unity of Command, Span of Control – Line and Staff Agencies – Forms of Organization: Department, Corporation, Board and Commission – Public Enterprises – Accountability and Control.

UNIT IV: PERSONNEL AND FINANCIAL ADMINISTRATION **9**

Personnel Administration – Recruitment, Training, Promotion – Civil Service: Meaning and Types – Financial Administration – Budgeting, Accounting and Auditing – Performance Budgeting and Zero-Based Budgeting – Role of Finance Ministry.

UNIT V: DEVELOPMENT AND CONTEMPORARY PUBLIC ADMINISTRATION **9**
Development Administration – Concept and Features – Good Governance and E-Governance – Public Policy: Formulation and Implementation – Administrative Reforms in India – Role of NGOs and Civil Society.
Total: 45 Periods

Learning Resources

1	Public Administration – *M. Laxmikanth,* McGraw Hill Education India, Latest Edition, 2023.
2	New Horizons of Public Administration – Mohit Bhattacharya, Jawahar Publishers and Distributors, Latest Edition, 2022.
3	Public Administration: Concepts and Theories – Rumki Basu, Sterling Publishers, Latest Edition, 2021.
4	Administrative Thinkers – D. Ravindra Prasad, Sterling Publishers, Latest Edition, 2020.
5	Public Administration in Theory and Practice – M. P. Sharma & B. L. Sadana, Kitab Mahal, Latest Edition, 2022.

Course Outcomes

Upon completion of this course, the student should be able to:

CO	Course Outcome Statement	Knowledge Level
CO1	Explain the concept, scope, and significance of public administration.	Understand
CO2	Describe major administrative theories and contributions of thinkers	Understand
CO3	Explain organizational principles and administrative structures.	Understand
CO4	Describe personnel systems and financial management in public administration.	Understand
CO5	Explain development administration and recent administrative reforms.	Understand

U24MNPA02	**CONSTITUTION OF INDIA**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

- To understand the historical background and evolution of the Indian Constitution.
- To familiarize learners with the features and principles of the Constitution.
- To develop knowledge about fundamental rights, duties and directive principles.
- To understand the structure and functioning of Union and State governments.
- To analyse constitutional bodies and recent developments in Indian governance.

Detailed Syllabus

UNIT I: HISTORICAL BACKGROUND AND MAKING OF THE CONSTITUTION **9**
Historical background of the Indian Constitution – Regulating Act 1773, Charter Acts, Government of India Acts – Constituent Assembly: Composition and Functions – Drafting Committee – B. R. Ambedkar – Salient features of the Constitution.

UNIT II: FUNDAMENTAL RIGHTS AND DUTIES 9 Fundamental Rights – Right to Equality, Freedom, Against Exploitation, Freedom of Religion, Cultural and Educational Rights, Constitutional Remedies – Fundamental Duties – Directive Principles of State Policy – Relationship between Fundamental Rights and DPSP.
UNIT III: UNION GOVERNMENT 9 President – Powers and Functions – Vice President – Prime Minister and Council of Ministers – Parliament: Lok Sabha and Rajya Sabha – Legislative Procedures – Judicial Review.
UNIT IV: STATE GOVERNMENT AND JUDICIARY 9 Governor – Chief Minister and Council of Ministers – State Legislature – High Courts – Supreme Court of India – Judicial Activism and Independence of Judiciary.
UNIT V: CONSTITUTIONAL BODIES AND AMENDMENTS 9 Election Commission – Finance Commission – Union Public Service Commission – Comptroller and Auditor General (CAG) – Constitutional Amendments – Basic Structure Doctrine – Recent Constitutional Developments.
Total: 45 Periods

Learning Resources

1	Indian Polity – *M. Laxmikanth,* McGraw Hill Education India, Latest Edition, 2023.
2	Introduction to the Constitution of India – D. D. Basu, LexisNexis, Latest Edition, 2022.
3	Our Constitution – Subhash C. Kashyap, National Book Trust, Latest Edition, 2021.
4	Indian Government and Politics – B. L. Fadia, Sahitya Bhawan Publications, Latest Edition, 2022.
5	Constitutional Law of India – J. N. Pandey, Central Law Agency, Latest Edition, 2021.

Course Outcomes

Upon completion of this course, the student should be able to:

CO	Course Outcome Statement	Knowledge Level
CO1	Understand the historical background and features of the Indian Constitution.	Understand
CO2	Explain fundamental rights, duties and directive principles.	Understand
CO3	Describe the structure and functions of the Union Government.	Understand
CO4	Explain the organization of State Government and Judiciary.	Understand
CO5	Understand constitutional bodies and amendment procedures.	Understand

U24MNPA03	PUBLIC PERSONNEL ADMINISTRATION	L	T	P	C
		3	0	0	3

Course Objective:

- To interpret the role and significance of personnel administration in public organizations.
- To distinguish various systems and principles of public personnel management.
- To summarize recruitment, training and career development processes in civil services.
- To explain performance appraisal and promotion systems in government.
- To discuss discipline, ethics and accountability in public service.

Detailed Syllabus

UNIT I: INTRODUCTION TO PUBLIC PERSONNEL ADMINISTRATION	**9**
Meaning, Nature and Scope of Public Personnel Administration – Evolution of Personnel Systems – Role of Human Resources in Public Administration – Distinction between Public and Private Personnel Administration – Emerging Trends in HRM in Public Sector.	
UNIT II: CIVIL SERVICE SYSTEMS	**9**
Civil Service: Meaning and Features – Types of Civil Services – Generalist vs Specialist – Neutrality and Anonymity – Recruitment Agencies – Union Public Service Commission – State Public Service Commission.	
UNIT III: RECRUITMENT, TRAINING AND DEVELOPMENT	**9**
Principles of Recruitment – Methods of Recruitment – Training: Types and Importance – Training Institutions in India – Career Development – Capacity Building in Public Service.	
UNIT IV: PERFORMANCE APPRAISAL AND PROMOTION	**9**
Performance Appraisal: Meaning and Methods – Confidential Reports – Promotion Policies – Seniority vs Merit – Pay Structure and Incentives – Employee Motivation in Public Sector.	
UNIT V: DISCIPLINE, ETHICS AND ACCOUNTABILITY	**9**
Disciplinary Procedures – Conduct Rules – Administrative Ethics – Code of Conduct – Integrity in Public Service – Grievance Redressal Mechanisms – Role of Vigilance Institutions	
	Total: 45 Periods

Learning Resources

1	Personnel Administration in India – Avasthi and Maheshwari, Lakshmi Narain Agarwal, Latest Edition, 2021.
2	Public Personnel Administration – M. P. Sharma, Kitab Mahal, Latest Edition, 2022.
3	Human Resource Management in Public Sector – B. P. Singh, Excel Books, Latest Edition, 2020.
4	Public Administration in Theory and Practice – M. P. Sharma & B. L. Sadana, Kitab Mahal, Latest Edition, 2022.
5	Indian Administration – S. R. Maheshwari, Orient Blackswan, Latest Edition, 2021.

Course Outcomes

Upon completion of this course, the student should be able to:

CO	Course Outcome Statement	Knowledge Level
CO1	Interpret the role and importance of personnel administration in public organizations.	Understand

CO2	Distinguish various civil service systems and their features.	Understand
CO3	Summarize recruitment, training and development processes in public services.	Understand
CO4	Explain performance appraisal and promotion systems in administration.	Understand
CO5	Discuss discipline, ethics and accountability mechanisms in public service.	Understand

U24MNPA04	ADMINISTRATIVE THEORIES	L	T	P	C
		3	0	0	3

Course Objective:

- To outline the evolution of administrative thought.
- To clarify the principles of classical administrative theories.
- To examine human relations and behavioural approaches.
- To illustrate modern administrative theories and systems approach.
- To compare traditional and contemporary administrative perspectives.

Detailed Syllabus

UNIT I: EVOLUTION OF ADMINISTRATIVE THOUGHT **9**

Nature and Significance of Administrative Theory – Evolution of Administrative Thought – Politics-Administration Dichotomy – Contribution of Woodrow Wilson – Early Administrative Ideas.

UNIT II: CLASSICAL ADMINISTRATIVE THEORIES **9**

Scientific Management Theory – Contribution of F. W. Taylor – Administrative Theory of Henri Fayol – Bureaucratic Theory of Max Weber – Principles and Criticism.

UNIT III: NEO-CLASSICAL AND HUMAN RELATIONS APPROACH **9**

Human Relations Theory – Hawthorne Experiments – Contribution of Elton Mayo – Behavioural Approach – Motivation Theories – Limitations of Human Relations Approach.

UNIT IV: MODERN ADMINISTRATIVE THEORIES **9**

Systems Theory – Decision-Making Theory – Contribution of Herbert Simon – Ecological Approach – Comparative Public Administration – Critique of Modern Theories.

UNIT V: CONTEMPORARY ADMINISTRATIVE PERSPECTIVES **9**

New Public Administration – New Public Management – Governance Approach – Public Choice Theory – Emerging Trends in Administrative Thought.

Total: 45 Periods

Learning Resources

1	Administrative Thinkers – D. Ravindra Prasad, Sterling Publishers, Latest Edition, 2020.
2	New Horizons of Public Administration – Mohit Bhattacharya, Jawahar Publishers and Distributors, Latest Edition, 2022.
3	Public Administration: Concepts and Theories – Rumki Basu, Sterling Publishers, Latest Edition, 2021.

4	Administrative Behavior – Herbert A. Simon, Free Press, Latest Edition, 2013 (Reprint).
5	The Theory of Public Administration – Nigro and Nigro, Harper & Row, Latest Edition (Reprint), 2017.

Course Outcomes

Upon completion of this course, the student should be able to:

CO	Course Outcome Statement	Knowledge Level
CO1	Outline the evolution of administrative thought and early theories.	Understand
CO2	Clarify the principles of classical administrative theories.	Understand
CO3	Examine human relations and behavioural approaches in administration.	Understand
CO4	Illustrate modern administrative theories and their applications.	Understand
CO5	Compare traditional and contemporary administrative perspectives.	Understand

U24MNPA05	INDIAN ADMINISTRATIVE SYSTEM	L	T	P	C
		3	0	0	3

Course Objective:

- To describe the structure and characteristics of the Indian administrative system.
- To explain the organization of central and state administration.
- To identify the role of district and local administration in governance.
- To examine the functions of public institutions and regulatory bodies.
- To highlight administrative reforms and challenges in India.

Detailed Syllabus

UNIT I: EVOLUTION AND FEATURES OF INDIAN ADMINISTRATION **9**

Historical evolution of Indian Administration – Colonial legacy – Post-independence developments – Salient features of Indian Administrative System – Continuity and change in administration.

UNIT II: CENTRAL ADMINISTRATION **9**

President and Council of Ministers – Prime Minister and Cabinet Secretariat – Central Secretariat – Ministries and Departments – Role of Civil Services – Cabinet Secretariat.

UNIT III: STATE AND DISTRICT ADMINISTRATION **9**

State Administration – Governor and Chief Minister – State Secretariat – District Administration – Role of District Collector – Changing role in development administration.

UNIT IV: LOCAL ADMINISTRATION AND PUBLIC INSTITUTIONS **9**

Panchayati Raj Institutions – Urban Local Bodies – Functions and Responsibilities – Role of Public Sector Institutions – Regulatory Authorities and Statutory Bodies.

UNIT V: ADMINISTRATIVE REFORMS AND CHALLENGES **9**
Administrative Reforms in India – Administrative Reforms Commission – Good Governance Initiatives – E-Governance – Issues of Corruption, Transparency and Accountability – Contemporary Challenges in Indian Administration.
Total: 45 Periods

Learning Resources

1	Indian Administration – S. R. Maheshwari, Orient Blackswan, Latest Edition, 2021.
2	Indian Administration – Arora and Goyal, New Age International, Latest Edition, 2020.
3	Public Administration in India – Padma Ramachandran, National Book Trust, Latest Edition, 2021.
4	Indian Polity – M. Laxmikanth, McGraw Hill Education India, Latest Edition, 2023.
5	Governance in India – M. Laxmikanth, McGraw Hill Education India, Latest Edition, 2022.

Course Outcomes

Upon completion of this course, the student should be able to:

CO	Course Outcome Statement	Knowledge Level
CO1	Describe the evolution and features of the Indian administrative system.	Understand
CO2	Explain the structure and functioning of central administration.	Understand
CO3	Identify the organization of state and district administration.	Understand
CO4	Examine the role of local administration and public institutions.	Understand
CO5	Highlight administrative reforms and contemporary challenges in India.	Understand

U24MNPA06	PUBLIC POLICY ADMINISTRATION	L	T	P	C
		3	0	0	3

Course Objective:

- To define the concept and significance of public policy in governance.
- To classify different types and approaches of public policy.
- To explain the stages involved in public policy formulation and implementation.
- To interpret the role of institutions and stakeholders in policy processes.
- To review policy evaluation and contemporary policy challenges.

Detailed Syllabus

UNIT I: INTRODUCTION TO PUBLIC POLICY **9**
Meaning and Nature of Public Policy – Scope and Importance – Types of Public Policy – Public Policy vs Decision Making – Role of Government in Policy Making.
UNIT II: APPROACHES AND MODELS OF PUBLIC POLICY **9**
Institutional Approach – Group Theory – Elite Theory – Rational Model – Incremental Model – Systems Approach – Policy Analysis Frameworks.
UNIT III: POLICY FORMULATION AND IMPLEMENTATION **9**
Policy Formulation – Agenda Setting – Policy Design – Policy Implementation – Role of Bureaucracy and Political Executive – Factors influencing implementation.

UNIT IV: POLICY ACTORS AND INSTITUTIONS	**9**
Role of Legislature, Executive and Judiciary – Role of Civil Society and NGOs – Role of International Organizations – NITI Aayog – Policy Networks and Stakeholders.	
UNIT V: POLICY EVALUATION AND CONTEMPORARY ISSUES	**9**
Policy Monitoring and Evaluation – Techniques of Policy Evaluation – Public Policy and Development – Issues in Policy Implementation – Emerging Policy Challenges in India.	
Total: 45 Periods	

Learning Resources

1	Public Policy: Concepts, Theory and Practice – B. Guy Peters, Routledge, 2021.
2	Public Policy – Thomas R. Dye, Pearson, Latest Edition, 2020.
3	Understanding Public Policy – Thomas R. Dye, Pearson, Latest Edition, 2021.
4	Public Policy and Administration in India – Rajesh K. Shukla, Sage Publications India, Latest Edition, 2022.
5	Public Policy in India – Kuldeep Mathur, Oxford University Press India, Latest Edition, 2020.

Course Outcomes

Upon completion of this course, the student should be able to:

CO	Course Outcome Statement	Knowledge Level
CO1	Define the concept and significance of public policy.	**Understand**
CO2	Classify various approaches and models of public policy.	**Understand**
CO3	Explain the stages of policy formulation and implementation.	**Understand**
CO4	Interpret the role of institutions and stakeholders in policy processes.	**Understand**
CO5	Review policy evaluation methods and contemporary policy issues.	**Understand**