PROGRAMME STRUCTURE

SHARDA SCHOOL OF ENGINEERING & SCIENCE

Department of Civil Engineering

M. Tech. Civil Engineering for Working Professionals (Specialization in Structural Engineering/Environmental Engineering/Geotechnical & Earthquake Engineering/Construction Management/Remote Sensing & GIS)

Programme Code: SET0310

Batch: 2025-27

Vision, Mission and Core Values of the University

Vision of the University

To serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship.

Mission of the University

1. Transformative educational experience
2. Enrichment by educational initiatives that encourage global outlook
3. Develop research, support disruptive innovations and accelerate entrepreneurship
4.Seeking beyond boundaries

Core Values

Integrity
Leadership
Diversity
Community

Vision of the Sharda School of Engineering & Science

Achieve academic excellence in the realm of basic and engineering science to address the global challenges and to become global leaders.

Mission of the Sharda School Engineering & Science

- To impart basic, advanced and transformative knowledge and skills in science and technology.
- To strengthen capacity and capabilities in cutting-edge technology and research.
- To nurture multidisciplinary research and entrepreneurship temperament for developing innovative solutions to global, societal and environmental challenges.
- To foster multi-dimensional partnerships and collaborations for skill development and global employability.

Vision and Mission of the Department of Civil Engineering

Vision of the Department of Civil Engineering

To become a globally acclaimed institution of higher learning in engineering and technology promoting excellence in research, innovation and entrepreneurship to provide sustainable solution to the needs of the society.

Mission of the Department of Civil Engineering

1. Imparting quality education along with co-curricular and extra-curricular activities.
2. Develop broader outlook, ethical values and leadership qualities.
3. Support research and development and nurture entrepreneurship.
4. Inculcate innovative and original thinking to face the challenges.

About the Program

Undergraduate and Post Graduate program in Civil Engineering have been developed to meet the latest requirements of the infrastructural development of our country in areas like Construction, Transportation, Hydropower and Environmental Engineering. The curriculum has been developed to keep it more practical and industry oriented without compromising on its academic rigor. Students are provided with comprehensive theoretical knowledge through lectures, tutorials and assignments covering the basic as well as advanced topics in various subjects of Civil Engineering. They are trained for practical understanding in departmental laboratories namely Concrete Technology, Structural Engineering, Geotechnical Engineering, Environmental Engineering, Highway Engineering, and Surveying, Remote Sensing & GIS in addition to the traditional Engineering Graphics and Workshop Practices.

Program Outcomes (POs) of M.Tech. Civil Engineering for Working Professionals

PO1: **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using advanced understanding of mathematics and engineering.

PO2: **Design/development/execution of solutions**: Design sustainable solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public safety, and the cultural, societal, legal and environmental considerations.

PO3: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO4: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO5: **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO6: **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO7: **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work effectively, as a member and leader in a multidisciplinary and/or diverse team, to manage projects and in multidisciplinary environments.

PO8: **Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PO9: **Leadership in research and practice**: Use a combination of technical, managerial and soft skills to play the leadership role in research and practice.

PO10: **Engineer and Society**: Apply reasoning informed by the appropriate knowledge to assess societal, safety, legal issues and the consequent responsibilities relevant to engineering practice.

Program Specific Outcomes (PSOs) of M.Tech. Civil Engineering for Working Professionals

PSO1: Design, develop, construct and manage new civil engineering infrastructure.

PSO2: Analyze Evaluate, and Execute sustainable solutions to the structural problems faced by the society.

PSO3: Cognizance of social awareness, environmental necessity, modern management and construction techniques to have a successful career in their respective specializations.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs) OF PG PROGRAM

PEO1: Graduates will develop into proficient resources in the advanced aspects of engineering & and technology with analytical and quantitative reasoning and design abilities.

PEO2: Graduates will apply the skills to formulate, analyze and solve the societal problems of sustainable development related to their specialization along with maintaining the professional integrity and ethics.

PEO3: Graduates will grow personally and professionally in the careers through continued development of analytical, technical and managerial skills.

PEO4: Graduates will excel as entrepreneurs through continuous enhancement of communication skills, professional networking and life-long learning.

PEO5: Graduates will be prepared to assume higher roles and responsibilities at national and international level to imprint their presence for the larger good of the society.

Department of Civil Engineering M.TECH Civil Engineering for Working Professionals 2025-27															
Course Structure for batches admitted in session 2025-26 and onwards															
Semester	**Courses**								**Courses**	**Labs**	**L**	**T**	**P**	**Weekly contact**	**Credits**
I	Programme Core-1 (3-0-0) 3	Programme Core-2 (3-0-0) 3	Departmental Elective-1 (3-0-0) 3	Departmental Elective-2 (3-0-0) 3	Departmental Elective-3 (3-0-0) 3	RBL-1 (0-0-0)	Programme Core-1 Lab (0-0-2) 1	Community Connect (0-0-0) 2	8	3	15	0	2	17	18
II	Programme Core-3 (3-0-) 3	Programme Core-4 (3-0-0) 3	Departmental Elective-4 (3-0-0) 3	Departmental Elective-5 (3-1-0) 4	Departmental Elective-1 Lab (0-0-2) 1	RBL-2 (0-0-0)	Programme Core-2 Lab (0-0-2) 1		7	3	12	1	4	17	15
III	Dissertation -1 (0-0-20) 12		Departmental Elective-6 (3-0-0) 3 NPTEL	Departmental Elective-5 Lab (0-0-2) 1	Departmental Elective-6 Lab (0-0-2) 1				4	3	3	0	24	7	17
IV	Dissertation -II (0-0-32) 16	Departmental Elective-7 (3-0-0) 3 NPTEL	Departmental Elective-8 (3-0-0) 3 NPTEL						3	1	6	0	32	6	22

	Structural Engg	**Environmental Engg**	**Geotechnical & Earthquake Engg**	**Construction Management**	**Remote Sensing & GIS**	**Credits**
PC-1	Application of GIS in Civil Engineering	Application of GIS in Civil Engineering	Application of GIS in Civil Engineering	Application of GIS in Civil Engineering	Application of GIS in Civil Engineering	3
PC-2	Project Planning & Scheduling	Project Planning & Scheduling	Project Planning & Scheduling	Project Planning & Scheduling	Project Planning & Scheduling	3
PC-3	Renewable Energy Technologies	Renewable Energy Technologies	Renewable Energy Technologies	Renewable Energy Technologies	Renewable Energy Technologies	3
PC-4	Research Methodology	Research Methodology	Research Methodology	Research Methodology	Research Methodology	3
DE-1	Advanced Structural Analysis	Environmental Chemistry and microbiology	Geo-hazard and Geo-environmental Engineering	Estimation and Quantity Surveying	GIS Fundamentals	3
DE-2	Structural Dynamics	Physico-Chemical Processes	Soil Foundation Interaction	Analysis of Construction cost and finances	Principles of Remote Sensing and Photogrammetry	3

DE-3	Construction Equipment Management	Biological Processes	Soil Dynamics and Machine Foundation	Construction Equipment Management	Fundamentals of Image Processing	3
DE-4	Advance RCC Design	Solid and Hazardous waste Management	Reinforced Soil Structure	Quality Assurance and Quality Control	GIS Data Analysis	3
DE-5	Advanced Concrete Technology	Air pollution and control	Advanced Concrete Technology	Advanced Concrete Technology	Fundamentals of SAR and data processing	4
DE-6	NPTEL	NPTEL	NPTEL	NPTEL	NPTEL	3
DE-7	NPTEL	NPTEL	NPTEL	NPTEL	NPTEL	3
DE-8	NPTEL	NPTEL	NPTEL	NPTEL	NPTEL	3
PC-1 Lab	Application of GIS in Civil Engineering Lab	Application of GIS in Civil Engineering Lab	Application of GIS in Civil Engineering Lab	Application of GIS in Civil Engineering Lab	Application of GIS in Civil Engineering Lab	1
PC-2 Lab	Project Planning & Scheduling Lab	Project Planning & Scheduling Lab	Project Planning & Scheduling Lab	Project Planning & Scheduling Lab	Project Planning & Scheduling Lab	1
DE-1 Lab	Structural Modelling & Design Lab - 1	Environmental Engineering Lab	Advance Soil Mechanics Lab	Construction Management Lab-I (Estimator)	GIS Fundamentals Lab	1
DE-5 Lab	Advance Concrete Technology Lab	Advance Environmental Engineering Lab	Advance Concrete Technology Lab	Advance Concrete Technology Lab	SAR Data processing Lab	1
DE-6 Lab	Structural Modelling & Design Lab - 2	Solid waste and air pollution lab	Advanced Geotechnical Data Analysis And Modeling Lab	MSP and financial accounting lab	Python and Google Earth Engine for Remote Sensing & GIS Lab	1
	Dissertation -1	Dissertation -1	Dissertation -1	Dissertation -1	Dissertation -1	12
	Dissertation -2	Dissertation -2	Dissertation -2	Dissertation -2	Dissertation -2	16
	Community Connect	Community Connect	Community Connect	Community Connect	Community Connect	2
TOTAL						**72**

School: SSES		**Batch : 2025-27**		
Programme: M.TECH		**Current Academic Year: 2025-26**		
Branch: Civil Engineering		**Semester: I**		
1	Course Code	CVT5110	Course Name: Project Planning and Scheduling	
2	Course Title	Project Planning and Scheduling		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Core		
5	Course Objective	Introducing the concept of Project Management. Delivering the knowledge of tools and techniques used for project planning, scheduling and control.		
6	Course Outcomes	The students will be able to CO1: Define the concept of project management and general management, providing an overview of their roles and importance in achieving organizational goals. CO2: Recognize the significance of project scope and arrange components in a work breakdown structure. Describe the process of creating project networks and their relevance in visualizing task dependencies. CO3: Differentiate between various activities integral to projects and construct a viable schedule for executing these activities. Relate the scheduling process to efficient project execution. CO4: Examine the resource demands of a project and assess their availability and allocation. Appraise the critical role of resources in project success. CO5: Appraise the concept of earned value management and project crashing. Formulate strategies to oversee and manage projects using these techniques, ensuring project objectives are met effectively. CO6: Formulate comprehensive plans for project initiation, scheduling, and control. Utilize project management principles to steer projects towards successful outcomes, adapting strategies as needed.		
7	Course	This course will provide students an understanding and ability in areas of project management and general management. The emphasis is on		

	Description	planning, scheduling and controlling construction projects.			
8	Outline syllabus				
	Unit 1	**General management**			CO1, CO6
	A	Project Management introduction, Project Life Cycle			
	B	Management functions, management styles, objectives of management			
	C	Management techniques and use, organization and forms of organization.			
	Unit 2	**Project Management**			CO2, CO6
	A	Work Breakdown Structure			
	B	Project Activities, Activities Relationship			
	C	Drawing project network, Estimating Activity Duration.			
	Unit 3	**Project Planning and Scheduling**			CO3, CO6
	A	Principles of planning and scheduling			
	B	Techniques of planning and scheduling - CPM			
	C	Techniques of planning and scheduling - PERT			
	Unit 4	**Resource Management**			CO4, CO6
	A	Resource definition, resource management			
	B	Resource allocation, resource levelling			
	C	Material and inventory control, ABC Analysis			
	Unit 5	**Project Controls**			CO5, CO6
	A	Problems that may arise during construction, schedule updating			
	B	Earned value management			
	C	Network Crashing			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. Chitkara. K.K. Construction Project Management: Planning Scheduling and Control Tata McGraw Hill Publishing Company, New Delhi, 1998			

	Other References	1. Construction Project Management: Theory and Practice Hall Ltd., by - Kumar Neeraj Jha 2. Callahan, M. T., Quackenbush, D. G., and Rowings, J. E., Construction Project Scheduling, McGraw-Hill, New York, 1992 3. Moder, J., C. Phillips and E. Davis, Project Management with CPM, PERT and Precedence Diagramming, Van Nostrand Reinhold Company, Third Edition, 1983 4. PMBOK,6th Edition-1	

CO and PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) **2-Moderate (Medium)** **3 -Substantial (High)**

School: SSES		**Batch : 2025-27**	
Programme: M.TECH		**Current Academic Year: 2025-26**	
Branch: CE (Structures)		**Semester: I**	
1	Course Code	CVT5118 | Course Name: Advanced Structural Analysis	
2	Course Title	Advanced Structural Analysis	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective 2	
5	Course Objective	This course will provide students an understanding and ability to use Force and Displacement Method for analysis of structure. Through which students can find out the behaviour of structure subjected to various loading which will be useful for Designing.	
6	Course Outcomes	The students will be able to CO1: Differentiate between the analysis methods employed for Determinate and Indeterminate Structures. CO2: Comprehend the procedure to develop stiffness and flexibility matrices using both global and element approaches. CO3: Apply the Stiffness and Flexibility Method to analyze beams and frames systematically. CO4: Analyze the influence of temperature and lack of fit, as well as grasp the concept of the Element Approach. CO5: Examine beams with curved plans through a detailed structural analysis. CO6: Utilize the Force and Displacement Method to analyze structures while also assessing its effectiveness and implications.	
7	Course Description	Review of basic structural analysis i.e. Virtual work method, Maxwell-Betti's theorem, conjugate beam etc. Analysis of continuous beam, frame and trusses by using stiffness and Flexibility methods. Element approach and substructure analysis. Analysis of beam curved in plan.	
8	Outline syllabus		CO-PO Mapping
	Unit 1	**Review of basic structural analysis**	
	A	Review of Work and Energy Principles, Maxwell-Betti's and Castiglano's Theorem,	CO1, CO6
	B	Principle of Virtual Work	
	C	Degrees of Freedom, Static and Kinematic Indeterminacy.	
	Unit 2	**Stiffness and Flexibility Matrix**	CO2, CO6
	A	Direct Stiffness Approach, Stiffness Matrix Assembly, Incorporation of Boundary Element Solutions	
	B	Gauss Elimination, Matrix Inversion	
	C	Truss Element, Beam Element, Element Flexibility Matrix	
	Unit 3	**Stiffness Method**	CO3, CO6
	A	continuous beams (settlement of Supports)	
	B	Rigid jointed frames, Substructure analysis	

	C	Analysis of Pin Jointed Frames (temperature effect, lack of fit),			
	Unit 4	**Flexibility Method**			CO4, CO6
	A	Force Transformation Matrix			
	B	Continuous Beams (with and without settlement of supports)			
	C	Analysis of Rigid Jointed frames			
	Unit 5	**Beams Curved in Plan**			CO5, CO6
	A	Forces developed at a section of curved beam, Torsion factor			
	B	Analysis of beam curved in plan			
	C	Semi-circular beam fixed at two end subjected to concentrated load and UDL			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Company, New Delhi. 2. Gupta and Pandit, Structural Analysis: A Matrix Approach, TMH. 3. Structural Analysis II by S BhaviKatti			4.
	Other References	1. Analysis of Indeterminate Structures – C.K. Wang, Tata McGraw-Hill, 1992 2. Theory of Structures by S. Ramamruthum 3. Weaver & Gere "Matrix Structural Analysis," CBS Publisher			4.

CO and PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) 2-Moderate (Medium) 3 -Substantial (High)

School: SSES		**Batch : 2025-27**		
Programme: M.TECH		**Current Academic Year: 2025-26**		
Branch: CE (Structures)		**Semester: I**		
1	Course Code	CVT5119	Course Name: Structural Dynamics	
2	Course Title	Structural Dynamics		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Elective 1		
5	Course Objective	The objective of this course is to provide students an understanding and ability to learn fundamentals of structural dynamics, techniques used for solving dynamic problems and real-life dynamic problems.		
6	Course Outcomes	The students will be able to CO1: Describe the characteristics of free vibrations in single-degree-of-freedom systems. CO2: Apply principles to formulate and solve equations describing the response of single-degree-of-freedom systems under various conditions. CO3: Develop formulations and solutions for multi-degree-of-freedom systems experiencing undamped free vibrations. CO4: Examine the free and forced vibration in continuous systems, demonstrating an understanding of their characteristics and behavior. CO5: Analyze the impact of soil-structure interaction on the response of structures. CO6: Evaluate and assess the dynamic response of both single-degree-of-freedom and multi-degree-of-freedom systems.		
7	Course Description	This course will be helpful in understanding the dynamic behavior of structures. For the structural engineers it is very important to know the dynamic behavior of structures and the effect of Soil Structure Interaction on structural response		
8	Outline syllabus			CO Mapping
	Unit 1	**Theory of Vibrations**		
	A	Introduction-Elements of Vibratory system, Degrees of freedom, continuous system		CO1, CO6
	B	Lumped Mass idealization, Oscillatory Motion, Simple Harmonic Motion		
	C	Free Vibrations of Single degree of freedom system- Damped and Un-damped Vibrations		
	Unit 2	**Introduction to Structural Dynamics**		
	A	Objective of Dynamic Analysis, Types of prescribed loading, Formulation of Equation of Motion-D'Alembert's Principle		CO1, CO2 CO6
	B	Formulation and solution of Single Degree of Freedom Systems		
	C	Free, Forced, Damped and Undamped vibration response		
	Unit 3	**Multi Degree of Freedom Systems**		
	A	Selection of degree of freedom, evaluation of structural property matrices, Formulation of MDOF-Undamped Free Vibrations		CO3 CO6

	B	Solution for Eigen Value Problem for natural frequencies and mode shapes			
	C	Orthogonality of modes, Mode Superposition Principle.			
	Unit 4	**Free and Forced Vibration of Continuous Systems**			
	A	Introduction, Flexural Vibrations in Beams			CO4 CO6
	B	Derivation of governing differential equation of motion			
	C	Analysis of undamped free vibrations of beams in flexure			
	Unit 5	**Introduction to Soil Structure Interaction**			
	A	Objectives of SSI			CO5 CO6
	B	Effect of Soil Structure Interaction on structural response			
	C	Kinematic and inertial interactions			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. A. K. Chopra, "Dynamics of Structures," PHI 2. Clough and Penzien, "Dynamics of Structures," CSI 3. S. R. Damodarasamy and S. Kavitha, "Structural Dynamics and Aseismic Design," PHI			
	Other References	1. Seismic analysis of structures by T.K.datta, John wiley and sons Pvt Ltd, 2010 2. Theory of Vibration with Application; W.T. Thomson; Prentice Hall 3. Mario Paz, "Structural Dynamics: Theory & Computation," CBS Publishers And Distributors			

CO and PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	2	1	2	1	3	2	-	1	1
CO2	3	2	1	1	1	2	1	1	2	1	-	3	2
CO3	3	3	-	1	3	1	2	1	3	2	1	1	2
CO4	2	2	-	2	3	1	-	1	3	1	1	3	2
CO5	3	3	-	-	2	1	1	-	-	-	1	3	1
CO6	3	3	-	-	2	1	1	-	-	-	1	3	1
CO	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**1**	**3**	**2**	**1**	**2**	**2**

1-Slight (Low) 2-Moderate (Medium) 3 -Substantial (High)

School: SSES		**Batch: 2025-27**	
Program: M.TECH.		**Current Academic Year: 2025-26**	
Branch: CE (ALL)		**Semester: I**	
1	Course Code	CVT5112	Course Name: Higher Engineering Mathematics
2	Course Title	Higher Engineering Mathematics	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	This course will provide students an understanding and ability to use certain concepts of mathematics which are useful for their courses. The emphasis is on matrices, statistics, numerical methods and distribution.	
6	Course Outcomes	CO1: Recall basic concepts of Matrices and Determinants and Linear Equations. CO2: To understand the various statistical methods applicable in engineering. CO3: Categorize the use of Finite Difference and Finite Element scheme in engineering. CO4: To understand the concepts of calculus of variation. CO5: To understand the application of probability theory in engineering. CO6: To apply concepts of mathematics in engineering problems.	
7	Course Description	Linear Algebra, Statistical Methods, Introduction to Numerical Methods, Calculus of Variation, Probability.	
8	Outline syllabus		CO Mapping
	Unit 1	**Linear Algebra**	
	A	Properties of Matrices and Determinants	CO1, CO6
	B	Linear Equations and their representations in matrix form, Eigen Values and Eigen Vectors	
	C	Matrix Transformation and Inverse	
	Unit 2	**Introduction to Numerical Methods**	
	A	Introduction to Finite Difference Scheme	CO2, CO6
	B	Introduction to Finite Element Scheme	
	C	Unequal interval problems.	
	Unit 3	**Statistical Methods**	
	A	Measures of Central Tendency, Dispersion	CO3, CO6
	B	Skewness and Kurtosis – Principles of least squares	
	C	Correlation and regression	
	Unit 4	**Calculus of Variation**	
	A	Concept of maxima and minima of functions	CO4, CO6

	B	Constraints and Lagrange's multipliers			
	C	Euler's equation and their solution.			
	Unit 5	**Probability Theory**			
	A	Terminology, Laws of Probability			CO5, CO6
	B	Binomial Distribution, Poisson's Distribution			
	C	Normal Distribution			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. Advanced Engineering Mathematics by E. Kreyszig, John Wiley & Sons, 2010, ISBN: 0470458364			
	Other References	1. Advanced Engineering Mathematics by Alan Jeffrey, Academic Press, 2001. ISBN: 0080522963.			

CO and PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	1	1	2	2	1	2	-	3	3	-	2	2
CVL	**2**	**1**	**1**	**2**	**2**	**1**	**2**	**-**	**3**	**3**	**-**	**2**	**2**

1-Slight (Low) 2-Moderate (Medium) 3 -Substantial (High)

School: SSES		**Batch : 2025-27**		
Programme: M.Tech.		**Current Academic Year: 2025-26**		
Branch: CE		**Semester: II**		
1	Course Code		Course Name: Advanced R.C.C. Design	
2	Course Title	Advanced R.C.C. Design		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	ELECTIVE 4		
5	Course Objective	The objective of this Course is to provide knowledge with more advanced coverage of various topics relating to the design of concrete structures. The course will enhance the knowledge of various design methods and behaviour of material in different conditions.		
6	Course Outcomes	The students will be able to CO1: Recognize the distinctions between normal slabs and flat slabs, as well as comprehend the fundamental design principles of flat slabs. CO2: Demonstrate comprehension of the various foundation types essential for constructing buildings, including their design considerations. CO3: Examine and explain the design aspects associated with different storage structures such as water tanks, showcasing an understanding of their structural requirements. CO4: Analyze the design components of various retaining walls, including cantilever retaining walls, illustrating a grasp of their structural mechanics. CO5: Apply principles of design to special structural elements like deep beams, shear walls, and long columns, showcasing an ability to solve complex problems related to their behavior and stability. CO6: Develop intricate designs for reinforced concrete structures, integrating multiple concepts and considerations, and demonstrating high-level problem-solving skills.		
7	Course Description	Foundation, Retaining Walls, Water Tank and Domes Design, Long Column Design, Deep Beam and Shear Wall Design		
8	Outline syllabus			
	Unit 1	**Design of Flat Slab**		CO1, CO6
	A	Behavior Analysis, Stresses in Slabs		
	B	Reinforcement Requirement		
	C	Design of Flat Slabs		
	Unit 2	**Design of Foundations**		CO2, CO6
	A	Design of Strip Foundation		
	B	Design of Raft Foundation		
	C	Design of Pile foundation and Pile Cap		
	Unit 3	**Water Tank**		CO3, CO6
	A	Design of Intz Tanks		
	B	Design of Circular Tanks resting on ground		

	C	Design of Domes			
	Unit 4	**Design of Retaining Walls**			CO4, CO6
	A	Analysis of cantilever retaining wall			
	B	Design of Heel and Toe slab			
	C	Design of Vertical stem			
	Unit 5	**Special Structural Elements**			CO5, CO6
	A	Design of Shear Walls			
	B	Design of Deep Beams			
	C	Design of Long Columns			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. N. Krishna Raju, "Advanced Reinforced Concrete Design", CBS Publishers & Distributors. 2. S.S. Bhavikatti, "Advance RCC Design", New Age International.			
	Other References	1. Indian standard on "PLAIN AND REINFORCED CONCRETE -CODE OF PRACTICE," Bureau of Indian Standard, 2000 – IS456:2000 2. A.K Jain, "Reinforced concrete limit state design" by Nem Chand & Bros, Roorkee			

CO and PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) **2-Moderate (Medium)** **3 -Substantial (High)**

School: SSES		Batch: 2024-26	
Programme: M.TECH		Current Academic Year: 2024-25	
Branch: CE (STR)		Semester: I	
1	Course Code	CVP5107	
2	Course Title	Structural Modelling And Design Lab-1	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Core	
5	Course Objective	To apply the concepts of structural analysis and design in various engineering problems through the use of Design software (STAAD-Pro)	
6	Course Outcomes	The students will be able to CO1: Recognize appropriate software applications for addressing structural engineering issues. CO2: Examine beams, frames, and trusses using software tools to deduce their behavior. CO3: Explain the design procedures for 2D buildings by employing software applications. CO4: Demonstrate the analysis and design processes for 3D buildings using software tools. CO5: Apply software tools to carry out dynamic analysis and foundation design. CO6: Analyse problem-solving scenarios by integrating critical evaluation, design principles, and real-world applications.	
7	Course	Subject consists of practical related to structural analysis and design using the use of design software (STAAD-	

	Description	Pro/ETABS). Students will learn the use of STAAD-Pro/ETABS in various structural engineering problems of analysis and design.	
8	Outline syllabus		CO-PO Mapping
	Unit 1	Basics of Structural Analysis and STAAD-Pro/ETABS	
		Exp 1- Introduction of Structural Analysis and Design. Exp 2- General Guidelines for Design, Model Editing Tools, Model Generation.	CO1, CO6
	Unit 2	Analysis of Beams, frames and trusses	
		Exp 3 - Analysis of different type of beam for various loading Exp 4 - Analysis of Rigid Jointed plane frame and space Frame Exp 5: Modelling and Analysis of Trusses	CO2, CO6
	Unit 3	Analysis and Design of 2D Buildings	
		Exp 6: Modelling, Static analysis and Design of 2D RCC Buildings Exp 7: Modelling, Static analysis and Design of 2D Steel Buildings	CO3, CO6
	Unit 4	Analysis and Design of 3D RCC Buildings	
		Exp 8: Modelling, Static analysis and Design of 3D RCC Buildings Exp 9: Modelling, Static analysis and Design of 3D Steel Buildings	CO4, CO6
	Unit 5	Dynamic Analysis and Foundation Design	
		Exp 10: Modelling, Analysis and Design of Multi-storey buildings subjected to Wind load and seismic loads	CO5, CO6
		Exp 11: Foundation Design	

	Mode of examination	Practical			
	Weightage Distribution	CA	CE-Viva	ESE	
		75%		25%	
	Reference	Lab Manual			

CO and PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) 2-Moderate (Medium) 3 -Substantial (High)

School: SSES		**Batch : 2025-27**	
Programme: M.TECH		**Current Academic Year: 2025-26**	
Branch: CE (Env. Engg.)		**Semester: II**	
1	Course Code	Course Name: Renewable Energy Technology	
2	Course Title	Renewable Energy Technology	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	ELECTIVE	
5	Course Objective	The course provides an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternate energy sources and their technology and application.	
6	Course Outcomes	The students will be able to CO1. Recognize the significance of renewable energy sources on a global scale due to the ongoing energy crisis. CO2. Appraise the obstacles encountered within the renewable energy sectors. CO3. Generate discourse and formulate plans for diverse solar energy technologies, taking into account the challenges associated with each. CO4. Illustrate and devise strategies for different wind energy technologies, considering the hurdles involved in their implementation. CO5. Comprehend the value of various miscellaneous energy technologies beyond solar and wind energy. Examine a range of energy fields, with a specific focus on alternative energy sources, their technological aspects, and their practical applications.	
7	Course Description	This course includes solar energy, wind energy and miscellaneous energy technologies along with their practical use and design.	
8	Outline syllabus		
	Unit 1	**Introduction**	CO1, CO6
	A	Global energy crisis	
	B	Types of renewable energy, historical developments in renewable energy	
	C	Challenges and global outlook	
	Unit 2	**Solar Energy Technology**	CO2, CO6
	A	Solar cells, generations of solar cells, characterization techniques,	
	B	Materials, degradation and safety	
	C	Fabrication and deployment of photovoltaics,	
	Unit 3	**Solar Energy Technology and Introduction to Wind Energy Technology**	CO3, CO6
	A	Design of photovoltaic using “Polysun” software	
	B	Design of solar thermal systems using “Polysun” software	

	C	Challenges and global outlook of solar energy			
	Unit 4	**Wind Energy Technology**			CO4, CO6
	A	Basics of wind energy, Components of wind mill			
	B	Design of wind turbines, costing and scaling			
	C	Off-shore wind energy development, challenges and global outlook of wind energy			
	Unit 5	**Miscellaneous Energy Technologies**			CO5, CO6
		Geothermal, tidal			
		Hydroelectric, fuel cells (hydrogen and microbial)			
		Biomass energy			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	References	1. A guide to Photovoltaic system Design and installation, California Energy Commission, 2001. 2. Podcast Notes by Instructor 3. MOOCs on "Solar Energy" (edX) and "Organic Photovoltaics" (Coursera). 4. From Penn State Univ, (https://itunes.apple.com/us/itunes-u/design-solar-energy-conversion/id430672321?mt=10) 5. "Solar Energy, basics, technology and systems", Arno Smets, Delft University. (available with instructor) 6. Wind turbine design cost and scaling model, NREL, US, 2006. 7. "Multi Rotor Wind Turbine Design And Cost Scaling" (2013), Preeti Verma. Masters Theses, MIT.			8.

CO and PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) **2-Moderate (Medium)** **3 -Substantial (High)**

School: SSES		**Batch : 2025-27**		
Programme: M.TECH		**Current Academic Year: 2025-26**		
Branch: CE (Structures)		**Semester: II**		
1	Course Code		Course Name: Earthquake Resist Design of Structure	
2	Course Title	Earthquake Resistant Design of Structure		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Elective 8		
5	Course Objective	This course will provide students an understanding and ability to use IS Code provision for earthquake resistant design and various aspects of design.		
6	Course Outcomes	The students will be able to CO1: Demonstrate comprehension of the Earth's interior composition and the underlying causes of earthquakes. CO2: Apply conceptual design principles to various scenarios, fostering a deeper understanding of their underlying concepts. CO3: Analyse and synthesize strategies for engineering earthquake-resistant buildings, fostering a greater ability to evaluate structural integrity under seismic conditions. CO4: Evaluate the potential failure risks associated with existing buildings, enhancing the capacity to assess structural vulnerabilities and propose mitigation measures. CO5: Compare and contrast the role of ductility in different building structures, leading to an increased ability to discriminate among varying approaches to seismic resilience. CO6: Create an effective methodology for measuring the performance of existing structures and formulating strategies for performance enhancement through meticulous detailing, demonstrating mastery in structurally optimizing buildings for seismic events.		
7	Course Description	Access the probability of earthquake in India, design the earthquake resistant structure and concept for the layout. To measure the performance of existing structure and enhance the performance with proper detailing.		
8	Outline syllabus			
	Unit 1	**Seismic Hazard Management**		CO1, CO6
	A	Engineering Seismology Introduction, Seismic Hazard, Seismic Tectonics and Seismic Zoning of India.		
	B	Earthquake basics, plate tectonics, faults, consequence of earthquake, Magnitude and Intensity.		
	C	Effect of earthquake on structures and lesson learnt.		
	Unit 2	**Concept of Earthquake Resistant Design**		CO2, CO6
	A	Types of Buildings, Causes of damage, Do’s and Don’ts for protection of life and property.		

	B	Philosophy and Principle of Earthquake Resistant Design, Limit states. Inertia forces in structure Guidelines for Earthquake Resistant Design,	
	C	Earthquake Resistant Low Strength Masonry Buildings (IS 13828: 1993), Earthquake Resistant Design of Masonry Buildings-Strength and structural properties of masonry.	
	Unit 3	**Analysis and Design for Earthquake Building**	CO3, CO6
	A	Earthquake Resistant Design of R.C.C. Buildings, Response of Structures: Effect of deformations in structure,	
	B	Lateral strength, Stiffness, Damping, Ductility ,Floor Diaphragms: Flexible, Rigid, Numerical example for lateral load distribution	
	C	Torsion in Buildings: Causes, Effects, Centre of mass and rigidity, Torsional coupled and uncoupled system, Lateral load distribution, Concept of capacity design, Strong column weak beam, Soft storey, Calculation of base shear and its distribution by using codal provision.	
	Unit 4	**Vulnerability Assessment of Existing Buildings**	CO4, CO6
	A	Vulnerability Atlas of India/ States, Assessment and Retrofitting needs, Seismic Evaluation. Visual Inspection & Study of Drawings (Check list), In-situ Testing Vulnerability Assessment of Urban Areas/ Cities.	
	B	Building Typology Studies (Classification of Buildings). Seismic Vulnerability Reduction	
	C	Retrofit in building.	
	Unit 5	**Ductile Detailing of Structures**	CO5, CO6
	A	Impact of Ductility, Requirements for ductility.	
	B	Ductile Detailing, Ductile detailing of structures as per 13920:1993 (Beams).	
	C	Ductile detailing of structures as per 13920:1993 (Columns and joints.)	
	Mode of examination	Theory	
	Weightage Distribution	CA: 75% / MTE: / ETE: 25%	
	Text book/s*	1. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures," Prentice Hall of India. 2. IS 1893 (Part 1): 2016, Criteria for Earthquake Resistant Design of Structures. 3. IS 13920:2016, Ductile Detailing of Reinforced Concrete structures subjected to Seismic Forces.	
	Other References	4. S. K. Duggal, "Earthquake Resistant Design of Structures", Oxford University Press, Second Edition 2013.	

CO and PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) **2-Moderate (Medium)** **3 -Substantial (High)**

School: SSES		**Batch : 2025-27**	
Programme: M.TECH		**Current Academic Year: 2025-26**	
Branch: CE (Structures)		**Semester: II**	
1	Course Code	Course Name: Advance Concrete Technology	
2	Course Title	Advanced Concrete Technology	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective 7	
5	Course Objective	The objective of this Course is 1. To understand the behaviour of various admixtures in mortar/concrete and their importance in various applications. 2. To learn the rheological and hardened properties of concrete and factors affecting fresh properties of concrete. 3. To learn various destructive and Non-destructive testing methods 4. To understand the electro-chemical process of corrosion of rebar 5. To understand the IS recommendations for design Mix and quality control in construction work.	
6	Course Outcomes	The students will be able to CO1: Identify the components required to formulate workable concrete, both with and without admixtures. CO2: utilize a variety of testing techniques on materials and structures to assess their properties. CO3: Demonstrate the ability to create a design mix for concrete. CO4: Analyse and apply strategies to improve concrete properties such as strength, fire resistance, thermal conductivity, and permeability. CO5: design specialized types of concrete, including self-compacting, lightweight, and high-performance concrete CO6: Evaluate the impact of different chemicals on concrete properties.	
7	Course Description	Rheological properties, factor affecting workability of concrete. Function and applications of admixtures. Mechanical properties of concrete, Durability and factors affecting durability of concrete, NDT test. IS recommendation for design mix and quality control. Special concrete i.e. FRP, Geo-polymer, light weight, HPC, HDC and Self compacting concrete.	
8	Outline syllabus		
	Unit 1	**Fresh Concrete and Concrete Mix Design**	CO1, CO6
	A	Rheological properties, w/c ratio, Workability of concrete, Factors affecting workability of concrete, Workability Test	
	B	Mixing of concrete, Vibration of concrete, Different types of mixers and vibrators, Concreting in hot weather condition	

	C	Basic considerations, Factors affecting Design mix, Design of concrete mixes by IS method, Introduction to various design methods			
	Unit 2	**Hardened Concrete and Non-destructive testing of concrete**			CO2, CO6
	A	Mechanical properties of concrete and their testing Compressive strength, Split tensile strength, Flexural strength, Curing of concrete, Factors influencing the strength of concrete,			
	B	Shrinkage and creep of concrete, Permeability and durability of concrete, Fire resistance of concrete, Thermal properties of concrete, Fatigue & Impact strength of concrete, Corrosion, Electro-Chemical Process, measure of protection.			
	C	Rebound hammer test, Penetration resistance test, Pull-out test, Ultrasonic pulse velocity test			
	Unit 3	**Quality Control and Admixtures**			CO3, CO6
	A	Flaws in concrete and its remedial measures, Field control for quality of concrete, Factors causing variation in the quality of concrete, Advantages of quality control, Quality management in concrete construction			
	B	Introduction, Functions of admixtures, Classification of admixtures, effect of chemical admixtures on the properties of concrete			
	C	Chemicals for construction and their application			
	Unit 4	**FRP, Industrial waste in concrete, Ferro-cement and RMC**			CO4, CO6
	A	Faber reinforced concrete. Types of fibres, workability, mechanical and physical properties of fibre reinforced concrete.			
	B	Industrial waste materials in concrete, their influence on physical and mechanical properties and durability of concrete, Concrete at high temperature			
	C	Ferro-cement and Polymer concrete, RMC as per IS 4926:2003			
	Unit 5	**Special concrete in terms of density, strength and performance**			CO5, CO6
	A	Light weight concrete and Heavy weight concrete, Mix proportion, fresh and Mechanical properties, application.			
	B	High strength concrete, Ultra High strength concrete, methods and applications.			
	C	High performance concrete, Mix proportion, advantage and applications, Self-compacting concrete, Mix proportion, Workability test for SCC, advantage and disadvantage, Application			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. Shetty .M.S., " Concrete Technology, Theory and Practice", Revised Edition, S. Chand & company Ltd., New Delhi,2006 2. Neville. A.M. , " Properties of Concrete", 4th Edition Longman			
	Other References	1. Metha P.K and Monteiro. P.J.M, " CONCRETE", Microstructure, Properties and Materials, Third Edition, Tata McGraw- Hill Publishing company Limited, New Delhi, 2006 2. Mindass and Young, “Concrete", Prentice Hall.			

CO and PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) **2-Moderate (Medium)** **3 -Substantial (High)**

School: SSES		**Batch :**	
Program: M.TECH		**Current Academic Year: 2025-26**	
Branch: CE		**Semester: II**	
1	Course Code		Course Name: BRIDGE ENGINEERING
2	Course Title	Bridge Engineering	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	The objective of this course is to introduce the basics of R.C.C. Bridge Design, with a focus on **Limit State Method (LSM)** for designing Slab and T-beam bridges under various loads. It will cover the basic design principles, IRC loading standards, and reinforcement detailing.	
6	Course Outcomes	CO1: Describe the basics of bridge types and selection criteria, and understand IRC loading standards. CO2: Apply various analysis methods and the Limit State Method (LSM) for RCC bridges. CO3: Design Slab Culverts under various loading conditions as per IRC using LSM. CO4: Design T-beam bridges under various loading conditions as per IRC using LSM. CO5: Detail the reinforcement in slab and T-beam bridges as per LSM. CO6: Explain the construction methodology, durability aspects, and maintenance considerations for reinforced concrete bridges, ensuring sustainability and long-term performance.	
7	Course Description	Introduction to bridge design basics, focusing on the **Limit State Method (LSM)**. This course covers design methodologies for slab bridges, T-beam bridges, and slab culverts under various load conditions.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Basics of Bridge Design**	
	A	Site selection, various types of bridges and their suitability	CO1
	B	Loads, forces and IRC Bridge loading	
	C	Permissible stresses and Introduction to Limit State Method (LSM)	
	Unit 2	**Analysis Methods**	
	A	Working Stress Method	CO2
	B	Limit State Method (LSM) introduction and application	
	C	Courbon's method of load distribution and Pigeaud's Method	
	Unit 3	**Slab Bridge**	
	A	Components of Reinforced Concrete slab Bridge	CO3
	B	Impact factors and Design considerations under LSM	
	C	Design of RCC Slab Culvert using LSM	
	Unit 4	**T Beam Bridge**	
	A	Components of RCC T-Beam Bridge	CO4

	B	Types of Superstructure			
	C	Design of T-Beam Bridge using LSM under various loading conditions			
	Unit 5	**Box Girder Bridge & Reinforcement Detailing**			
	A	Introduction to Box Girder Design			CO5
	B	Detailing criteria for RCC slab and T-beam bridges under LSM			
	C	Reinforcement detailing for RCC T-Beam and Slab Bridges			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Design of Bridges by N.Krishna Raju, Oxford and IBH Publishing Co. Ltd., New Delhi, India. 2. Design of Bridge Structure by T.R. Jagdeesh and M.A. Jayaram, Prentice-Hall of India Pvt. Ltd., New Delhi, India.			
	Other References	1. Concrete Bridge Practice - Analysis, Design and Economics by V.K. Raina, Tata McGraw Hill, New Delhi. 2. **IRC 21: 2000** Standard specifications and code of practice for road bridges, Section III: Cement concrete (plain and reinforced) (Indian Roads Congress, New Delhi) 3. **IRC 112: 2011** Code of practice for concrete road bridges (Indian Roads Congress, New Delhi) 4. **IS 456: 2000** Indian Standard Plain and Reinforced Concrete (Bureau of Indian Standards, New Delhi) 5. **IRC 5: 1998** – Standard Specifications and Code of Practice for Road Bridges, Section I: General Features of Design 6. **IRC 6: 2017** – Standard Specifications and Code of Practice for Road Bridges, Section II: Loads and Stresses			

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	2	1	2	2	3	2	1
CO2	3	3	3	2	-	-	-	-	2	2	3	3	2
CO3	3	3	3	2	2	-	-	1	2	2	3	3	2
CO4	3	3	3	2	2	-	-	-	2	2	3	3	2
CO5	3	3	2	-	2	2	-	-	2	3	3	3	2
CO6	3	3	3	2	2	2	2	2	3	3	3	3	3

1-Slight (Low) **2-Moderate (Medium)** **3 -Substantial (High)**

School: SSES		**Batch : 2025-27**	
Programme: M.TECH		**Current Academic Year: 2025-26**	
Branch: CE (STRUC. ENGG)		**Semester: II**	
1	Course Code		Course Name: Advanced Solid Mechanics
2	Course Title	Advanced Solid Mechanics	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	DE-6	
5	Course Objective	This course will introduce students to the theoretical fundamentals of theory of elasticity and plasticity. The students will be able to use the principles of the theory of elasticity and plasticity in engineering problems.	
6	Course Outcomes	The students will be able to CO1: Display comprehension by examining the internal structure within the elastic limit. CO2: Apply the concepts of plane stress and plane strain to real-world scenarios, showcasing practical application. CO3: Convey understanding by explaining the relationships between stress and strain for linearly elastic solids, as well as torsion. CO4: Demonstrate application by utilizing the theory of plasticity in various structural contexts. CO5: Analyse and assess stress and strain within spherical and cylindrical structures for the purpose of in-depth analysis. CO6: Showcase the highest cognitive level of synthesis by analysing complex 2D and 3D bodies in a comprehensive manner.	
7	Course Description	Theory of elasticity, plane stress and strain, inverse and semi-inverse methods, theory of plasticity, spherical and cylindrical tube	
8	Outline syllabus		CO Mapping
	Unit 1	**Theory of Elasticity**	
	A	Stress tensors, equations of equilibrium	CO1
	B	Generalized Hooke's law, boundary conditions	
	C	Compatibility conditions	
	Unit 2	**Plane Stress and Strain**	
	A	Plane stress and strain, relationship, stress functions	CO2, CO6
	B	Stress at a point	
	C	Rectangular and polar coordinates, bending of beam loaded at end	
	Unit 3	**Inverse and Semi Inverse Methods**	
	A	Inverse and Semi Inverse	CO3, CO6
	B	Torsion of bars	
	C	Membrane analogy	
	Unit 4	**Theory of Plasticity**	
	A	Introduction	CO4, CO6
	B	Hydrostatic and Deviatorial Stress	
	C	Octahedral stresses	
	Unit 5	**Analysis of thick spherical and cylindrical tube**	
	A	Analysis of bending of bars of narrow rectangular cross section,	CO5, CO6

		formation of plastic hinge			
	B	Spherical shells			
	C	Problems			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. S. P. Timoshenko & J. N. Goodier, "Theory of Elasticity", McGraw Hill-1970.			
	Other References	1. J. Chakraborty "Theory of Plasticity", McGraw Hill Publication			

CO and PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	-	1	2	2	2	-	-	3	3	2
CO2	2	3	2	3	-	1	1	2	2	1	3	3	3
CO3	2	1	3	3	2	2	2	-	3	1	3	2	2
CO4	1	2	1	-	2	2	3	2	2	-	3	2	1
CO5	2	1	3	1	-	-	-	-	-	-	3	2	-
CO6	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**3**	**2**	**2**

1-Slight (Low) 2-Moderate (Medium) 3 -Substantial (High)

School: SSES		**Batch : 2025-27**	
Programme: M.Tech.		**Current Academic Year: 2025-26**	
Branch: CE		**Semester: II**	
1	Course Code		Course Name: Prestressed Concrete Member Design
2	Course Title	Prestressed Concrete Member Design	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	DE 5	
5	Course Objective	The objective of this Course is to provide knowledge with more advanced coverage of various topics relating to the design of prestressed concrete structures. The course will enhance the knowledge of various design methods and behaviour of material in different conditions.	
6	Course Outcomes	The students will be able to CO1: Examine prestressed members. CO2: Examine prestressed members in terms of flexure, shear, and torsion. CO3: Formulate designs for prestressed concrete members intended for flexure. CO4: Develop designs for prestressed concrete members intended for shear and torsion. CO5: Analyze and evaluate composite sections. CO6: Assess and formulate designs for prestressed members as per IS code recommendations.	
7	Course Description	Introduction to prestress, systems of prestressing, elastic analysis, losses, design for flexure, shear and torsion.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to prestressed concrete**	
	A	Materials, methods and systems of prestressing	CO1, CO2
	B	Indian Standard recommendations.	
	C	Elastic analysis of prestressed concrete beams with different cable profiles.	
	Unit 2	**Elastic analysis and transmission of prestress**	
	A	Analysis of prestressed concrete beam section for flexure, shear and torsion.	CO2, CO6
	B	Transfer of pre-stress in pre-tensioned members and end zone reinforcement.	
	C	Anchorage zone stresses and end zone reinforcement as per Indian Standard.	
	Unit 3	**Design for Flexure**	
	A	Kern, line of pressure, allowable stresses and design criteria as per Indian Standards	CO3, CO6
	B	Elastic design of pre-tensioned and post-tensioned beams having rectangular cross-section for flexure, shear and torsion.	
	C	Elastic design of pre-tensioned and post-tensioned flanged beams for flexure, shear and torsion	
	Unit 4	**Design for Shear and Torsion**	
	A	IS code recommendations	CO4,

	B	Elastic design of pre-tensioned and post-tensioned beams having rectangular cross-section for shear and torsion.			CO6
	C	Elastic design of pre-tensioned and post-tensioned flanged beams for shear and torsion.			
	Unit 5	**Design of composite sections**			
	A	Introduction and analysis of stress			CO5, CO6
	B	Differential shrinkage			
	C	General design considerations			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. Krishna Raju, N., "*Prestressed Concrete*," Tata McGraw-Hill Publishing Company Limited, 2012.			
	Other References	1. Rajagopalan, N., "Prestressed Concrete," Narosa publishing house, 2013. 2. Indian standard on "CODE OF PRACTICE FORPRESTRESSED CONCRETE," Bureau of Indian Standard, 2003 – IS 1343:2012.			

CO and PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) 2-Moderate (Medium) 3 -Substantial (High)

School: SSES		**Batch : 2025-29**
Program: M.Tech.		**Current Academic Year: 2025**
Branch: CE		**Semester:**
1	Course Code	CVT5102 | Course Name: PHYSICO-CHEMICAL PROCESSES
2	Course Title	PHYSICO-CHEMICAL PROCESSES
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	
5	Course Objective	This course aims to provide students with a comprehensive understanding of physico-chemical treatment processes used in water and wastewater treatment. The objective is to equip students with the fundamental principles, design methodologies, and operational aspects of various treatment processes. By the end of the course, students will be able to: • Understand the physical and chemical phenomena involved in water and wastewater treatment. • Apply theoretical concepts to analyze and design treatment processes. • Develop expertise in sedimentation, coagulation, filtration, gas transfer, and advanced treatment methods. • Evaluate and design treatment systems for different pollution scenarios. • Gain knowledge of modern treatment technologies, including advanced oxidation processes and membrane filtration.
6	Course Outcomes	**CO1**: Explain the physical and chemical phenomena underlying the design of unit processes. **CO2**: Apply theoretical knowledge of physical and chemical principles to treatment processes. **CO3**: Design physico-chemical treatment processes to achieve treatment objectives for different pollution scenarios. **CO4**: Implement advanced treatment methods for water and wastewater purification. **CO5**: Develop conceptual process schematics for water and wastewater treatment
7	Course Description	This course covers fundamental and advanced physico-chemical processes for water and wastewater treatment. It begins with an introduction to pollution control mechanisms and proceeds to detailed discussions on sedimentation, coagulation, filtration, gas transfer, and disinfection. The course further explores advanced treatment techniques such as adsorption, ion exchange, membrane processes, and desalination. Emphasis is placed on understanding process mechanisms, mathematical modeling, and

		practical applications in environmental engineering. Students will engage with theoretical concepts, case studies, and design exercises to develop a solid foundation in modern treatment practices. The course will also reference standard texts and industry-relevant literature to provide a holistic perspective on water and wastewater management.			
8	Outline syllabus				CO Mapping
	Unit 1	Introduction			
	A	Overview of physico-chemical processes for water and wastewater pollution control			CO1, CO2
	B	flowchart representation of water and wastewater			
	C	Brief description of process.			
	Unit 2	**Sedimentation and Coagulation**			
	A	Types of settling and mathematical analysis			CO2
	B	Coagulation mechanisms			
	C	Colloidal chemistry, Coagulation modeling, Impact of turbidity and alkalinity, Coagulant chemistry, Design of coagulation processes			
	Unit 3	**Flow Through Beds of Solids**			
	A	Filter types and filtration modeling, Filtration mechanisms			CO3
	B	Ion exchange units, Contacting towers			
	C	Expanded bed flow, Flow through porous plates and membranes			
	Unit 4	**Gas Transfer and Disinfection**			
	A	IS code recommendations			CO4
	B	Elastic design of pre-tensioned and post-tensioned beams having rectangular cross-section for shear and torsion.			
	C	Elastic design of pre-tensioned and post-tensioned flanged beams for shear and torsion.			
	Unit 5	**Advanced Treatment Operations**			
	A	Adsorption and isotherms, Softening processes, Ion exchange methods			CO5
	B	Removal of specific chemical contaminants (fluorides, arsenic, nitrates, and organic pollutants) , Advanced oxidation processes, embrane processes			
	C	Reverse osmosis, Electro-dialysis, Desalination			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	2. Metcalf, L., & Eddy, H. (2014). *Wastewater Engineering: Collection, Treatment, Disposal, and Reuse* (5th ed.). McGraw-Hill.			

	Other References	1. Wiesmann, U., Choi, I. S., & Dombrowski, E. M. (2018). *Fundamentals of Biological Wastewater Treatment* (2nd ed.). Wiley. 2. Hendricks, D. (2006). *Water Treatment Unit Processes: Physical and Chemical.* CRC Press. 3. Tchobanoglous, G., Burton, F. L., & Stensel, H. D. (2017). *Wastewater Engineering: Treatment and Reuse* (7th ed.). Tata McGraw-Hill. 4. Arceivala, S. J., & Asolekar, S. R. (2007). *Wastewater Treatment for Pollution Control and Reuse* (3rd ed.). Tata McGraw-Hill. 5. Sincero, A. P., & Sincero, G. A. (2008). *Environmental Engineering: A Design Approach* (2nd ed.). Prentice-Hall.	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3				1	3				3	1	3	2
CO2	3		3				1	3				3	1	3	2
CO3	3		3				1	3				3	1	3	2
CO4	3		3				1	3				3	1	3	2
CO5	3		3				1	3				3	1	3	2
CO6	3		3				1	3				3	1	3	2
CVL	**3**		**3**				**1**	**3**				**3**	**1**	**3**	**2**

School: SSES		**Batch : 2025-27**	
Program: M.Tech.		**Current Academic Year: 2025-26**	
Branch: CE		**Semester: I**	
1	Course Code	CVT5109	Course Name: BIOLOGICAL PROCESSES
2	Course Title	BIOLOGICAL PROCESSES	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	The objective of this course is to provide students with a comprehensive understanding of biological processes used in wastewater treatment. The course will focus on the principles of microbial growth, substrate utilization, and the design of various biological treatment systems. It aims to equip students with the knowledge to analyze, design, and optimize biological treatment processes for effective nutrient removal and sludge processing.	
6	Course Outcomes	· **CO1:** Explain the fundamentals of reactions, reactors, and biological treatment processes. · **CO2:** Understand microbial growth principles and substrate utilization in biological systems. · **CO3:** Differentiate various biological treatment processes. · **CO4:** Design and evaluate biological treatment process units. · **CO5:** Develop nutrient removal strategies through biological processes.	
7	Course Description	This course covers fundamental and advanced concepts of biological treatment in wastewater engineering. It includes topics such as microbial kinetics, suspended and attached growth systems, aerobic and anaerobic treatment processes, nutrient removal mechanisms, and sludge treatment methods. Students will learn about various biological treatment units, including activated sludge processes, moving bed biofilm reactors (MBBR), membrane bioreactors (MBR), and upflow anaerobic sludge blanket (UASB) reactors. By the end of the course, students will be able to design and evaluate biological treatment systems for efficient pollutant removal and environmental sustainability.	

8	Outline syllabus		CO Mapping
	Unit 1	Reactors and Reactor Analysis	
	A	Reaction mechanisms and kinetics	CO1, CO2
	B	Hydraulic properties of reactors	
	C	Types and characteristics of reactors	
	Unit 2	**Kinetics of Biological Growth**	
	A	· Nutritional and growth conditions · Environmental factors influencing microbial growth	CO2
	B	· Bacterial growth kinetics and substrate utilization · Growth models (Monod's equation, substrate-limited growth)	
	C	· Endogenous metabolism, inhibition, and temperature effects · Application of growth kinetics in biological treatment	
	Unit 3	**Aerobic Processes**	
	A	· Suspended and attached growth systems · Modeling suspended growth processes	CO3
	B	· Activated sludge: types, design, and operation	
	C	· Advanced biological processes (MBBR, MBR, IFAS, Aerobic Granular Sludge Technology)	
	Unit 4	**Anaerobic Treatment Processes**	
	A	· Microbial fundamentals of anaerobic processes	CO4
	B	· Different types of anaerobic treatment systems	
	C	Design of UASB and attached growth systems	
	Unit 5	Nutrient Removal and Pond Treatment Processes	
	A	· Biological removal of nitrogen and phosphorus · Nitrification and denitrification processes	CO5

		· Design principles of pond treatment systems			
	B	· Design principles of pond treatment systems			
	C	**Biological Processes for Sludge Processing** Anaerobic digestion of sludge			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Metcalf & Eddy, Inc. (2014). *Wastewater Engineering: Treatment and Reuse* (5th ed.). Tata McGraw-Hill.			
	Other References	1. Benefield, L. D., & Randall, C. W. (2002). *Biological Process Design for Wastewater Treatment* (2nd ed.). Prentice Hall. 2. Qasim, S. R. (2012). *Wastewater Treatment Plants: Planning, Design, and Operation* (3rd ed.). CRC Press. 3. Karia, G. C., & Christian, R. A. (2017). *Wastewater Treatment: Concepts and Design Approach* (2nd ed.). Prentice Hall. 4. Hendricks, D. (2018). *Water Treatment Unit Processes – Physical and Chemical* (2nd ed.). CRC Press.			

Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3		3				1	3				3	1	3	2
CO2	3		3				1	3				3	1	3	2
CO3	3		3				1	3				3	1	3	2
CO4	3		3				1	3				3	1	3	2
CO5	3		3				1	3				3	1	3	2
CO6	3		3				1	3				3	1	3	2
CVL	**3**		**3**				**1**	**3**				**3**	**1**	**3**	**2**

School: SSES		**Batch : 2025-27**		
Programme: M.TECH		**Current Academic Year: 2025-26**		
Branch: CE (Env. Engg.)		**Semester: I**		
1	Course Code		Course Name: Solid, biomedical and Hazardous Waste Management	
2	Course Title	Solid, biomedical and Hazardous Waste Management		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	ELECTIVE		
5	Course Objective	This course is designed to provide students with an understanding of technical issues and the management of solid wastes. The course includes solid waste policy, both domestic and international, and then examines appropriate methods of storage, collection, transfer, treatment and disposal appropriate for industrialised and developing countries. The course also provides the opportunity to visit recycling facilities and disposal sites to better understand links between theory and practice		
6	Course Outcomes	The Students will be able to CO1. To comprehend the implications of solid waste management in terms of production, resource management, and environmental impact. CO2. To explain the elements comprising infrastructure systems for solid waste management aimed at minimizing the aforementioned impacts. CO3. To design engineered systems intended for solid waste management, encompassing composting and landfills. CO4. To justify the importance of solid waste recycling, reusing, and reclaiming. CO5. To evaluate the attributes of biomedical waste and propose strategies for its remediation. CO6. To scrutinize suitable techniques for storing, collecting, transferring, treating, and disposing of solid waste.		
7	Course Description	The course introduces the concepts of waste management, including the sources, characteristics and measures needed for the remediation.		
8	Outline syllabus			
	Unit 1	**Introduction to solid waste**		CO1, CO6
	A	Sources, Composition & Properties of solid waste		
	B	Handling & Separation of solid waste		
	C	Municipal Waste (Management & Handling Rules, 2000), Hazardous Waste (Management & Handling Rules, 1989 and amendments), Federal Hazardous Waste Regulations under RCRA, Superfund, CERCLA &SARA and Life cycle analysis of waste.		
	Unit 2	**Engineered Systems for Solid waste management-I**		CO2, CO6
	A	Integrated solid waste management (SWM) System, Hierarchical		

		approach for SWM. Solid Waste Collection & Transportation			
	B	Methods of Disposal of Solid Waste			
	C	Landfills: Classification, Types & methods, Site selection, Site preparation, Composition, Characteristics, Generation, & Control of Landfill gases; Composition, Formation, Movement & control of leachate in landfills; landfill design.			
	Unit 3	**Engineered Systems for Solid waste management-II**			CO3, CO6
	A	Re-vegetation of closed landfill sites, Long term post closure plan, Groundwater monitoring during & after closure. Hazardous Waste Landfill remediation.			
	B	Composting: Theory of composting, Manual and mechanized composting, Design of composting plan			
	C	Recovery of bio-energy from organic waste.			
	Unit 4	**Systems for resources and Energy Recovery**			CO4, CO6
	A	Thermal Conversion Technologies: Incineration, Pyrolysis & Gasification Systems. Types & design of Incinerators.			
	B	Treatment methods of Hazardous waste management: Air Stripping, Carbon Adsorption, Steam stripping neutralization,			
	C	Oxidation- Reduction, Precipitation, Solidification and stabilization, Bioremediation.			
	Unit 5	**Bio-medical waste management**			CO5, CO6
	A	Characterization of biomedical waste & Storage of biomedical waste, Segregation of biomedical waste; Bio-medical wastes (Management & Handling) Rules, 1998, Amendments & guidelines			
	B	Techniques of Biomedical waste management: Autoclaving, Microwave radiations, Chemical treatments.			
	C	Introduction to linear programming & transportation problem, Route & cost optimization.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, "Environmental Engineering", McGraw-Hill-International Editions. 2. Bala Krishnamoorthy, "Environmental Management, Text Book and Cases", PHI Publication.			3.
	Other References	1. George Tchobanoglous, Hilary Theisen, Samuel A. Viquel, "Integrated Solid Waste Management: Engineering, Principles & Management issues", McGraw-Hill- International Editions. 2. CPHEEO Manual on Municipal Solid Waste Management. 3. Michael D. LaGrea, Phillip L. Buckingham, Jeffrey C. Evans, "Hazardous Waste Management and Environmental Resource Management", McGraw-Hill- International Edition. 4. Mackenzige L. Davis, David A. Cornwell, Introduction to environmental engineering", McGraw-Hill-International Edition. 5. William P. Cunningham, Mary Ann Cunningham, "Principles of Environmental Science", TMH. India.			7.

		6. Richard T. Wright, “Environmental Science”, Pearson Education.	

CO and PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) **2-Moderate (Medium)** **3 -Substantial (High)**

School: SSES		**Batch : 2025-27**	
Program: M.Tech.		**Current Academic Year: 2025-26**	
Branch: CE		**Semester: I**	
1	Course Code		Course Name: Air Pollution and Control Measure
2	Course Title	Air Pollution and Control Measure	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status		
5	Course Objective	This course aims to provide students with a comprehensive understanding of air pollution, its sources, impacts, and control technologies. The key objectives are: 1. To introduce the fundamental concepts of air pollution, including sources, classifications, and effects on human health and the environment. 2. To familiarize students with air quality standards, air pollution indices, and regulatory frameworks. 3. To develop an understanding of meteorological factors influencing air pollutant dispersion and transport. 4. To equip students with knowledge of mathematical models for air pollution prediction and assessment. 5. To explore various air pollution control technologies for particulate and gaseous pollutants. 6. To introduce computational tools and simulation techniques for air pollution assessment and control strategies.	
6	Course Outcomes	• **CO1**: Identify air pollution sources and understand their fate and transport under various meteorological conditions. • **CO2**: Recognize the impact of air pollutants on human health, vegetation, materials, and the environment. • **CO3**: Apply air quality standards and interpret air pollution indices. • **CO4**: Understand meteorological aspects and develop dispersion models for predicting air pollutant behavior. • **CO5**: Design and implement control technologies for particulate and gaseous pollutants. • **CO6**: Utilize computational tools and simulation software for air pollution assessment and control.	
7	Course Description	This course provides an in-depth exploration of air pollution science, focusing on pollutant sources, atmospheric dispersion, and control strategies. It covers air quality standards, environmental regulations, and air pollution monitoring techniques. Students will learn about meteorological aspects affecting air pollution, including atmospheric stability, plume behavior, and dispersion modeling. The course also delves into control technologies for particulate and gaseous pollutants,	

		such as filtration, scrubbing, adsorption, and combustion methods. Additionally, students will gain hands-on experience with computational modeling tools for air pollution assessment and control planning.			
8	Outline syllabus				CO Mapping
	Unit 1	**Air Pollution: Basics and Standards**			
	A	• Definition, sources, and classification of air pollutants			CO1, CO2
	B	Significance of occupational health in industries			
	C	• Effects of air pollution on human health, vegetation, and materials • Ambient air quality monitoring and stack emission sampling			
	Unit 2	Air Quality Index and Standards			
	A	Source apportionment and emission inventory			CO2
	B	• Smoke, ozone, smog, and haze visibility • Air Quality Index (AQI)			
	C	National and global air quality standards and legislation			
	Unit 3	**Meteorology and Dispersion Models**			
	A	• Meteorological factors influencing air pollution • Atmospheric motion and its stability • Lapse rate and inversions			CO3
	B	• Atmospheric stability and turbulence • Plume behavior and dispersion models • Transport, transformation, and deposition of air pollutants			
	C	• Box model, Gaussian model, and Maximum Mixing Depth • Role of computational models in air pollution assessment			
	Unit 4	**Air Pollution Control Technologies: Particulates**			
	A	Settling chambers and cyclone separators			CO4
	B	Wet scrubbers and fabric filters			
	C	• Electrostatic precipitators • Other advanced technologies for particulate matter control			
	Unit 5	**Air Pollution Control Technologies: Gaseous Pollutants**			
	A	• Absorption, adsorption, and chemical reactions for pollutant removal			CO5
	B	Combustion techniques for gaseous pollutants			
	C	• Advanced air purification technologies			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	

	Text book/s*	2. Warck, K., & Warner, C. F. (2022). *Air pollution: Its origin and control* (4th ed.). Harper & Row Publishers.	
	Other References	1. Rao, C. S. (2020). *Environmental Pollution Control Engineering* (3rd ed.). New Age International. 2. Davis, W. T. (2013). *Air Pollution Control Engineering* (3rd ed.). McGraw-Hill Education. 3. Nevers, N. D. (2019). *Principles of Air Quality Management* (2nd ed.). CRC Press. 4. Boulet, B. W. (2017). *Fundamentals of Air Pollution* (5th ed.). Academic Press.	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3				1	3				3	1	3	2
CO2	3		3				1	3				3	1	3	2
CO3	3		3				1	3				3	1	3	2
CO4	3		3				1	3				3	1	3	2
CO5	3		3				1	3				3	1	3	2
CO6	3		3				1	3				3	1	3	2
CVL	**3**		**3**				**1**	**3**				**3**	**1**	**3**	**2**

School: SSES		**Batch : 2025-27**	
Program: M.Tech.		**Current Academic Year: 2025-26**	
Branch: CE		**Semester: II**	
1	Course Code	CVT	Course Name: Environmental Legislation and Impact Assessment
2	Course Title	Environmental Legislation and Impact Assessment	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	This course aims to provide students with a comprehensive understanding of Environmental Impact Assessment (EIA) and environmental legislation. It focuses on the principles, methodologies, and legal frameworks governing environmental impact studies. By the end of the course, students will be able to: • Understand the objectives and significance of EIA in sustainable development. • Analyze various environmental attributes and their role in impact assessment. • Interpret national and international environmental regulations and policies. • Apply impact assessment methodologies to predict and evaluate environmental consequences. • Develop an EIA report, incorporating public participation and legal compliance.	
6	Course Outcomes	**CO1**: Interpret and explain the objectives and scope of Environmental Impact Assessment (EIA). **CO2**: Categorize the importance of various environmental attributes in impact assessment. **CO3**: Describe the legal framework and statutory requirements for environmental clearance. **CO4**: Analyze methods for identifying and predicting environmental impacts of new or expansion projects. **CO5**: Develop an EIA report for a given project.	
7	Course Description	This course explores the fundamental concepts of Environmental Impact Assessment (EIA) and its role in environmental management. It covers EIA methodologies, regulatory frameworks, and strategic planning for environmental protection. Key topics include screening, impact identification, prediction techniques, public participation, and post-project monitoring. Students will gain insights into case studies of major infrastructure	

		projects, nuclear plants, and urban developments, analyzing their environmental implications. The course also delves into environmental legislation, including the Water Act, Air Act, Wildlife Protection Act, and Environmental Protection Act. The role of regulatory bodies such as the Central Pollution Control Board (CPCB) and the Ministry of Environment, Forest, and Climate Change (MoEF&CC) will be examined in detail.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	**Impact Assessment: Types and Significance**	CO1, CO2
	B	Overview of impact assessment types	
	C	Brief description of process.	
	Unit 2	**EIA: Introduction & Planning**	
	A	• Evolution and significance of EIA • Policy and regulatory framewor	CO2
	B	• EIA procedures in India • EIA Rules (1994 & 2006)	
	C	Screening methods (Rapid and Comprehensive EIA)	
	Unit 3	EIA: Methodologies and Strategies	
	A	• Screening and baseline data collection • Environmental inventory (physical, biological, and socio-economic attributes)	CO3
	B	• Impact identification techniques • Prediction tools such as adhoc methods, matrices, and networks	
	C	• Evaluation of environmental impacts • Post-project monitoring and management plans	
	Unit 4	**Public Participation**	
	A	• Role of affected persons in EIA • Public consultation methods	CO4
	B	• Legal frameworks for public participation (Public Notice & Public Hearings) • Resettlement and rehabilitation laws	
	C	Land acquisition policies and environmental acts	
	Unit 5	**EIA Case Studies**	
	A	Case studies on various project types, including metro rail projects, nuclear power plants, and large-scale infrastructure projects.	CO5

	B	• Indian environmental legislation overview
		• Key environmental laws:
		  • Water Act (1974)
		  • Air Act (1981)	

	C	• Wildlife Protection Act (1972), Environmental Protection Act (1986), Coastal Regulation Zone (CRZ) Rules, National Green Tribunal (NGT) and landmark judgments			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	3. Canter, L. W. (2018). *Environmental Impact Assessment* (3rd ed.). Tata McGraw-Hill Education.			
	Other References	1. Munn, R. E. (2018). *Environmental Impact Assessment* (2nd ed.). John Wiley & Sons. 2. Dhameja, S. K. (2014). *Environmental Engineering and Management* (2nd ed.). S. K. Kataria & Sons. 3. Central Pollution Control Board (CPCB). (n.d.). *General Standards.* Retrieved from https://cpcb.nic.in/general-standards/ 4. Ministry of Environment, Forest and Climate Change (MoEF&CC). (n.d.). *Rules and Regulations: Environment Protection.* Retrieved from https://moef.gov.in/en/rules-and-regulations/environmentprotection/ 5. Central Pollution Control Board (CPCB). (n.d.). *Home Page.* Retrieved from https://cpcb.nic.in/index.php			

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3				1	3				3	1	3	2
CO2	3		3				1	3				3	1	3	2
CO3	3		3				1	3				3	1	3	2
CO4	3		3				1	3				3	1	3	2
CO5	3		3				1	3				3	1	3	2
CO6	3		3				1	3				3	1	3	2
CVL	**3**		**3**				**1**	**3**				**3**	**1**	**3**	**2**

School: SSES		Batch : 2025-27	
Program: M.Tech.		Current Academic Year: 2025-26	
Branch: CE		Semester: II	
1	Course Code	CVT	Course Name: Occupational Health, Safety & Environment
2	Course Title	Occupational Health, Safety & Environment	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	This course aims to equip students with fundamental knowledge of occupational health, safety, and environmental management in industrial settings. The objectives of the course are to: 1. Provide an understanding of workplace hazards, risk assessment, and safety planning to ensure a secure working environment. 2. Familiarize students with national and international safety standards, regulations, and legal frameworks governing workplace safety and environmental management. 3. Develop competency in implementing Health, Safety, and Environmental (HSE) policies and Environmental Management Systems (EMS). 4. Enhance knowledge of workplace ergonomics, occupational stress, and strategies to improve employee health and productivity. 5. Train students in designing and implementing Standard Operating Procedures (SOPs) for various industrial activities to mitigate risks and ensure compliance with safety regulations.	
6	Course	CO1: Identify and explain the interrelationship between industries and the	

	Outcomes	government in occupational health, environment, and safety. CO2: Understand the statutory requirements of workplace safety and environmental legislation. CO3: Apply principles and concepts of occupational health and safety in various work environments. CO4: Develop and implement Standard Operating Procedures (SOPs) for different industrial activities. CO5: Execute Health, Safety, and Environmental (HSE) policies and Environmental Management Systems (EMS).	
7	Course Description	This course provides a comprehensive understanding of occupational health, safety, and environmental management in industrial and workplace settings. It covers key aspects such as workplace hazards, risk assessment, safety legislation, environmental management systems, and occupational ergonomics. The course emphasizes the importance of government regulations, industrial safety standards, and stress management techniques to promote a safe and healthy work environment. Through real-world applications, students will develop skills to implement Health, Safety, and Environmental (HSE) policies and design safety protocols for various industries.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	· Importance of safety, health, and productivity · Role of government and regulatory bodies	CO1, CO2
	B	Significance of occupational health in industries	
	C	· National Safety Council and awards · Housekeeping and industrial safety practices	
	Unit 2	Occupational Environment – Basics & Standards	
	A	· Workplace environment and its impact on occupational health	CO2

		· Health hazards in industries	
	B	· Effects of environmental factors on human body and mind · Basics of environmental design and workplace safety improvements	
	C	· International standards: ISO 14000 and ISO 45001 · Environmental Management Systems (EMS) and ISO standards (ISO 14001 & ISO EMS)	
	Unit 3	Safety – Planning, Standards, and Legislation	
	A	· Safety standards and risk assessment · HAZOP and risk analysis	CO3
	B	· Industrial safety legislation · Indian Factories Act, Boiler Act, and Electricity Act	
	C	· Workman's compensation act · Safety policy planning and emergency response measures · On-site and off-site emergency management	
	Unit 4	Occupational Ergonomics *(*	
	A	· Human-body interaction at the workplace · Posture and workplace ergonomics	CO4
	B	Economic implications of ergonomics	
	C	Anthropometry in industrial safety	
	Unit 5	Occupational Stress and Health *(*	
	A	· Work-related stress: causes, signs, and measurement · Stress management systems and interventions	CO5

	B	Occupational health and stress prevention policies			
	C	· Occupational Safety and Health Act · Health programs for workers			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	4. Jain, R. K., & Rao, S. S. (2020). *Industrial Safety, Health, and Environmental Management Systems* (2nd ed.). Khanna Publishers.			
	Other References	1. Parashar, P., & Banerji, P. (2018). *Industrial Safety and Environment* (2nd ed.). S.K. Kataria & Sons. 2. Goetsch, D. L. (2012). *Industrial Occupational Health Assessment and Strategy* (2nd ed.). APH Publishing Corporation. 3. Slote, L. (2017). *Handbook of Occupational Safety and Health* (3rd ed.). John Wiley & Sons. 4. National Safety Council. (2015). *Safety, Health, and Working Conditions: Training Manual* (2nd ed.). National Safety Council.			

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3		3				1	3				3	1	3	2
CO 2	3		3				1	3				3	1	3	2

CO 3	3		3				1	3				3	1	3	2
CO 4	3		3				1	3				3	1	3	2
CO 5	3		3				1	3				3	1	3	2
CO 6	3		3				1	3				3	1	3	2
CV L	3		3				1	3				3	1	3	2

School: SSES		**Batch : 2025-27**	
Programme: M.TECH		**Current Academic Year: 2025-26**	
Branch: CE (Geotechnical)		**Semester: I**	
1	Course Code	CVT5120	
2	Course Title	Geo-hazard and Geo-environmental Engineering	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Type	ELECTIVE	
5	Course Objective	1. To generate understanding of soil pollution and contaminant transport. 2. To understand the method of solid waste containment and design of disposal site. 3. To understand the technique of polluted site remediation. 4. To understand the method of waste utilization in geotechnical engineering. To understand the various geo-hazards.	
6	Course Outcomes	The students will be able to CO1: Identify a polluted site and grasp the fundamental concept of contaminant transport. CO2: Analyse and evaluate a waste disposal system through critical assessment. CO3: Apply strategies to reduce the concentration of pollutants at the contaminated site. CO4: Utilize solid waste as geo-material to mitigate the need for waste storage. CO5: Conduct research investigations related to various Geo-environmental subjects. CO6: Formulate and conduct research inquiries pertaining to a range of Geo-environmental topics.	
7	Course Description		
8	Outline syllabus		CO-PO Mapping
	Unit 1	**Soil-Pollutant Interaction and Contaminant Transport**	CO1, CO6
	A	Introduction to Geo-environmental, production and classification of waste, causes of soil pollution, factors governing soil-pollutant interaction.	
	B	Contaminant transport in sub surface, advection, diffusion, dispersion. Governing equations of contaminant transformation, sorption, biodegradation, ion exchange, precipitation.	
	C	Disposal of solid waste, Environmental impact of waste dump.	
	Unit 2	**Containment of Solid and Slurry Waste**	CO2, CO6
	A	Introduction to Waste containment concept	
	B	Landfills – Shape and Size of landfills, Type of landfills, Impervious barriers for liners and covers, Stability of landfills, Landfill construction and operation, Hydrological consideration in landfills design.	
	C	Slurry transported wastes, Environmental impact and control, Vertical barriers for containment.	

	Unit 3	**Remediation of Contaminated Soil**			CO3, CO6
	A	Rational approach to evaluate and remediate contaminated sites – monitored natural attenuation ex-situ and in-situ remediation – solidification, bio–remediation, incineration, soil washing, electro kinetics, soil heating, verification, bio venting – Ground water remediation – pump and treat, air sparging, reactive well.			
	B	Mechanical modification of contaminated site: Introduction, principles of densification, properties of compacted soil and compaction control specifications for quality controls.			
	C	Hydraulic modification of contaminated site: Introduction, objectives, techniques, Dewatering methods, soil and water relationship, Design of Dewatering systems, filtration, drainage and seepage, electro kinetic dewatering and stabilization.			
	Unit 4	**Geotechnical Reuse of Waste Material**			CO4, CO6
	A	Classification of hazardous and non-hazardous waste, Solidification of waste, Utilization of waste for soil improvement.			
	B	Characterization of waste for soil replacement, Engineering property of waste, Waste material in embankment and fills.			
	C	Environmental impact of utilizing waste as geo-materials.			
	Unit 5	**Geo-hazards**			CO5, CO6
	A	Introduction to Geo-hazards, Various types of Geo-hazards			
	B	Earthquake, Landslide, Liquefaction			
	C	Numerical Analysis of liquefaction assessment using empirical approach			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. Lakshmi N. Reddy, Hilary. I. Inyang, Geo-Environmental Engineering – Principles and Applications, Makcel Dekker. 2. D. E. Daniel, Geotechnical Practice for Waste Disposal, Chaman & Hall, London.			
	Other References	1. P. M. Cherry, Solid and Hazardous Waste Management, CBS Publishers and Distributors Pvt. Ltd.			

CO and PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) 2-Moderate (Medium) 3 -Substantial (High)

School: SSES		**Batch : 2025-27**	
Programme: M. TECH		**Current Academic Year: 2025-26**	
Branch: CE (Geotechnical)		**Semester: I**	
1	Course Code	CVT5121	
2	Course Title	Soil Structure Interaction	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Type	ELECTIVE	
5	Course Objective	1. To introduce the students to theory and need for SSI in engineering designs. 2. Should be able to apply the effects of interaction between soil and foundation 3. The ability to apply the concepts for solving multi task applications.	
6	Course Outcomes	The students will be able to: CO1: Recognize different theories related to soil structure interaction. CO2: Comprehend the capabilities of various models utilized for simulating the interaction. CO3: Apply methods of analysis, incorporating their features, to real-life scenarios. CO4: Evaluate the necessity of SSI in diverse design projects where its applicability might be relevant. CO5: Utilize available numerical tools effectively for addressing soil structure interaction. CO6: Demonstrate the integration of concepts in solving multifaceted engineering design challenges.	
7	Course Description	Introduction to soil-foundation interaction, Model Analysis of Beams, Analysis of Plates, Elastic Analysis of Piles, Laterally loaded pile	
8	Outline syllabus		
	Unit 1	**Introduction**	CO1, CO6
	A	Introduction to soil-foundation interaction problems	
	B	Soil behaviour, Foundation behaviour, Interface	
	C	Scope of soil-foundation interaction analysis, Soil response models	
	Unit 2	**Model Analysis of Beams**	CO2, CO6
	A	Beam on Elastic Foundation- Soil Models: Infinite beam	
	B	Two-parameters models, Isotropic elastic half space model	
	C	Analysis of beams of finite length	
	Unit 3	**Analysis of Plates**	CO3, CO6
	A	Infinite plate, Winkler, Two parameters, Isotropic elastic medium	
	B	Thin and thick plates, Plates on Elastic Continuum	
	C	Thin and thick rafts, Analysis of finite plates	
	Unit 4	**Elastic Analysis of Piles**	CO4, CO6
	A	Elastic analysis of single pile	

	B	Theoretical solutions for settlement and load distributions, analysis of pile group	
	C	Interaction analysis, Load distribution in groups with rigid cap.	
	Unit 5	**Laterally loaded pile**	CO5, CO6
	A	Rigid pile, Elastic pile, Standard solutions for different end conditions, Pile on elastic continuum	
	B	Sub grade reaction and elastic analysis	
	C	Interaction analysis and pile raft system, Solutions through influence charts	
	Mode of examination	Theory	
	Weightage Distribution	CA: 75% / MTE: / ETE: 25%	
	Text book/s*	1. Hemsley, J.A, Elastic Analysis of Raft Foundations, Thomas Telford, 1998. 2. McCarthy, D.F. Essentials of Soil Mechanics and Foundations, basic geotechnics (6th Edition), Prentice Hall, 2002. 3. Selvadurai, A.P.S., Elastic Analysis of Soil Foundation Interaction, Elsevier, 1979.	4.
	Other References	1. Scott, R.F. Foundation Analysis, Prentice Hall, 1981. 2. Structure Soil Interaction - State of Art Report, Institution of structural Engineers, 1978.	3.

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) 2-Moderate (Medium) 3 -Substantial (High)

School: SSES		**Batch : 2025-27**	
Programme: M. TECH		**Current Academic Year: 2025-26**	
Branch: CE (Geotechnical)		**Semester: I**	
1	Course Code	CVT5122	
2	Course Title	Soil Dynamics and Machine foundation	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Type	ELECTIVE	
5	Course Objective	1. To familiarize students with the dynamic properties of soil. 2. To create an understanding about the importance of designing machine foundation for reciprocating and impact machines. 3. To gain ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	
6	Course Outcomes	The students will be able to CO1: Recall fundamental concepts related to vibration, including formulation and mathematical equations. CO2: Grasp the impact of vibration on soil properties. CO3: Apply their acquired knowledge of various laboratory tests for dynamic loading and liquefaction. CO4: Showcase ability to design piles for dynamic loading, employing both manual techniques and finite element software. CO5: Demonstrate their capacity to outline the procedure for designing shallow foundations for dynamic loading. This will encompass both manual methodologies and the utilization of finite element software. CO6: Engage in the critical analysis of the dynamic properties of soil through thorough examination.	
7	Course Description	Introduction to Vibration, Dynamic Soil Properties, Shear Strength and Liquefaction, Dynamic Analysis of Piles, Dynamic Analysis of Shallow Foundation.	
8	Outline syllabus		CO-PO Mapping
	Unit 1	**Introduction to Vibration**	CO1, CO6
	A	Fundamentals of theory of vibrations-simple harmonic motion	
	B	Vibration analysis procedure- Free and forced vibration with and without damping	
	C	Formulation of mathematical model of different vibration modes	
	Unit 2	**Dynamic Soil Properties**	CO2, CO6
	A	Dynamic moduli, Dynamic elastic constants. Poission's Ratio, Damping ratio, Liquefaction parameters, Laboratory techniques	
	B	Factors affecting shear modulus, Elastic modulus and Elastic Constants	
	C	Propagation of seismic waves in soil deposits - Attenuation of stress waves	
	Unit 3	**Shear Strength and Liquefaction**	CO3,

					CO6
	A	Stress – Strain and Strength characteristics of soils under dynamic loads			
	B	Resonance column test, Triaxial tests under dynamic loads			
	C	Liquefaction of soils and factors influencing liquefaction, Dynamic earth pressure, retaining wall problems under dynamic loads			
	Unit 4	**Dynamic Analysis of Piles**			CO4, CO6
	A	Analysis of piles under vertical vibrations			
	B	Analysis of piles under translation and rocking, Analysis of piles under torsion			
	C	Design procedure for a pile supporting the machine foundation			
	Unit 5	**General Principles of Machine Foundation Design**			CO5, CO6
	A	Types of machines and Foundations, Requirements of machine foundation			
	B	Permissible amplitude, soil pressure, stress of concrete, steel and timber			
	C	Design procedure of machine foundation.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. Prakash S and Puri, Foundations for Machines: Analysis and design, Wiley, New York, 1988. 2. Braja M. Das, Fundamentals of Soil Dynamics, Elsevier Publishers, New York. 1983. 3. Swami Saran, Soil Dynamics and machine foundations, Galgotia Publishers, New Delhi, 1997.			
	Other References	1. Kramer S. L., Geotechnical Earthquake Engineering – Pearson Education Inc. New Delhi. 2. Bharat Bhushan Prasad – Advanced Soil Dynamics and Earthquake Engineering, PHI Learning Pvt. Limited, New Delhi, 2011.			

CO and PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) 2-Moderate (Medium) 3 -Substantial (High)

School: SSES		**Batch : 2025-27**	
Programme: M. TECH		**Current Academic Year: 2025-26**	
Branch: CE (Geotechnical)		**Semester: II**	
1	Course Code		
2	Course Title	Sub-Soil Exploration	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Type	ELECTIVE	
5	Course Objective	1. To know the geological condition of rock and soil formation. 2. To establish the groundwater levels and determine the properties of water. 3. To select the type and depth of foundation for proposed structure. 4. To determine the bearing capacity of the site. 5. To learn in-situ stresses and its measurement.	
6	Course Outcomes	The students will be able to CO1: Recognize potential foundation problems and devise solutions in advance. CO2: Examine safety considerations related to existing structures and recommend appropriate corrective measures. CO3: Estimate maximum and differential settlements with reasonable precision using calculations. CO4: Assess and appraise the soil's performance post-construction. CO5: Devise strategies to enhance soil conditions using suitable techniques. CO6: Perform detailed geological investigations of a given site.	
7	Course Description	Geotechnical Investigation, Methods of Sampling, Borehole Logging and In-situ Tests, Hydraulic Techniques of Ground Improvement, Mechanical Densification of Soil	
8	Outline syllabus		
	Unit 1	**Methods of Geotechnical Investigation**	CO1, CO6
	A	Introduction to Geotechnical Investigation – Accessible exploration - Test pits, Trenches,	
	B	Semi-direct methods - Auger boring, Wash boring, Rotary drilling, Percussion drilling	
	C	Indirect methods – Geophysical methods - seismic refraction method - electrical resistivity methods – electrical sounding and electrical profiling – Cross hole seismic test.	
	Unit 2	**Samplers and Methods of Sampling**	CO2, CO6
	A	Sampling – Disturbed and undisturbed soil sampling – representative samples.	
	B	Types of samplers – split spoon sampler, piston sampler, thin walled sampler etc.	
	C	Preservation and handling of samples – Piston extruder.	
	Unit 3	**Borehole Logging and In-situ Tests**	CO3, CO6
	A	Logging of Boreholes-logging methods- Ground water observations –	

		water table fluctuations and effects			
	B	Preparation of soil profiles - Field Tests – SPT, SCPT, DCPT			
	C	Methods and specifications – visual identification tests, vane shear test, Soil exploration Reports			
	Unit 4	**Hydraulic Techniques of Ground Improvement**			CO4, CO6
	A	Scope and necessity of ground improvement in Geotechnical engineering- basic concepts and philosophy			
	B	Classification of Ground Modification Techniques – suitability and feasibility, Emerging Trends in ground improvement.			
	C	Drainage - Ground Water lowering by well points deep wells, vacuum and electro-osmotic methods, Stabilization by thermal and freezing techniques			
	Unit 5	**Mechanical Densification of Soil**			CO5, CO6
	A	Methods of compaction- Shallow compaction and deep compaction techniques			
	B	In situ densification -Dynamic compaction, Blasting			
	C	Sand piles – Preloading with sand drains – Stone columns- Lime piles.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. Purushothama raj P. (1975), Geotechnical Engineering, Tata Mc-Graw Hill Publishing Co. Ltd., New Delhi. 2. Gopal Ranjan and Rao A.S.R. (2000), Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi. 3. Ramanatha Ayyar, T.S., Ramachandran Nair, C.L. and Balakrishnan Nair, N., Comprehensive Reference book on Coir Geotextiles, Centre for development of Coir Technology, 2002.			
	Other References	1. Rowe, R.K., Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001. 2. Moseley, M.D., Ground Treatment, Blackie Academic and Professional, 1998.			

CO and PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) 2-Moderate (Medium) 3 -Substantial (High)

School: SSES		**Batch : 2025-27**	
Programme: M. TECH		**Current Academic Year: 2025-26**	
Branch: CE (Geotechnical)		**Semester: II**	
1	Course code		
2	Course Title	Advance Analysis of Shallow and Deep Foundation	
3	Credits	3	
4	Contact Hours (L-T-P)	(3-0-0)	
5	Course Objective	1. To generate understanding of information needed to design foundations at the state of the art. 2. To gain abilities to evaluate bearing capacity and settlement failure conditions for shallow and deep foundations. 3. To equip students with modern instrumentation for foundation design and correct selection of soil parameters for foundation design. 4. To enable students select the best foundation solutions for different types of Civil Engineering problems.	
6	Course Outcomes	The students will be able to CO1: Recognize the necessary prerequisites required for the successful design of foundation elements. CO2: Apply conventional techniques to design foundation systems and assess their effectiveness. CO3: Convert measurements and their associated uncertainties from in-situ tests into relevant design parameters, followed by the analysis of results. CO4: Analyze the load-bearing capacity of shallow foundations systematically, evaluating their performance. CO5: Formulate judgments concerning the immediate settlement of both shallow and deep foundations. CO6: Develop suitable foundation systems based on ground-investigation data.	
7	Outline syllabus		
7.01	Unit A	**Load on Footing**	CO1, CO6
7.02	Unit A Topic 1	Footings with Eccentric or Inclined Loads	
7.03	Unit A Topic 2	Footings on Layered Soils, on slope and on top of the slopes, on finite layer with a Rigid Base at Shallow Depth	
7.04	Unit A Topic 3	Vertical stress distribution beneath footings and for loaded areas of various shapes.	
7.05	Unit B	**Settlement of Foundations**	CO2, CO6
7.06	Unit B Topic 1	Immediate, Consolidation, Stresses and Displacements in Homogeneous, Layered and Anisotropic Soils.	
7.07	Unit B Topic 2	Consolidation Settlement; One, Two & Three dimension.	

7.08	Unit B Topic 3	Caissons and well foundations – design aspects of caissons, open caissons, pneumatic caissons, floating caissons, well foundations, monoliths, design and construction aspects of well foundations.	
7.09	Unit C	**Pile Foundations**	CO3, CO6
7.10	Unit C Topic 1	Single Pile: Vertically loaded piles, Static capacity- α, β and λ Methods	
7.11	Unit C Topic 2	Dynamic formulae; Wave Equation Analyses; Point Bearing Resistance with SPT and CPT Results;	
7.12	Unit C Topic 3	Negative Skin Friction; Batter Piles; Under Reamed Piles;	
7.13	Unit D	**Dynamic Behaviour of Footing**	CO4, CO6
7.14	Unit D Topic 1	Behaviour of foundation under dynamic loading	
7.15	Unit D Topic 2	Pile foundation, Axial capacity, Lateral capacity ,	
7.16	Unit D Topic 3	Deflections, constructions, anchored foundations. Static and dynamic analysis of platforms and components	
7.17	Unit E	**Footing on Marine Soil**	CO5, CO6
7.18	Unit E Topic 1	Origin, nature and distribution of marine soils, their engineering properties	
7.19	Unit E Topic 2	Sampling and sample disturbance in-situ testing	
7.20	Unit E Topic 3	Design criteria. Environmental loading. Wind, wave and current loads after installation. Stability during towing.	
8.1	Course work: 25 marks		
8.11	Attendance	None	
8.12	Homework	None	
8.13	Quiz:	25	
8.14	Labs:	None	
8.14	Projects		
8.15	Presentations	None	
8.16	CA	75%	
8.2	MTE		
8.3	ETE	25%	
9	References		
9.1	Text book	1. Das, B. M. – Principles of Foundation Engineering 5th Edition Nelson Engineering (2004) 2. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012. Phi Learning (2008) 3. Bowles, J. E. – Foundation Analysis & Design 5th Edition McGraw-Hill Companies, Inc. (1996) 4. Poulos, H. G. & Davis, E. H. – Pile Foundation Analysis and Design john wiley & sons inc (1980-08)	

CO and PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2

CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) **2-Moderate (Medium)** **3 -Substantial (High)**

School: SSES		**Batch : 2025-27**	
Programme: M. TECH		**Current Academic Year: 2025-26**	
Branch: CE (Geotechnical)		**Semester: II**	
1	Course code		
2	Course Title	Seismic Analysis of Geotechnical Structures	
3	Credits	3	
4	Contact Hours (L-T-P)	(3-0-0)	
5	Course Objective	1. To introduce the student to the fundamentals of soil dynamics giving emphasis on the behaviour of soils under seismic and dynamic loading and on the effect of superficial geology on strong-motion. 2. To enable the student to perform an equivalent-linear site response analysis.	
6	Course Outcomes	The students will be able to CO1: Acquire foundational skills in describing earthquake actions and evaluating seismic hazard. CO2: Apply essential concepts of wave propagation in engineering illustrations, showcasing comprehension and implementation. CO3: Demonstrate understanding of elementary aspects of soil response under dynamic loading. CO4: Analyze the influence of soil deposits on altering seismic earth pressure. CO5: Execute a ground response analysis employing analytical and numerical methods, illustrating application and synthesis. CO6: Evaluate factor of safety using various simplified techniques and interpret geotechnical structure behavior.	
7	**Prerequisite**	Students should have basic knowledge of soil foundation interaction	
8	**Course Contents**		**CO-PO Mapping**
8.01	Unit A	**Vibration and Measuring Instruments**	CO1, CO6
8.02	Unit A Topic 1	Theory of vibration – Basic Definition – Governing equation for single degree freedom system – Forced vibrations	
8.03	Unit A Topic 2	Rotating mass type excitation – Base excitation – Isolation vibration measuring instruments.	
8.04	Unit A Topic 3	Seismology and earthquakes (basic concepts only), Quantification of earthquake, Intensity and magnitudes.	
8.05	Unit B	**Ground Motion Parameters**	CO2, CO6

8.06	Unit B Topic 1	Ground motion parameters, Estimation of Ground motion parameters	
8.07	Unit B Topic 2	Waves in unbounded media, waves in a layered body	
8.08	Unit B Topic 3	Attenuation of stress waves, Seismic hazard analysis. Evaluation of Dynamic soil properties	
8.09	Unit C	**Seismic Design of Foundations**	CO3, CO6
8.10	Unit C Topic 1	Earthquake Resistant Design of foundation of buildings, Design considerations, Geotechnical Architectural Structures od	
8.11	Unit C Topic 2	Seismic analysis. Earthquake Response of slopes, Evaluation of slope stability, Pseudostatic Analysis	
8.12	Unit C Topic 3	Newmark's Study of Block Analysis , Dynamic Analysis – Earth pressure due to ground shaking Evaluation,	
8.13	Unit D	**Seismic Analysis of Earth Pressure**	CO4, CO6
8.14	Unit D Topic 1	Monobe-Okabe Theory, Effects of Saturation on Lateral Dynamic Earth Pressure	
8.15	Unit D Topic 2	Modified Culmann Construction, Dynamic Active Earth Pressure for cohesive and cohesion less soil	
8.16	Unit D Topic 3	Displacement analysis, Richard Elms Model based on Newmark's Approach	
8.17	Unit E	**Seismic Design of Footings and Walls**	CO5, CO6
8.18	Unit E Topic 1	Seismic Design of Foundations, Retaining Walls & Slopes – Seismic design requirements for foundation,	
8.19	Unit E Topic 2	Seismic bearing capacity, Seismic settlement, Design loads. Seismic slope stability analysis – Internal stability and weakening instability	
8.20	Unit E Topic 3	Seismic design of retaining walls: Dynamic response of retaining walls, Seismic displacement of retaining walls, Seismic design consideration.	

9	**Course Evaluation**				
		Continuous Assessment	Mid-Term Examination	End-Term Examination	
9.11	Attendance	Mandatory	Mandatory	75%	
9.12	Assignment/MOOC/NPTEL Courses/ Swayam Courses	5	--	--	
9.13	Quizzes	15	--	--	
9.14	Projects	--	--	--	
9.15	Case Study/ Field Study/Presentations	5	--	--	
9.16	Exam	--		Yes	
9.17	Total Marks	75%		25%	
10	**Reading Content**				
9.1	Text book*	T1: Kramer, S. (1995). Geotechnical Earthquake Engineering, Pearson, New Delhi. T2: Robert W Day. (2007). Geotechnical Earthquake Engineering Handbook, McGraw Hill, New York. T3: Ishihara, K.(1996). Soil Behaviour in Earthquake Geo-techniques, Oxford Science, NY.			

9.2	other references	R1: Kamalesh Kumar. (2009). Basic Geotechnical Earthquake Engineering, New Age	

CO and PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) 2-Moderate (Medium) 3 -Substantial (High)

School: SSES		**Batch : 2025-27**	
Programme: B.TECH		**Current Academic Year: 2025-26**	
Branch: CE		**Semester: I**	
1	Course Code	CVP5108	
2	Course Title	Advance Soil Mechanics Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Elective	
5	Course Objective	The course will create the understanding between theoretical concepts of soil mechanics and apply the knowledge to determine index, flow, strength, and compaction properties of soils for various applications.	
6	Course Outcomes	The students will be able to CO1: Recognize different index properties demonstrated by soils and differentiate between them. CO2: Categorize soils based on their unique properties and classify them accordingly. CO3: Describe flow characteristics observed in various soil types and compare their differences. CO4: Analyze the diverse strength attributes exhibited by soils and evaluate their variations. CO5: Examine compaction and consolidation characteristics of soil and predict their practical consequences in real-world scenarios. CO6: Evaluate different types of soil and their strength characteristics through a comprehensive analysis.	
7	Course Description	Identifying and conduct the various tests used for determining the soil properties in the laboratory and knowing their area of applications	
8	Outline syllabus		CO Mapping
	Unit 1	**Index Properties of Soils**	
		Exp 1- Determination of moisture content of soil Exp 2- Determination of specific gravity of soil Exp 3- Determination of grain size distribution of coarse grained soils Exp 4- Determination of Atterberg's limit of cohesive soils Exp 5- Determination of relative density of cohesion less soil	CO1, C02
	Unit 2	**Hydraulic or flow properties of soil**	
		Exp 6- Determination of permeability of coarse and fine grained soil.	CO3, CO6
	Unit 3	**Strength properties of soil**	

		Exp 7- Determination of cohesion and friction of coarse grained soils using direct shear test. Exp 8- Determination of shear strength parameters of soil in U triaxial apparatus Exp 9- Determination of unconfined compressive strength of soil Exp 10- CBR test			CO4, CO6
	Unit 4	**Compaction characteristics of soil**			
		Exp 11- Determination of optimum moisture content and Maximum dry density using light compaction test			CO5
	Unit 5	**Consolidation Properties**			
		Exp 12- Determination of consolidation properties of soil using 1D consolidation test			CO5, CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE-Viva	ETE	
		75%		25%	
	Reference codes	1. ASTM Code 2. IS Code (IS2720)			

CO and PO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	2	1	2	1	3	2	1	2	-	1	1
CO2	3	2	1	1	1	2	1	1	2	1	1	1	-	3	2
CO3	3	3	-	1	3	1	2	1	3	2	1	1	1	1	2
CO4	2	2	-	2	3	1	-	1	3	1	-	3	1	3	2
CO5	3	3	-	-	2	1	1	-	-	-	-	2	1	3	1
CO6	3	3	-	-	2	1	1	-	-	-	-	2	1	3	1

1-Slight (Low) 2-Moderate (Medium) 3 -Substantial (High)

School: SSES		**Batch : 2025-27**	
Program: M. TECH		**Current Academic Year: 2025-26**	
Branch: CE (Geotechnical)		**Semester: II**	
1	Course Code		
2	Course Title	**ADVANCED GEOTECHNICAL DATA ANALYSIS AND MODELING LAB**	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-2	
	Course Type	ELECTIVE	
5	Course Objective	1: To master data-driven soil characterization techniques for geotechnical applications. 2: To apply neural network models to analyze slope stability with precision. 3: To utilize statistical methods to enhance site investigation and geotechnical data analysis.	
6	Course Outcomes	The student will be able to: CO1. Implement regression analysis to predict settlement of shallow foundations based on soil characteristics. CO2. Develop regression models using machine learning techniques to predict shear strength parameters CO3. Proficiently train machine learning models to classify soil types based on laboratory test data, such as grain size distribution and Atterberg limits. CO4. To validate the performance of machine learning models with traditional settlement prediction methods. CO5: Investigate the ability of Neural Network models to capture complex relationships in slope stability analysis CO6. Integrate Data Analysis and Modelling Technique for Geotechnical Data	
7	Course Description	Computational Modeling and Machine Learning in Geotechnical Engineering	
8	Outline syllabus		
	Unit 1	**Statistical Analysis**	**CO1, CO6**
	Experiment 1	To implement regression analysis to predict settlement of shallow foundations based on soil characteristic.	
	Experiment 2	Develop regression models using machine learning to predict shear strength parameters (e.g., cohesion and friction angle) from soil properties.	
	Unit 2	**Machine Learning**	**CO2,CO6**
	Experiment 3	To train a machine learning model to classify soil types based on laboratory test data (e.g., grain size distribution, Atterberg limits).	

	Experiment 4	Compare the performance of machine learning models with traditional settlement prediction methods.	
	Experiment B	Integration of Remote Sensing Data	
	Unit 3	**Neural Networks**	**CO3,CO6**
	Experiment 5	To investigate the Neural Network model's ability to capture complex relationships in slope stability analysis.	
	Experiment 6	To implement neural networks for predicting slope stability based on input parameters.	
	Unit 4	**Machine Learning Application**	**CO4,CO6**
	Experiment 7	To explore the potential of machine learning in automating the detection of data irregularities.	
	Experiment 8	To employ machine learning algorithms to diagnose faults or anomalies in geotechnical structures, such as retaining walls or foundations.	
	Experiment A	Implement real-time monitoring and predictive analytics for the geotechnical system.	
	Unit 5	**Deep Learning Technique**	**CO5,CO6**
	Experiment 9	To use deep learning techniques to analyse site investigation data containing multiple variables.	
	Experiment 10	To evaluate the liquefaction prediction using deep learning models.	
	Mode of examination	Theory	

	Weightage Distribution	CA	CE Viva	ETE
		75%		25%

	Text book/s*	3. Samui, P, Sitharam T. G (2010) Intelligent Models in Geotechnical Engineering, LAP Lambert Academic Publishing 4. Nguyen, H., Bui, X. N., Topal, E., Zhou, J., Choi, Y., & Zhang, W. (Eds.). (2023). Applications of Artificial Intelligence in Mining and Geotechnical Engineering. Elsevier. 5. Kutner, M. H., Nachtsheim, C. J., Neter, J., & Li, W. (2005). Applied linear statistical models. McGraw-hill.
	Other References	2. Bengio, Y., Goodfellow, I., & Courville, A. (2017). Deep learning (Vol. 1). Cambridge, MA, USA: MIT press. 3. Shalev-Shwartz, S., & Ben-David, S. (2014). Understanding machine learning: From theory to algorithms. Cambridge university press.

CO and PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	1	3	-	1	-	2	1	1	3	1	3
CO2	3	2	1	3	-	2	-	2	1	1	2	3	2
CO3	3	3	1	3	-	1	-	2	2	1	3	1	2
CO4	2	2	1	2	-	1	-	2	3	1	2	3	2
CO5	3	3	1	3	-	1	-	2	3	1	2	3	2
CO6	3	3	1	3	-	1		2	3	2	2	3	3

School: SSES		**Batch : 2025-27**	
Programme: M.TECH		**Current Academic Year: 2025-26**	
Branch: CE (Structures)		**Semester: I**	
1	Course Code	CVT5124 Course Name: Estimation and Quantity Surveying	
2	Course Title	Estimation and Quantity Surveying	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	ELECTIVE	
5	Course Objective	Develop understanding of the basic concepts estimation and develop and ability to carry out quantity estimation and rate analysis of various construction works.	
6	Course Outcomes	The students will be able to CO1 – Acquire knowledge of the fundamental concepts and regulations governing quantity estimation, methods of measurement, and units of measurement. CO2 – Demonstrate comprehension and skill in executing quantity estimation for building projects. CO3 – Illustrate comprehension and proficiency in conducting quantity estimation for earthwork and water supply projects. CO4 – Analyse rates for diverse construction undertakings, showcasing a grasp of the underlying principles. CO5 – Appraise the fundamental concepts of valuation and billing, exhibiting an understanding of their significance. CO6 – Execute estimation and rate analysis for a range of construction ventures, showcasing a high level of competence in these tasks.	
7	Course Description	This course teaches the basic concepts estimation and rate analysis of various construction works.	
8	Outline syllabus		
	Unit 1	**Introduction To Estimation**	CO1, CO6
	A	General items of work in Building. Standard Units Data for Estimates.	
	B	Types of estimate, Detailed, Revised, supplementary,	
	C	Abstract and Approximate method of estimating. Methods of Building estimates, specification	
	Unit 2	**Estimation Of Buildings**	CO2, CO6
	A	Detailed Estimates of foundation work, RCC work.	
	B	Detailed Estimates of Brickwork, stonework, woodwork.	
	C	Reinforcement bar bending and bar requirement schedules.	
	Unit 3	**Earthwork Estimation And Water Supply Works**	CO3, CO6
	A	Earthwork for roads,	
	B	Earthwork on hilly roads.	
	C	Earthwork of irrigation channel, Water supply works	
	Unit 4	**Analysis Of Rates**	CO4, CO6
	A	Factors affecting analysis of rate, Task or turn out of work	

	B	Analysis of Rates for earthwork, concrete works. D P C. Brickwork, stone masonry, Analysis of Rates for Sanitary & water supply works			
	C	Analysis of Rates for plastering, pointing, road work, carriage of materials.			
	Unit 5	**Valuation And Billing**			CO5, CO6
	A	Purpose of Valuation, Principles of valuation,			
	B	Sinking Fund, Depreciation			
	C	Methods of valuation, Billing			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	Dutta B.N. Estimating and Costing, UBS publishers, 2000.			
	Other References	Gurcharan Singh and Jagdish Singh, Estimating costing and valuation, Standard Publishers, 2011 Shah M.H and Kale C.M, Principles of building drawing Tata Mc Graw Hill Publishing co. Ltd., New Delhi.			

CO and PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) **2-Moderate (Medium)** **3 -Substantial (High)**

School: SSES		**Batch : 2025-27**		
Programme: M.TECH		**Current Academic Year: 2025-26**		
Branch: CE (Structures)		**Semester: I**		
1	Course Code	CVT5125	Course Name: Analysis of Construction Cost and Finances	
V2	Course Title	Analysis of Construction Cost and Finances		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	ELECTIVE		
5	Course Objective	Providing the fundamental technical knowledge and skills in Mathematics, Applied Science and engineering subjects to recognize and solve problems in the areas of design, execution and maintenance of engineering.		
6	Course Outcomes	The students will be able to CO1: Acquire familiarity with the fundamental principles of engineering economics and the concept of time value of money. CO2: Demonstrate comprehension of cash flows related to both uniform and non-uniform series of payments. CO3: Compare and contrast alternatives through the application of different combinations of payments, rate of return, capitalized cost, and benefit-cost analysis. CO4: Analyse the impacts of depreciation, inflation, and taxation within the context of India. CO5: Apply the principles of construction accounting and manage working capital effectively. CO6: Solve complex problems pertaining to the design, execution, and maintenance of engineering projects.		
7	Course Description	This course will provide students an understanding and ability in areas of Engineering Economics and Financial Management in construction.		
8	Outline syllabus			
	Unit 1	**Engineering Economics**		CO1, CO6
	A	Time Value of Money, Cash Flow diagrams, Equivalence		
	B	Single payments in Future, Present and uniform series		
	C	Future payments compared to uniform series payments		
	Unit 2	**Non-Uniform Payments**		CO2, CO6
	A	Arithmetic gradient		
	B	Geometric gradient		
	C	Analysis of gradient cash flows		
	Unit 3	**Alternative Comparisons**		CO3, CO6
	A	Present, future and annual worth of comparisons		
	B	Rate of return, Incremental rate of return		
	C	Break-even comparison, Capitalized cost analysis, Benefit cost analysis		
	Unit 4	**Depreciation, Inflation and Taxes**		CO4, CO6

	A	Depreciation			
	B	Inflation			
	C	Taxes			
	Unit 5	**Financial Management**			CO5, CO6
	A	Construction Accounting			
	B	Financial Statements and ratios			
	C	Working Capital Management			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. NPTEL notes on "Construction Cost and Finance", provided to all students through LMS.			
	Other References	1. R1. Blank, L. T. and Tarquin, A. J., "Engineering Economy", Fourth Edition, WCB/Mc GrawHill, 1998. 2. R2. Bose, D. C., "Fundamentals of Financial management", 2nd ed., PHI, New Delhi, 2010 3. R3. Boyer, C. B. and Merzbach, U. C., "A History of Mathematics", 2nd ed., John Wiley & Sons, New York, 1989. 4. R4. Gould, F. E., "Managing the Construction Process", 2nd ed., Prentice Hall, Upper Saddle River, New Jersey, 2002.			

CO and PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) **2-Moderate (Medium)** **3 -Substantial (High)**

School: SSES		**Batch : 2025-27**	
Programme: M.TECH		**Current Academic Year: 2025-26**	
Branch: CE (Structures)		**Semester: I**	
1	Course Code	Course Name: Quality Assurance and Quality Control	
2	Course Title	Quality Assurance and Quality Control	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	ELECTIVE	
5	Course Objective	Quality is one of the very strong pillars for any construction project. We have to meet the client's requirement and specifications. Since construction site is one of the most dangerous and hazardous place to work on, knowledge of safety measures and best safety practices are of foremost importance.	
6	Course Outcomes	The students will be able to CO1: Understand the concept of quality planning and assurance (QA/QC). CO2: Describe the principles of quality control. CO3: Apply management techniques for effective project execution. CO4: Analyse quality management standards and their significance. CO5: Discuss the importance of safety and promote safe work behaviour. CO6: Evaluate safety measures and recommend best practices for construction sites.	
7	Course Description	This course focuses on the various measures to enhance and manage the quality parameters related to construction project. It also focuses on various safety issues and safe work practices.	
8	Outline syllabus		
	Unit 1	**Quality Concept**	CO1, CO6
	A	Introduction to Quality assurance and quality control (QA/QC)	
	B	objectives of QA/QC	
	C	Planning and control of quality during various stages of project.	
	Unit 2	**Quality Control Techniques**	CO2, CO6
	A	Quantitative techniques in quality control	
	B	Quality assurance during construction	
	C	Inspection of materials and machinery.	
	Unit 3	**Quality Management**	CO3, CO6
	A	Establishing quality assurance system	
	B	Quality Circle	
	C	Quality audit	
	Unit 4	**Quality Management Standards and Principles**	CO4, CO6
	A	Quality standards and Quality Management System	

	B	ISO 9004 & ISO 9000			
	C	Various quality management principles by Juran, Crosby and Deming			
	Unit 5	**Safety in Construction**			CO5, CO6
	A	Concept of safety and necessity of safe practices in Construction. Factors affecting safety: Physiological, Psychological and Technological			
	B	Safety Indicators, Safety climate at construction site, factors affecting safe climate			
	C	Safe work behaviour, PPEs. Training for safety awareness and implementation.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. Abdul Razzak Rumane, "Quality Management in Construction Projects", Taylor & Francis, 2010 2. Richard J. Coble, Theo C. Haupt, Jimmie Hinze, "The Management of Construction Safety and Health", Taylor & Francis, 2000			
	Other References	1. Tim Howarth, Paul Watson, "Construction Safety Management", John Wiley & Sons, 2008 2. Phil Hughes, Ed Ferrett, "Introduction to Health and Safety in Construction: The Handbook for Construction Professionals and Students on Nebosh and Other Construction Courses", Edition 3, Publisher Routledge, 2008			

CO and PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) 2-Moderate (Medium) 3 -Substantial (High)

School: SSES		**Batch : 2025-27**		
Programme: M.TECH		**Current Academic Year: 2025-26**		
Branch: CE (Structures)		**Semester: II**		
1	Course Code	CVT5126	Course Name: Construction Equipment Management	
2	Course Title	Construction Equipment Management		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	ELECTIVE		
5	Course Objective	To develop understanding about modern equipment used in construction. Develop selection and procurement strategies for construction equipment. Plan, manage and maintain modern construction equipment usage at construction site and		
6	Course Outcomes	The students will be able to CO1 - Acquire knowledge of contemporary construction equipment, comprehending their planning and selection. CO2 - Apply economic principles to acquire construction equipment through procurement. CO3 - Analyse different earth moving equipment utilized in contemporary construction. CO4 - Evaluate various earth hoisting and transportation equipment employed in present-day construction. CO5 - Compare and contrast diverse earth piling and concreting equipment utilized in modern construction. CO6 - Judge the selection and procurement of diverse equipment employed in contemporary construction.		
7	Course Description	The course teaches the used, selection and procurement of various equipment used in modern construction.		
8	Outline syllabus			
	Unit 1	**Equipment Management**		CO1, CO6
	A	Planning and management of equipment.		
	B	Factors affecting selection of equipment - technical and economic.		
	C	Equipment maintenance management		
	Unit 2	**Equipment Economics**		CO2, CO6
	A	Equipment Economics-Equipment costs, Ownership and operating cost		
	B	Buy/Rent/Lease options,		
	C	Replacement analysis.		
	Unit 3	**Earthwork Equipment**		CO3, CO6
	A	Analysis of production outputs and costs,		
	B	Characteristics and performances of earthwork equipment.		
	C	Excavators, scraper, dredger		
	Unit 4	**Erection and Transporting**		CO4, CO6
	A	Cranes- Mobile Cranes,		

	B	Tower Cranes , launching girder			
	C	Trailer, Dumpers.			
	Unit 5	**Piling Concreting and Tunnelling**			CO5, CO6
	A	Piles and Piling equipment			
	B	Concrete construction (including batching, mixing, transport, and placement)			
	C	Tunnelling			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	Jerry Irvine, Advanced Construction Techniques CA Rockers, 1984 Peurifoy, R.L., Ledbetter, W.B. and Schexnayder. C, Construction Planning Equipment and Methods, McGraw Hill. Singapore 1995			
	Other References	Sharma S.C. Construction Equipment and Management, Khanna Publishers, Delhi, 1988 Deodhar, S.V. Construction Equipment and Job Planning Khanna Publishers Delhi, 1988 Dr. Mahesh Varma, Construction Equipment and its planning and application, Metropolitan Book Company, New Delhi 1983			

CO and PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) 2-Moderate (Medium) 3 -Substantial (High)

SSES		**Batch : 2025-27**		
Programme: M.TECH		**Current Academic Year: 2025-26**		
Branch: CE (Structures)		**Semester: II**		
1	Course Code		Course Name: Contract Laws and Regulations	
2	Course Title	Contract Laws and Regulations		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	ELECTIVE		
5	Course Objective	The subject intends to impart basic knowledge about construction contracts and laws related to construction sector. This would enable students to understand the process of Tendering and practice of Contract Management and Laws and Regulations related to construction projects.		
6	Course Outcomes	The students will be able to CO1: Recognize the steps comprising the tendering process, negotiate contract terms, execute contract awards, and administer contract management activities in construction projects. CO2: Interpret and analyse construction contracts, extracting essential information and implications for various project aspects. CO3: Classify and differentiate between diverse contract types utilized within the construction industry, considering their unique characteristics and applications. CO4: Evaluate and compare dispute resolution methods, such as arbitration, negotiation, mediation, and conciliation, with an emphasis on their relevance and effectiveness in construction contexts. CO5: Examine and explain the legal frameworks pertinent to the construction sector, outlining key regulations and requirements governing construction activities. CO6: Apply tendering practices, contract management techniques, and legal knowledge to effectively execute and oversee construction projects in compliance with applicable laws and regulations.		
7	Course Description	The start of any construction project happens by participating in bid and signing of contract. A lot of agreement and contract happens in projects. It's very much important to understand the laws that govern these contracts and how to resolve disputes in a legal framework. This course deals with various laws and regulations related to agreement and contracts. It also focuses of disputes resolving methods and various labour laws.		
8	Outline syllabus			
	Unit 1	**Agreements and Contracts**		CO1, CO6
	A	Indian Contracts Act - Indian contract act 1872		

	B	definition of contract and its applicability			
	C	Elements of Contracts			
	Unit 2	**Contract Types**			CO2, CO6
	A	Types of contract			
	B	International contracts			
	C	Condition and specification of contract.			
	Unit 3	**Bidding and Tendering**			CO3, CO6
	A	Qualification of bidders- Pre qualification - Bidding - Two Cover System			
	B	Tender documents- Evaluation of Tender from Technical, financial aspects			
	C	Tendering and contractual procedures.			
	Unit 4	**Bidding and Tendering**			CO4, CO6
	A	Arbitration and conciliation act 1996			
	B	Violations- appointment of arbitrator			
	C	Power and duties of arbitrator - dispute review board.			
	Unit 5	**Laws and Regulations**			CO5, CO6
	A	Labour laws - workmen compensation act			
	B	Minimum wages Act - Child labour Act			
	C	Industrial dispute Act. , RERA Act.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. Keith Collier, "Construction Contracts" Reston Publishing Company, Inc, Reston, Verginia. 2. Patil, B.S., "Building and Engineering Contracts" Mrs. S.B. Patil, Pune. 3. John Murdoch & Will Hughes, Construction Contracts - Law and Management" Spon Press, Taylor & Francis Group			
	Other References	1. Gajerai, G.T., "Law relating to Building and Engineering Contracts in India" Butterworths. 2. Govt of India, Central Public Works Department, "CPWD Works Manual 2003." 3. Govt of India, Central Public Works Department, "Analysis of Rates for Delhi (Vol 1 & 2)." and "Delhi Schedule of Rates." 4. Govt of India, Central Public Works Department, "CPWD 7/8: General Conditions of Contracts." 5. Govt of India, Military Engineer Services, "IAFW 2249: General Conditions of Contracts			

CO and PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) **2-Moderate (Medium)** **3 -Substantial (High)**

School: SSES		**Batch : 2025-27**	
Programme: M.TECH		**Current Academic Year: 2025-26**	
Branch: CE (Structures)		**Semester: II**	
1	Course Code	Course Name: Operational Research in CM	
2	Course Title	Operational Research in CM	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	ELECTIVE	
5	Course Objective	Providing the fundamental technical knowledge and skills in Probability, decision science and quantitative techniques for construction management	
6	Course Outcomes	The students will be able to CO1 – Recall and describe the fundamental principles of probability and statistics in construction management. CO2 – Explain the concept of linear programming, its graphical solution, and the simplex method's application in construction decision-making. CO3 – Illustrate the concept of transportation and assignment problems, and their relevance in optimizing resource allocation within construction projects. CO4 – Analyse the concept of dynamic programming and queuing theory's significance in addressing complex scheduling and resource management challenges in construction. CO5 – Evaluate the concept of game theory and simulation problems in construction scenarios. CO6 – Apply foundational technical knowledge and skills related to probability, decision science, and quantitative techniques.	
7	Course Description	Providing the fundamental technical knowledge and skills in Probability, decision science and quantitative techniques for construction management	
8	Outline syllabus		
	Unit 1	**Introduction and concepts of probability and statistics**	CO1, CO6
	A	Probability - Revision	
	B	Statistics in construction-I	
	C	Statistics in construction-I	
	Unit 2	**Linear programming-I**	CO2, CO6
	A	Linear programming	
	B	Graphical method of solving Linear programming	
	C	Simplex method	
	Unit 3	**Linear Programming-II**	CO3, CO6
	A	Transportation	
	B	Assignment problems-I	
	C	Assignment problems-I	
	Unit 4	**Dynamic Programming**	CO4, CO6

	A	Dynamic programming			
	B	Queuing theory			
	C	Examples of queuing theory			
	Unit 5	**Decision, game theory and Simulation**			CO5, CO6
	A	Decision theory			
	B	Games theory			
	C	Simulations applied to construction			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	Taha, H.A., Operations Research: An Introduction, 8th Edition, Prentice Hall of India, New Delhi, 2010.			
	Other References	Freund, J.E. and Miller, I.R., Probability and Statistics for Engineers, 5th Edition, Prentice Hall of India, New Delhi, 1994. Gupta, S.C. and Kapur, V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 1999.			

CO and PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) **2-Moderate (Medium)** **3 -Substantial (High)**

School: SSS		**Batch : 2025-27**	
Programme: M.TECH		**Current Academic Year: 2025-26**	
Branch: CE (CM)		**Semester: II**	
1	Course Code		Course Name: Advanced Construction Techniques
2	Course Title	Advanced Construction Techniques	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	Acquaint the students with the advanced construction techniques being used in modern day constructions	
6	Course Outcomes	The students will be able to CO1: Gain familiarity with contemporary construction formworks to establish a foundational awareness. CO2: Grasp the fundamental principles behind pre-fabricated construction to comprehend key concepts. CO3: Build a comprehension of composite constructions and pre-engineered buildings to demonstrate an understanding. CO4: Develop an understanding of the construction methods employed in Deep foundations to apply acquired knowledge. CO5: Acquire knowledge regarding the supervision of pavement construction to analyse and evaluate. CO6: Apply advanced and modern construction techniques using the acquired understanding to create and innovate.	
7	Course Description	Providing the fundamental technical knowledge and skills in Probability, decision science and quantitative techniques for construction management	
8	Outline syllabus		CO Mapping
	Unit 1	**Modern Formworks**	
	A	Aluminium and Mivan	CO1, CO6
	B	Tunnel Formworks	
	C	Slip and jump formworks	
	Unit 2	**Prefabricated Constructions**	
	A	Precast constructions	CO2, CO6
	B	Prestressed constructions-I	
	C	Prestressed constructions-II	
	Unit 3	**Composite Constructions and Pre -engineered buildings**	
	A	Steel concrete composite constructions	CO3, CO6
	B	Steel constructions	
	C	Pre-engineered buildings	
	Unit 4	**Deep Foundations**	
	A	Raft foundations	CO4, CO6
	B	Well foundation-I	
	C	Well foundation-II	
	Unit 5	**Pavement Management**	
	A	Embankment	CO5, CO6
	B	Base/Subbase	

	C	Flexible/ concrete pavements			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*				
	Other References				

CO and PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	2	2	1	2	-	3	3	-	2	2
CO2	2	1	1	2	2	1	2	-	3	3	-	2	2
CO3	2	1	1	2	2	1	2	-	3	3	-	2	2
CO4	2	1	1	2	2	1	2	-	3	3	-	2	2
CO5	3	2	2	2	3	1	1	-	3	3	-	2	2
CO6	2	2	2	2	3	1	1	-	2	3	-	2	2

1-Slight (Low) 2-Moderate (Medium) 3 -Substantial (High)

School: SSES		**Batch : 2025-29**	
Program: M.Tech		**Current Academic Year: 2025-26**	
Branch: CE		**Semester:**	
1	Course Code		Course Name : Lean Construction Practices
2	Course Title	Lean Construction Practices	
3	Credits	Audit Course	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	VAC	
5	Course Objective	To understand Lean Construction Management and improve project delivery by minimizing waste and maximizing value to the customer.	
6	Course Outcomes	The students will be able to CO1: Comprehend the contemporary management techniques and the issues in present scenario. CO2: Understand the basics of lean management principles and their evolution from manufacturing industry to construction industry CO3: Develops a better understanding of core concepts of lean construction tools and techniques and their importance in achieving better productivity CO4: Understand lean techniques to achieve sustainability in construction projects. CO5: Turn out lean construction techniques in design and modelling. CO6: Inculcate lean construction management	
7	Course Description	This course will describe the Basic concept of lean Construction practices and Project planning and management.	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION TO THE LEAN**	
	A	Introduction and overview of the construction project management-Review of Project Management& Productivity Measurement Systems–Productivity in Construction–Daily Progress Report.	CO1, CO6
	B	The state of the industry with respect to its management practices–construction project phases-Essential features of contemporary construction management techniques	
	C	The problems with current construction management techniques–Current production planning	
	Unit 2	**LEAN MANAGEMENT**	
	A	Introduction to lean management–Toyota's management principle-Evolution of lean in construction industry	CO2, CO6
	B	Production theories in construction–Lean construction value-Value in construction	
	C	Target value design–Lean project delivery system-Forms of waste in construction industry–Waste Elimination	
	Unit 3	**CORE CONCEPTS IN LEAN**	
	A	Concepts in lean thinking–Principles of lean construction–Variability and its impact	CO3, CO6
	B	Traditional construction and lean construction–Traditional project delivery	
	C	Lean construction and workflow reliability–Work structuring–	

		Production control.	
	Unit 4	**LEAN CONSTRUCTION TOOLS AND TECHNIQUES**	
	A	Value Stream Mapping–Work sampling–Last planner system–Flow and pull based production	CO4, CO6
	B	Look ahead schedule–constraint analysis–weekly planning meeting	
	C	Daily Huddles–Root causes analysis–Continuous improvement–Just in time.	
	Unit 5	**LEAN CONSTRUCTION IMPLEMENTATION**	
	A	Lean construction implementation-Enabling lean through information technology–Lean in design	CO5, CO6
	B	Design Structure Matrix Location Based Management System	
	C	BIM (Building Information Modelling)-IPD (Integrated Project Delivery)–Sustainability through lean construction approach	
		Total Hours	
	Mode of examination	NA	
	Weightage Distribution	75 % CA , 25% ETE	
		100	
	Text book/s*	1. Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London. 2. "Disaster Management in India", Ministry of Home Affairs, Government of India. 3. "Disaster Management Act", Ministry of Home Affairs, Government of India. 4. "Disaster Management Plan of India", Ministry of Home Affairs, Government of India.	
	Other References		

CO, PO, PSO Mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	1	-	-	-	-	2	1	2	2	3	-	-
CO 2	3	2	3	2	-	-	-	-	2	2	2	2	3	-	-
CO 3	2	2	1	2	-	-	-	-	2	1	-	2	2	2	2
CO 4	3	2	3	3	-	-	-	-	2	3	2	2	2	3	3
CO 5	2	3	3	3	3	-	-	-	2	1	2	2	2	-	-
CO 6	3	1	3	2	-	-	-	-	2	3	2	2	3	3	3

School: SSES		**Batch : 2025-27**	
Program: M.TECH		**Current Academic Year: 2025-2026**	
Branch: CE		**Semester: I**	
1	Course Code	CVL5127 | Course Name: GIS FUNDAMENTALS	
2	Course Title	GIS FUNDAMENTALS	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Departmental Elective (GIS and Remote Sensing)	
5	Course Objective	This course aims to develop an understanding of the basics of digital maps and mapping.	
6	Course Outcomes	At the end of the course, the students would be able to, CO1. Understand the fundamentals of digital mapping CO2. Classify the maps, co-ordinate systems and projection CO3. Understand the GIS database collection and storage CO4. Identify the errors and rectify the mapping inaccuracies CO5. Process spatial and non-spatial data and prepare thematic maps CO6. Suggest appropriate methodology for application of GIS in different fields	
7	Course Description	This course explains the fundamentals behind the making and analysis of digital maps for various applications	
8	Outline syllabus		

S No	UNIT	Title	CO Mapping
	Unit 1	**Map Introduction**	**CO1**
	A	Mapping concepts, analysis with paper-based maps, limitations	
	B	Computer Automated Cartography – History and Developments, GIS- Definition,	
	C	advantages of digital maps, projections and coordinate systems	
	Unit 2	**Fundamentals of GIS**	**CO2**
	A	Information Systems, Modelling Real World Features Data	
	B	Data Models – Spatial and Non-spatial, Components, Data Collection and Input	
	C	Data Conversion, Metadata	
	Unit 3	**Database management and Topology**	**CO3, CO4**
	A	Database Structures, Files; Standard Data Formats	
	B	Compression Techniques, Hardware and Software	
	C	Types of Errors, Editing and Error Rectification, Types of Topology, Modelling topological Relationships, Tolerances	
	Unit 4	**Spatial Analysis**	**CO5**
	A	Proximity Analysis, Overlay Analysis, Buffer Analysis, Network Analysis – Route alignment, Canal alignment;	
	B	Digital Elevation Models; Map composition	
	C	Preparation of qualitative and quantitative maps, levels of maps, map elements and map scales, 3D Analyst	
	Unit 5	**Project planning and implementation**	**CO6**
	A	Understanding the Requirements, Phases of Planning, Specifications	

	B	Procedure for analysis projects and design projects		
	C	Implementation of GIS projects		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		75%		25%
	Text book/s*	1. Geographic Information systems and Science, Paul Longley., John Wiley & Sons, 4th Edition,2015. 2. Introduction to Geographic Information Systems, 9th Edition, Kang Tsung Chang., Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 2018. 3. Concepts and Techniques of Geographic Information Systems, C.P.Lo & Albert K. W.Yeung, second Edition, Prentice Hall India Pvt. Ltd, 2016		
	Other References	1. Principles of GIS for Land Resource Assessment, Burrough, P.A., Oxford Publications, 2005. 2. The design and implementation of Geographic Information Systems, John E. Harmon & Steven J. Anderson., John Wiley & Sons, 2003.		

CO Mapping with POs and PSOs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
COXX.1	2	1	1	2				2					
COXX.2	1	2	2	2				2			1		
COXX.3	1	2	3	2				2			1		
COXX.4	1	1	2	2				2				2	
COXX.5	1	3	2	2		2		2	2	2		3	
COXX.6	1	1	3	2		2	3	2	3	2			3
CVLXX	**1**	**2**	**2**	**2**	**-**	**2**	**3**	**2**	**3**	**2**	**1**	**3**	**3**

School: SSES		**Batch : 2025-27**	
Program: M.TECH		**Current Academic Year: 2025-2026**	
Branch: CE		**Semester: I**	
1	Course Code	CVT5128	Course Name: PRINCIPLES OF REMOTE SENSING AND PHOTOGRAMMETRY
2	Course Title	PRINCIPLES OF REMOTE SENSING AND PHOTOGRAMMETRY	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Departmental Elective (GIS and Remote Sensing)	
5	Course Objective	This course aims to develop an understanding of the basic principles of remote sensing and photogrammetry.	
6	Course Outcomes	At the end of the course, the students would be able to, CO1. Understand the physics of the process of remote sensing CO2. Know about different platforms used for the collection of data through remote sensing CO3. Understand the fundamental concepts behind aerial photography CO4. Analyse the energy interactions with the atmosphere and earth surface features CO5. Identify the earth surface features from satellite images CO6. Apply remote sensing techniques for resources evaluation	
7	Course Description	This course explains the science behind the remote sensing and photogrammetry technique and different methods which are used to collect the data	
8	Outline syllabus		

S No	UNIT	Title	CO Mapping
	Unit 1	**Physics of Remote sensing**	**CO1**
	A	Sources of Energy, Active and Passive Radiation, Electromagnetic Radiation; Fundamental Principles and Laws	
	B	Reflectance, Transmission, Absorption, Thermal Emissions	
	C	Interaction with Atmosphere, Atmospheric windows, Spectral reflectance of Earth's surface features, and Multi concept of Remote Sensing	
	Unit 2	**Platforms and Sensors**	**CO2**
	A	Various types of platforms, different types of aircraft, manned and unmanned spacecrafts used for data acquisition	
	B	Characteristics of different types of platforms - airborne and spaceborne, IRS Satellite Sensors	
	C	LANDSAT, Quickbird, Geoeye, Worldview II & III, Microwave, Planet Data, Sentinel, MODIS etc	
	Unit 3	**Fundamentals of Aerial Photography Systems**	**CO3**
	A	Historical development, Classification and Application	
	B	Analogue and digital cameras, geometry of vertical photographs, scale, coordinate transformations	
	C	Relief displacement, tilted and oblique photographs, Flight Planning, Interpretation keys	

	Unit 4	**Data acquisition systems**			**CO4, CO5**
	A	Optical, Thermal and Microwave			
	B	Resolutions - spatial, spectral, radiometric and temporal, signal to noise ratio			
	C	LiDAR data acquisition and processing, Drone data acquisition and processing			
	Unit 5	**Applications**			**CO6**
	A	Applications of Remote sensing in various Engineering and Science domains			
	B	Applications in Agriculture, Forest, Soil, Geology			
	C	Applications in LU/LC, Water Resources, Urban, Disaster Management, etc.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. Introduction to Remote Sensing, James B. Campbell & Randolph H. Wynne., The Guilford Press, 2011. 2. Introduction to the physics and techniques of Remote Sensing, Charles Elach & Jakob van Zyl., John Wiley & Sons publications, 2006. 3. Remote Sensing and Image Interpretation, Lillesand T.M & Kiefer R.W., John Wiely and Sons, 2015 Elements of Photogrammetry with Application in GIS, Wolf P. R., McGraw Hill International Book Company, Fourth Edition, 2014. 4. Photogrammetry, Moffitt, Francis H. & Mikhail, Edward M., Harper and Row Publishers, 1980.			
	Other References	1. Thermal microwave radiation: Applications for remote sensing, Chritian Matzler., The institution of Engineering and Technology, London, 2006 2. Remote Sensing: Models and Methods for Image Processing, Schowengerdt, R. A., Academic Press, 2007. 3. Aerial Photography and Image Interpretation, Paine D. P., Kiser J. D., John Wiley & Sons, Inc., 2012.			

CO Mapping with POs and PSOs

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
COXX.1	3	2		2				2			1	2	1
COXX.2	2	3	2	2				2			1	2	1
COXX.3	2	2	3	2				2			1	2	1
COXX.4	3	1	1	2				2			2	2	1
COXX.5	2	3		3				2			1	2	1
COXX.6	2	2	3	2				2			1	2	1
CVLXX	**2**	**2**	**2**	**2**				**2**			**1**	**2**	**1**

School: SSES		**Batch: 2025-27**	
Program: M.TECH		**Current Academic Year: 2025-2026**	
Branch: CE		**Semester: II**	
1	Course Code		Course Name: GIS DATA ANALYSIS
2	Course Title	GIS DATA ANALYSIS	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Departmental Elective (GIS and Remote Sensing)	
5	Course Objective	To familiarize with the analytical functions of the GIS and to learn the versatile application capabilities and different GIS analysis techniques.	
6	Course Outcomes	At the end of the course, the students would be able to, CO1. Understand the formats in which the raster and vector data are stored CO2. Understand how both the data are stored and manipulated CO3. Use the different spatial data analysis tools CO4. Implement the network and 3-D analysis CO5. Use the raster and vector data for modelling and use it in several applications CO6. Apply the data in different applications	
7	Course Description		
8	Outline syllabus		

S No	UNIT	Title	CO Mapping
	Unit 1	**Introduction to GIS Data**	**CO1**
	A	Introduction to Vector data file formats	
	B	Introduction to Raster data file formats	
	C	Tabular data design, functions, pitfall and reprocessing, tables, queries, and basic geoprocessing tools	
	D	Vector and Raster Data Model; Miscellaneous data model – TIN, Quadtree etc	
	Unit 2	**Spatial Data Analysis**	**CO2**
	A	Spatial interpolation, measurement and analysis methods, reclassification techniques	
	B	Buffer analysis, overlay analysis, Vector overlay analysis, Topological overlay, raster over lay analysis – measurement of length, perimeter and area	
	C	Queries, 2D to 3D conversion, advantages and disadvantages	
	Unit 3	**Advanced Data Analysis**	**CO3**
	A	Network Analysis, Routing, GeoCoding, Proximity Analysis	
	B	3-D Analysis, DTM and DEM	
	C	Applications of network and 3-d analysis	
	Unit 4	**GIS Modelling**	**CO4, CO5**
	A	GIS modelling, Basic elements – classification, model processing, integration, Binary models, index model	
	B	Regression models – linear regression model, logistic	

		regression model, process model			
	C	Applications – problem identification– designing data model, project management and evaluation – implementation			
	Unit 5	**Web GIS and Post GIS**			
	A	Web GIS and cloud-based GIS platforms			
	B	GIS in decision-making and policy planning; Emerging trends in GIS (AI integration, Big Data, real-time GIS)			
	C	Post GIS			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. Burrogh .P.A, "Principles of Geographical Information System for Land Resources Assessment", Oxford Publications, 1980. 2. Paul A. Longley, Micheal F. Goodchild, David J. Magaine David J. Magaine, David W .Rhind, "Geographical Information System", Vol. I & II, John Wiley & Sons. Inc., 1999.			
	Other References	1. Chandra .A.M and Ghosh .S.K , "Remote Sensing and GIS", Narosa Publishing House, New Delhi, 2000. 2. Kang-Tsung Chang, "Introduction to Geographical Information System", Fourth Edition, Tata McGraw Hill, 2008.			

CO Mapping with POs and PSOs

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
COXX.1	3	2	2	3				2					
COXX.2	2	3	1	3				2					
COXX.3	1	1	3	3				2					
COXX.4		2	3	3			3	2					
COXX.5		2	3	3		2	3			2			
COXX.6		3	3	3						2			
CVLXX	**2**	**2**	**3**	**3**		**2**	**3**	**2**		**2**			

School: SSES		**Batch : 2025-27**	
Program: M.TECH		**Current Academic Year: 2025-2026**	
Branch: CE		**Semester: I**	
1	Course Code	CVP5127 | Course Name: GIS Fundamental Lab	
2	Course Title	GIS Fundamental Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Departmental Elective (GIS and Remote Sensing)	
5	Course Objective		
6	Course Outcomes	At the end of the course, the students would be able to, CO1. Install the sw and know the basic interface of the GIS sw CO2. Convert raster data into vector data after applying projection CO3. Populate the objects and bring external data to the map CO4. Perform spatial and Non-Spatial Analysis on the vector data CO5. Understand the image processing tool and apply for image enhancement and analysis CO6. Perform image classification and temporal analysis	
7	Course Description		
8	Outline syllabus		

S No	UNIT	Title	CO Mapping
	Unit 1	**Introduction to the GIS sw**	**CO1, CO2**
	A	GIS sw interface and data storage	
	B	Image Georeferencing, Projection and Transformation	
	C	Raster to Vector conversion, data cleaning,	
	Unit 2	**Vector Data Capture and Storage**	**CO3**
	A	Populating objects, bringing external data to the map	
	B	Building spatial and non-spatial query	
	C	Preparation of Thematic maps, Layout and Visualisation	
	Unit 3	**Vector Data Analysis**	**CO4**
	A	Spatial and Non-spatial Analysis	
	B	Network Analysis	
	C	3-D Analysis	
	Unit 4	**Image Analysis**	**CO5**
	A	Introduction to the Image Analysis tool in GIS sw,	
	B	Image enhancement	
	C	Image Analysis	
	Unit 5	**Image Classification**	**CO6**
	A	Supervised Image classification	
	B	Unsupervised Image classification	
	C	Temporal comparison	

	Mode of examination	Practical		
	Weightage Distribution	CA	Viva	ETE
		75%		25%
	Text book/s*	1. GIS Lab Manual and ArcGIS Manual 2. Image analysis with ArcGIS Manual		
	Other References	1. Understanding GIS: An ArcGIS Project Workbook. Published by ESRI 2. The ESRI guide to GIS Analysis, Vol-1-3 3. The ArcGIS Book (https://downloads.esri.com/esripress/PDFs/The-ArcGIS-Book-second-edition.pdf) 4. The ArcGIS Imagery Book (https://downloads.esri.com/esripress/PDFs/The-ArcGIS-Imagery-Book.pdf)		

CO Mapping with POs and PSOs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
COXX.1		2		3		2		3			1	3	1
COXX.2		2		3		2		3			1	3	1
COXX.3		2		3		2		3			1	3	1
COXX.4		2	3	3		2		3			1	3	1
COXX.5		2	3	3		2		3			1	3	1
COXX.6		2	3	3		2		3			1	3	1
CVPXX		**2**	**3**	**3**		**2**		**3**			**1**	**3**	**1**

School: SSES		**Batch : 2025-27**	
Program: M.TECH		**Current Academic Year: 2025-2026**	
Branch: CE		**Semester: I**	
1	Course Code	CVT5101	Course Name: APPLICATIONS OF REMOTE SENSING AND GIS IN CIVIL ENGINEERING
2	Course Title	APPLICATIONS OF REMOTE SENSING AND GIS IN CIVIL ENGINEERING	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	PC	
5	Course Objective	This course aims to provide the students of Civil Engineering a general overview of the use of GeoInformatics and its application in the field of Civil Engineering	
6	Course Outcomes	At the end of the course, the students should be able to CO7. Understand the fundamentals of GIS, Remote Sensing and GPS CO8. Know the data acquisition and processing techniques CO9. Explore the analysis of data and readily available data CO10. Understand the application of GeoInformatics in Water Resources, Hydrology and Agriculture CO11. Explore the applications in Transportation, Geotechnical, Environmental and Structural Engineering CO12. Apply the Geo-Informatics technology in different fields of Civil Engineering	
7	Course Description	This course provides Civil Engineering students with a comprehensive introduction to GeoInformatics and its diverse applications within the field of Civil Engineering. It covers the fundamental concepts, tools, and techniques of GeoInformatics, including Geographic Information Systems (GIS), Remote Sensing, and Global Positioning Systems (GPS).	
8	Outline syllabus		

S No	UNIT	Title	CO Mapping
	Unit 1	**Fundamentals of Remote Sensing (RS), GIS, and GPS**	**CO1**
	A	**Introduction to Remote Sensing (RS)**	
	B	GIS and Spatial Data Concepts	
	C	Global Positioning System (GPS) and Differential GPS (DGPS)	
	Unit 2	**RS & GIS Data Acquisition, Processing, and UAV Applications**	**CO2**
	A	Satellite, UAV, and GIS Data Sources	
	B	Image Processing Techniques	
	Unit 3	**Raster & Vector Analysis, Google Earth Pro & Analysis Ready Data**	**CO3, CO4**
	A	GIS Spatial Analysis & Digital Elevation Models (DEM)	

	B	Google Earth Pro & NASA Giovanni for Data Analysis			
	Unit 4	**RS & GIS Applications in Water Resources, Hydrology, and Agriculture**			**CO5**
	A	Hydrology & Water Resources Engineering			
	B	Agricultural Applications			
	Unit 5	**RS & GIS Applications in Transportation, Geotechnical, Environmental & Structural Engineering**			**CO5**
	A	Transportation & Urban Planning			
	B	Geotechnical & Structural Engineering			
	C	Environmental Applications			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. Lillesand, T.M., Kiefer, R.W., & Chipman, J.W. (2015). *Remote Sensing and Image Interpretation*. Wiley. 2. Longley, P.A., Goodchild, M.F., Maguire, D.J., & Rhind, D.W. (2015). *Geographic Information Systems and Science*. Wiley. 3. Jensen, J.R. (2013). *Remote Sensing of the Environment: An Earth Resource Perspective*. Pearson.			
	Other References				

CO Mapping with POs and PSOs

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
COXX. 1	2	1			3					1					
COXX. 2	2	1			3					1					
COXX. 3	2	1			3					1					
COXX. 4	2	1		3	3				1	1	2	3	3	2	3
COXX. 5	2	1		3	3		2		1	2	2	3	3	2	3
COXX. 6	2	1		3	3				2	1	2	3	3	2	3
CVLX X	**2**	**1**		**3**	**3**		**2**			**1**	**2**	**3**	**3**	**2**	**3**

School: SSES		**Batch : 2025-27**	
Program: M.TECH		**Current Academic Year: 2025-2026**	
Branch: CE		**Semester: I**	
1	Course Code	CVT5113 | Course Name: FUNDAMENTALS OF IMAGE PROCESSING	
2	Course Title	FUNDAMENTALS OF IMAGE PROCESSING	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Departmental Elective (GIS and Remote Sensing)	
5	Course Objective	This course aims to develop fundamentals of Digital Image processing tools to extract object information and techniques and its integration	
6	Course Outcomes	At the end of the course, the students would be able to, CO1. Understand the basics of digital data, image format and data extraction CO2. Know about different image distortions, errors and its rectification CO3. Apply various image enhancement techniques and error removal CO4. Understand the different methods of image classification and calculation of various indices CO5. Perform image analysis and interpretation CO6. Apply the satellite images and various applications	
7	Course Description	This course explains the fundamentals of satellite image acquisition, errors, distortions, and its rectification, image enhancement, classification methods and analysis of classified images for various applications	
8	Outline syllabus		

S No	UNIT	Title	CO Mapping
	Unit 1	**Image acquisition and format**	**CO1**
	A	Satellite data acquisition, DN characters-kernels- storage devices, CC, CDisk, Optical disk, Data retrieval	
	B	Export and import, Data formats, BSQ, BIL, BIP, Run length encoding	
	C	Image Compression, Data products, hard copy, digital products, Image display system requirement.	
	Unit 2	**Image distortion and rectification**	**CO2**
	A	Introduction, Sensor model, Preprocessing and Post processing Geometric distortion, sources and causes for distortion	
		Rectification, GCP, Resampling, Image registration, transformation, Radiometric distortion, sources and causes	
	C	Computation of radiance, Computation of reflectance, cosmetic operations, Noise removal, atmospheric correction.	
	Unit 3	**Image enhancement**	**CO3**
	A	Satellite image statistics, Univariate and multi-variate statistics, Basics of Histogram, noise models, image quality	
	B	Contrast manipulation, grey level thresholding, level slicing, contrast stretching, Spatial feature manipulations, spatial filtering, convolution	
	C	Low pass, high pass, edge enhancement, edge detection,	

		Fourier analysis		
	Unit 4	**Image classification**		**CO4, CO5**
	A	Introduction, Classification techniques, feature extraction, Supervised, training stage, classification stage, scatterogram, minimum distance to mean classifier		
	B	Parallelepiped classifier, Gaussian maximum Likelihood classifier, unsupervised classification		
	C	Hybrid classifier, classification of mixed pixel-fuzzy classification, output stage, classification accuracy, error matrix.		
	Unit 5	**Image analysis**		**CO5, CO6**
	A	Digital Image interpretation, Pattern recognition, shape analysis, Textural analysis		
	B	Decision concepts, fuzzy sets and Evidential reasoning, Change detection, multitemporal data merging		
	C	Multi sensor image merging, merging image data with ancillary data, Expert system, Artificial Neural Network, Integration with GIS.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		75%		25%
	Text book/s*	1. Thomas M. Lilles and, Ralph W. Kiefer, Jonathan W. Chipman, "Remote sensing and image interpretation", John Wiley & Sons, 2008. 2. John R. Jenson "Introducing Digital Image Processing", Prentice Hall, New Jersey 1986.		
	Other References	1. Anji Reddy .M, "Textbook of Remote Sensing and Geographical Information systems", BS Publications, Hyderabad. 2011. ISBN: 81-7800-112-8. 2. Robert A. Schowengergt, "Techniques for Image Processing and Classification in Remote Sensing", ISBN 13: 9780126289800, 1984.		

CO Mapping with POs and PSOs

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3
COXX.1	3	1	2	2				2			1	2	1
COXX.2	1	3	1	2				2			1	2	1
COXX.3	2	2	3	2				2			1	2	1
COXX.4	1	3	2	2				2			1	2	1
COXX.5	2	1	3	2				2			1	2	1
COXX.6	2	2	3	2				2				1	2
CVLXX	**2**	**2**	**2**	**2**				**2**			**1**	**2**	**1**

School: SSES		**Batch : 2025-27**	
Program: M.TECH		**Current Academic Year: 2025-2026**	
Branch: CE		**Semester: I**	
1	Course Code	CVP5101	Course Name: APPLICATIONS OF REMOTE SENSING AND GIS IN CIVIL ENGINEERING LAB
2	Course Title	APPLICATIONS OF REMOTE SENSING AND GIS IN CIVIL ENGINEERING LAB	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	PC	
5	Course Objective	By the end of this course, students will be able to apply remote sensing and GIS techniques to real-world civil engineering tasks using modern software and spatial data tools.	
6	Course Outcomes	CO1. Demonstrate the ability to access and utilize RS, GIS, and GPS data using appropriate software tools. CO2. Execute LULC classification and compute spectral indices for environmental and urban analysis. CO3. Perform raster and vector analysis using digital elevation data and Earth observation platforms. CO4. Integrate data from Google Earth Pro and UAVs to enhance spatial accuracy in civil engineering applications. CO5. Design and present a cartographically accurate civil engineering project utilizing geospatial data. CO6. Analyse the raster and vector data for civil engg applications	
7	Course Description	A hands-on laboratory course exploring the integration of RS, GIS, GPS, and UAV data for solving civil engineering problems through spatial analysis and visualization.	
8	Outline syllabus		

S No	UNIT	Title	CO Mapping
	Unit 1	**Fundamentals of Remote Sensing (RS), GIS, and GPS**	**CO1**
	A	Introduction to Remote Sensing & GIS Software	
	B	Satellite Data Acquisition & Download	
	Unit 2	**Classification and Indices**	**CO2**
	A	Land Use Land Cover (LULC) Classification	
	B	Remote Sensing Indices (NDVI, NDBI, NDWI, etc.)	
	Unit 3	**Raster & Vector Analysis, Google Earth Pro & Analysis Ready Data**	**CO3, CO4**
	A	GIS Spatial Analysis & Digital Elevation Models (DEM)	
	B	Google Earth Pro & NASA Giovanni for Data Analysis	
	Unit 4	**Google Earth Pro and UAV's**	**CO5**
	A	Google Earth Pro & Data Integration	
	B	Introduction to UAV Mapping & Data Acquisition	
	Unit 5	**Applications**	**CO5**
	A	DEM Analysis	
	B	Cartographic Principles & Map Layout Design	
	C	Practical Major Project	

	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		75	-	25%
	Text book/s*	1. Jensen, J. R. (2016). Introductory Digital Image Processing: A Remote Sensing Perspective (4th Edition). Pearson. 2. Burrough, P. A., & McDonnell, R. A. (1998). Principles of Geographical Information Systems. Oxford University Press. 3. Kumar, P. (2021). Remote Sensing and GIS for Civil Engineers. CRC Press. 4. Lillesand, T. M., Kiefer, R. W., & Chipman, J. (2015). Remote Sensing and Image Interpretation. Wiley. 5. Colomina, I., & Molina, P. (2014). Unmanned Aerial Systems for Photogrammetry and Remote Sensing: A Review. ISPRS Journal of Photogrammetry and Remote Sensing.		
	Other References			

CO Mapping with POs and PSOs

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
COXX.1	2	1			3					1					
COXX.2	2	1			3					1					
COXX.3	2	1			3					1					
COXX.4	2	1		3	3				1	1	2	3	3	2	3
COXX.5	2	1		3	3		2		1	2	2	3	3	2	3
COXX.6	2	1		3	3				2	1	2	3	3	2	3
CVLXX	**2**	**1**		**3**	**3**		**2**			**1**	**2**	**3**	**3**	**2**	**3**

School: SSES		**Batch : 2025-27**	
Program: M.TECH		**Current Academic Year: 2025-2026**	
Branch: CE		**Semester: II**	
1	Course Code	CVT5114 | Course Name: Fundamentals of SAR and data processing	
2	Course Title	Fundamentals of SAR and data processing	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Departmental Elective (GIS and Remote Sensing)	
5	Course Objective	To introduce students to the fundamentals of Synthetic Aperture Radar (SAR) and its image formation techniques, processing methods, and real-world applications in remote sensing and object identification.	
6	Course Outcomes	At the end of the course, the students would be able to, CO1. Understand the fundamentals of SAR and its working CO2. Understand how the technique is used for range calculations CO3. Understand how the SAR images are formed and how they can be processed to get meaningful outputs CO4. Know about the errors in the image and how they can be removed to improve the image quality CO5. Understand different applications of SAR data and object identification CO6. Understand and process the SAR data, and apply the same to different applications in identifying objects	
7	Course Description	This course provides an in-depth introduction to Synthetic Aperture Radar (SAR) and its applications in remote sensing and image analysis. Students will explore the fundamental principles behind SAR systems, including their design, signal processing techniques, and image formation processes.	
8	Outline syllabus		

S No	UNIT	Title	CO Mapping
	Unit 1	**Introduction to Synthetic Aperture Radar**	**CO1**
	A	Introduction, Origin and Examples of SAR	
	B	Timing and Geometry	
	C	The Synthetic Aperture	
	Unit 2	**Ranging and Imaging**	**CO2**
	A	Range via Echoing	
	B	Mathematical model, Doppler effect,	
	C	Synthetic Aperture and Exposure time, Azimuth resolution	
	Unit 3	**Image formation**	**CO3**
	A	Image formation chain,	
	B	Processing tools	
	C	Fourier transformation and Interpolation	
	Unit 4	**Phase error and Image quality**	**CO4, CO5**
	A	Sources of Phase errors, Phase error estimation, removal of phase error	
	B	Speckle and Multilook	
	C	Speckle reduction techniques, Image quality metrics	
	Unit 5	**Remote Sensing with Synthetic Aperture Radar**	**CO5, CO6**
	A	Polarimetry and Ocean remote sensing	

	B	Interferometry and change detection on land		
	C	Moving objects in SAR		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		75%		25%
	Text book/s	1. Richards, M. A. (2014). Fundamentals of radar signal processing (2nd ed.). McGraw-Hill Education. 2. Curlander, J. C., & McDonough, R. N. (1991). Synthetic aperture radar: Systems and signal processing. Wiley-Interscience.		
	Other References	3. Skolnik, M. I. (Ed.). (2008). Radar handbook (3rd ed.). McGraw-Hill Education.		

CO Mapping with POs and PSOs

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PSO 1**	**PSO 2**	**PSO 3**
COXX.1	3	1	1	3				2		1	2	3	1
COXX.2	1	3	2	3				2		1	2	3	1
COXX.3	1	2	3	3				2		1	2	3	1
COXX.4	2	3	1	3				2		1	2	3	1
COXX.5	1	1	3	3				2		1	2	3	1
COXX.6	1	1	1	3				2		1	2	3	1
CVLXX	**1**	**2**	**2**	**3**				**2**		**1**	**2**	**3**	**1**

School: SSES		**Batch : 2025-27**	
Program: M.TECH		**Current Academic Year: 2025-2026**	
Branch: CE		**Semester: II**	
1	Course Code	CVT5104	Course Name: PYTHON AND GOOGLE EARTH ENGINE FOR REMOTE SENSING & GIS
2	Course Title	PYTHON AND GOOGLE EARTH ENGINE FOR REMOTE SENSING & GIS	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	By the end of the course, students will be able to analyze, evaluate, and design geospatial studies using Python and cloud-based platforms with an understanding of the theoretical foundations of GIS and remote sensing workflows.	
6	Course Outcomes	CO1. Explain core Python concepts and data structures for GIS and remote sensing applications. CO2. Apply image processing techniques and basic classification methods to remote sensing datasets. CO3. Analyze spatial patterns using GIS functions including spatial joins, interpolation, and time-series analysis. CO4. Evaluate cloud-based geospatial platforms and assess their suitability for environmental and agricultural monitoring. CO5. Design a theoretical framework for a research-oriented geospatial project with visualization and presentation components. CO6. Apply the data in different applications	
7	Course Description	A theory-focused exploration of geospatial data science using Python and Google Earth Engine, emphasizing remote sensing analytics, GIS operations, and real-world application design.	
8	Outline syllabus		

S No	UNIT	Title	CO Mapping
	Unit 1	**Introduction to Python for GIS & Remote Sensing**	**CO1**
	A	**Introduction to Python for GIS**	
	B	**Geospatial Data in Python**	
	C	**Working with Vector Data and Raster Data; Visualisation**	
	Unit 2	**Remote Sensing Data Processing in Python**	**CO2**
	A	**Reading and Displaying Satellite Images**	
	B	**Computing Spectral Indices; Image Classification Basics (Supervised vs. Unsupervised)**	
	Unit 3	**GIS Operations Using Python**	**CO3, CO4**
	A	Spatial Joins and Overlay Analysis; Distance Calculations and Network Analysis; Geospatial Interpolation & Contour Mapping	
	B	Time-Series Analysis of Satellite Data; Change Detection in Remote Sensing; Case Study: Deforestation and Urban Growth Analysis	
	Unit 4	**Google Earth Engine (GEE) for Remote Sensing & GIS**	**CO5, CO6**

	A	Introduction to Google Earth Engine (GEE) & JavaScript API; Accessing and Visualizing RS Datasets in GEE	
	B	**Generating Time-Series Analysis in GEE; Case Study: GEE for Agriculture & Climate Monitoring**	
	Unit 5	**Applications**	**CO5, CO6**
	A	Research in RS & GIS: How to Conduct a Study; Working on Real-World Datasets; Developing a Small Geospatial Project	
	B	Project Implementation & Visualization; Final Project Presentation & Review; Future Trends in RS & GIS (Drones, AI, Cloud GIS)	
	Mode of examination	Theory	
	Weightage Distribution	CA: 75% / MTE: / ETE: 25%	
	Text book/s*	1. **Zandbergen, P. A. (2020).** *Python Scripting for ArcGIS Pro.* Esri Press. 2. **Liu, Y. & Mason, P. (2016).** *Essential Image Processing and GIS for Remote Sensing.* Wiley. 3. **Gorelick, N., et al. (2017).** *Google Earth Engine: Planetary-scale geospatial analysis for everyone. Remote Sensing of Environment.*	
	Other References		

CO Mapping with POs and PSOs

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3
COXX.1		2		3		2		3			1	3	1
COXX.2		2		3		2		3			1	3	1
COXX.3		2		3		2		3			1	3	1
COXX.4		2	3	3		2		3			1	3	1
COXX.5		2	3	3		2		3			1	3	1
COXX.6		2	3	3		2		3			1	3	1
CVPXX		**2**	**3**	**3**		**2**		**3**			**1**	**3**	**1**

School: SSES		**Batch : 2025-27**	
Program: M.TECH		**Current Academic Year: 2026-2027**	
Branch: CE		**Semester: III**	
1	Course Code	CVT6102	Course Name: R FOR REMOTE SENSING & GIS
2	Course Title	R FOR REMOTE SENSING & GIS	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	By the end of this course, students will be able to process, analyze, and automate geospatial and remote sensing workflows using R for real-world applications.	
6	Course Outcomes	CO1. Describe the structure and types of geospatial data in R and perform basic spatial operations on vector and raster datasets CO2. Apply raster data processing techniques in R to manipulate multi-band imagery and compute remote sensing indices.X CO3. Analyze spatial relationships and patterns in vector and raster datasets using spatial statistics and geospatial querying techniques in R. CO4. Evaluate and compare classification models for remote sensing imagery using accuracy assessment metrics and feature selection techniques. CO5. Design and automate geospatial workflows in R to solve real-world problems in environmental monitoring, urban analysis, and disaster management. CO6. Apply the data in different applications	
7	Course Description	An applied course on geospatial data analysis using R , integrating spatial statistics, machine learning, and real-world GIS automation.	
8	Outline syllabus		

S No	UNIT	Title	CO Mapping
	Unit 1	**Introduction to R and Geospatial Data Structures**	**CO1**
	A	**Overview of R for GIS and Remote Sensing;** Introduction to core R packages	
	B	**Geospatial Data Structures in R**	
	C	**Basic spatial operations: sub-setting, filtering, and summarizing vector and raster data**	
	Unit 2	**Raster Data Processing**	**CO2**
	A	**Raster Data Manipulation in R**	
	B	**Image Enhancement and Pre-processing; Manipulating multi-band raster data; Calculating vegetation indices**	
	Unit 3	**Spatial Analysis and Vector Data Processing**	**CO3**
	A	Spatial operations with sf and sp: buffering, dissolving, spatial joins; Spatial queries: point-in-polygon, nearest neighbor, and distance-based queries	
	B	Geospatial Statistics and Analysis; Introduction to spatial statistics: Kernel Density Estimation (KDE), Moran's I (spatial autocorrelation); Performing spatial analysis using spdep for spatial dependence; Visualizing spatial patterns using ggplot2	

		and leaflet	
	Unit 4	**Machine Learning and Classification for Remote Sensing**	**CO4**
	A	Introduction to Supervised Classification; Unsupervised Classification and Clustering;	
	B	Accuracy Assessment and Feature Selection	
	Unit 5	**Automation and Real-World Applications in GIS and Remote Sensing**	**CO5, CO6**
	A	Automating GIS Workflows in R; Writing R scripts for batch processing and automation of GIS tasks; Automating tasks like image classification, geospatial data transformation, and analysis	
	B	Environmental monitoring: Vegetation change detection, deforestation mapping; Urban studies: Land use/land cover change detection; Disaster management: Flood mapping, wildfire monitoring, and post-disaster damage assessment	
	Mode of examination	Theory	
	Weightage Distribution	CA: 75% / MTE: / ETE: 25%	
	Text book/s*	1. Bivand, R. S., Pebesma, E., & Gómez-Rubio, V. (2013). *Applied Spatial Data Analysis with R* (2nd ed.). Springer. 2. Lovelace, R., Nowosad, J., & Muenchow, J. (2019). *Geocomputation with R*. CRC Press. 3. Jensen, J. R. (2015). *Introductory Digital Image Processing: A Remote Sensing Perspective* (4th ed.). Pearson. 4. Brunsdon, C., & Comber, L. (2018). *An Introduction to R for Spatial Analysis and Mapping* (2nd ed.). SAGE.	
	Other References	• Zhang, C., & Li, W. (2019). *Geospatial Artificial Intelligence: Principles and Applications*. Springer.	

CO Mapping with POs and PSOs

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
COXX. 1	2	1			3					1					
COXX. 2	2	1			3					1					
COXX. 3	2	1			3					1					
COXX. 4	2	1		3	3				1	1	2	3	3	2	3
COXX. 5	2	1		3	3		2		1	2	2	3	3	2	3
COXX. 6	2	1		3	3				2	1	2	3	3	2	3
CVLX X	**2**	**1**		**3**	**3**		**2**			**1**	**2**	**3**	**3**	**2**	**3**

School: SSES		**Batch : 2025-27**	
Program: M.TECH		**Current Academic Year: 2025-2026**	
Branch: CE		**Semester: II**	
1	Course Code	CVP5104	Course Name: PYTHON AND GOOGLE EARTH ENGINE FOR REMOTE SENSING & GIS LAB
2	Course Title	PYTHON AND GOOGLE EARTH ENGINE FOR REMOTE SENSING & GIS LAB	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status		
5	Course Objective	By the end of the course, students will be able to develop and implement geospatial workflows using Python and Google Earth Engine for real-world environmental and spatial analysis.	
6	Course Outcomes	CO1. Identify core Python libraries and tools used in geospatial and remote sensing workflows. CO2. Demonstrate how to manipulate and visualize raster and vector geospatial data using Python. CO3. Analyze satellite image data to extract spectral indices and perform basic classification. CO4. Evaluate and apply advanced spatial operations (e.g., interpolation, joins, time-series analysis) in geospatial contexts. CO5. Design and develop a small-scale geospatial application using Python or Google Earth Engine. CO6. Apply the data in different applications	
7	Course Description	A practical introduction to using Python and cloud-based platforms for geospatial analysis and remote sensing applications.	
8	Outline syllabus		

S No	UNIT	Title	CO Mapping
	Unit 1	**Introduction to Python for GIS & Remote Sensing**	**CO1**
	A	**Python Setup & Geospatial Libraries**	
	B	**Geospatial Data in Python**	
	C	**Working with Vector Data and Raster Data; Visualisation**	
	Unit 2	**Remote Sensing Data Processing in Python**	**CO2**
	A	**Reading and Displaying Satellite Images**	
	B	**Computing Spectral Indices; Image Classification Basics (Supervised vs. Unsupervised)**	
	Unit 3	**GIS Operations Using Python**	**CO3, CO4**
	A	Perform spatial joins, Distance Calculations, and Network Analysis; Geospatial Interpolation & Contour Mapping	
	B	Time-Series Analysis of Satellite Data; Change Detection in Remote Sensing	
	Unit 4	**Google Earth Engine (GEE) for Remote Sensing & GIS**	**CO3, CO4**
	A	Introduction to Google Earth Engine (GEE) & JavaScript API; Accessing and Visualizing RS Datasets in GEE	
	B	**Generating Time-Series Analysis in GEE; GEE for Agriculture & Climate Monitoring**	

	Unit 5	**Applications**			**CO5, CO6**
	A	Developing a Small Geospatial Project			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		75%		25%	
	Text book/s*	1. **Sherman, G. (2023).** *The PyQGIS Developer Cookbook.* Open Source Geospatial Foundation. 2. **Liu, Y. & Mason, P. (2016).** *Essential Image Processing and GIS for Remote Sensing.* Wiley. 3. **Gorelick, N., et al. (2017).** *Google Earth Engine: Planetary-scale geospatial analysis for everyone. Remote Sensing of Environment.*			
	Other References				

CO Mapping with POs and PSOs

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PSO 1**	**PSO 2**	**PSO 3**
COXX.1		2		3		2		3			1	3	1
COXX.2		2		3		2		3			1	3	1
COXX.3		2		3		2		3			1	3	1
COXX.4		2	3	3		2		3			1	3	1
COXX.5		2	3	3		2		3			1	3	1
COXX.6		2	3	3		2		3			1	3	1
CVPXX		**2**	**3**	**3**		**2**		**3**			**1**	**3**	**1**