PROGRAMME STRUCTURE

SHARDA SCHOOL OF ENGINEERING & TECHNOLOGY

Department of Civil Engineering

M. Tech. Civil Engineering (Specialization in Structural Engineering/Environmental Engineering/Geotechnical & Earthquake Engineering/Construction Management)

Programme Code: SET0310

Batch: 2023-25

Department of Civil Engineering M.TECH in Civil Engineering 2023-25																		
Course Structure for batches admitted in session 2023-24																		
Semester	Courses											Courses	Labs	L	T	P	Weekly contact	Credits
I	Programme Core-1 (3-1-0) 4	Programme Core-2 (3-1-0) 4	Departmental Elective-1 (3-0-0) 3	Departmental Elective-2 (3-0-0) 3	Departmental Elective-3 (3-0-0) 3	Research Methodology (1-0-2) 2	RBL-1 (0-0-0)	Programme Core-1 Lab (0-0-2) 1		Departmental Elective-1 Lab (0-0-2) 1		6	3	16	2	6	24	21
II	Programme Core-3 (3-1-0) 4	Programme Core-4 (3-0-0) 3	Departmental Elective-4 (3-0-0) 3	Departmental Elective-5 (2-0-0) 2	Departmental Elective-6 (3-0-0) 3	Departmental Elective-7 (3-0-0) 3	Community Connect (0-0-0) 2	Programme Core-3 Lab (0-0-2) 1	Departmental Elective-4 Lab (0-0-2)	Departmental Elective-5 Lab (0-0-2)	RBL-2 (0-0-0)	6	3	17	1	6	24	23
III	Seminar (0-0-4) 2	Dissertation -1 (0-0-20) 10										0	2	0	0	24	24	12
IV	Dissertation - II (0-0-32) 16											0	1	0	0	32	32	16
TOTAL CREDITS																		72

Courses	Structural Engineering	Environmental Engineering	Geotechnical & EQ Engineering	Construction Management
PC-1	Project Planning & Scheduling	Project Planning & Scheduling	Project Planning & Scheduling	Project Planning & Scheduling
PC-2	Higher Engineering Mathematics	Higher Engineering Mathematics	Higher Engineering Mathematics	Higher Engineering Mathematics
PC-3	Advanced Concrete Technology	Advanced Concrete Technology	Advanced Concrete Technology	Advanced Concrete Technology
PC-4	Health, Safety and Green Building Methodology	Health, Safety and Green Building Methodology	Health, Safety and Green Building Methodology	Health, Safety and Green Building Methodology
DE-1	Structural Dynamics	Geo-hazard and Geo-environmental Engineering	Geo-hazard and Geo-environmental Engineering	Contract laws and Regulation
DE-2	Advanced Structural Analysis	Environmental Chemistry & Biotechnology	Soil Foundation Interaction	Analysis of Construction cost and finances
DE-3	Advance RCC Design	Water & Waste water Treatment	Soil Dynamics and Machine Foundation	Construction Equipment Management
DE-4	Advanced Design of Steel Structures	Renewable Energy Technologies	Reinforced Soil Structure	Estimation and Quantity surveying
DE-5	Prestressed Concrete Member Design	Air Pollution Control	Sub-Soil Exploration	Quality Assurance and Quality Control
DE-6	Advanced Solid Mechanics	Environmental Planning using GIS	Advance Analysis of Shallow and Deep Foundation	Operational Research in CM
DE-7	Earthquake Resistant Design of Structures	Solid, Biomedical & Hazardous waste management	Seismic Analysis of Geotechnical Structures	Advanced Construction Techniques
PC-1 Lab	Project Planning & Scheduling Lab	Project Planning & Scheduling Lab	Project Planning & Scheduling Lab	Project Planning & Scheduling Lab
DE-1 Lab	Structural Modelling & Design Lab - 1	Water & Waste water Quality Testing Lab	ADVANCE SOIL MECHANICS LAB	Structural Modelling & Design-1 Lab
PC-3 Lab	Advance Concrete Technology Lab	Advance Concrete Technology Lab	Advance Concrete Technology Lab	Advance Concrete Technology Lab
DE-4 Lab	Structural Modelling & Design Lab - 2	Environmental Planning using GIS Lab	COMPUTATIONAL AND NUMERICAL METHODS IN GEOTECHNICAL ENGINEERING LAB	MSP and financial accounting lab
DE-5 Lab	Construction Management Lab-II (Estimator)	Environmental Modelling Lab	Construction Management Lab-II (Estimator)	Construction Management Lab-II (Estimator)

Programme / Branch: M.Tech. STR/ENV/CM/GT&EQ **Semester: I**

S. No.	Paper ID/Course ID	Subject Code	Subjects	Teaching Load L	T	P	Credits	Core/Elective Pre-Requisite/ Co Requisite	Type of Course[1]: 1. CC 2. AECC 3. SEC 4. DSE
THEORY SUBJECTS									
1	16270	CVL836	Project Planning & Scheduling	3	1	0	4		CC
	16285	CVL861	Higher Engineering Mathematics	3	1	0	4	MATHS 1 & 2	
2			**DEPARTMENTAL ELECTIVE-1**	3	0	0	3		DSE
	15238	CVL702	Structural Dynamics					Maths and Physics	
	16286	CVL868	Geo-hazard and Geo-environmental Engineering					Geotech. Engg.	
	16286	CVL868	Geo-hazard and Geo-environmental Engineering					Env. Engg.	
	15795	CVL827	Contract laws and Regulation					None	
3			**DEPARTMENTAL ELECTIVE -2**	3	0	0	3		DSE
	15239	CVL703	Advanced Structural Analysis					Structural Analysis I & II	
	15242	CVL665	Environmental Chemistry & Biotechnology					Waste Water Tech.	
	16287	CVL865	Soil Structure Interaction					Foundation Engg.	
	16288	CVL881	Construction Economics and Finance					Project Management	
4			**DEPARTMENTAL ELECTIVE-3**	3	0	0	3		DSE
	15791	CVL823	Advance RCC Design					RCC Design	
	16289	CVL880	Water and Sewage Treatment					Hydrology	
	16290	CVL869	Soil Dynamics and Machine Foundation					Foundation Engg.	
		CVL828	Construction Equipment Management					CM	
PRACTICAL									
7	16291	CVP836	Project Planning & Scheduling Lab	0	0	2	1		SEC
			DEPARTMENTAL ELECTIVE-1 LAB	0	0	2	1		DSE
	16292	CVP863	Structural Modelling & Design Lab - 1					Structural Analysis	
	16293	CVP880	Water & Waste water Quality Testing Lab					Env. Engg..	
	16294	CVP878	Advance Soil Mechanics Lab					Geotech. Engg	
	16292	CVP863	Structural Modelling & Design-1 Lab					Quantity Survey	
	16396	MRM001	Research Methodology	1	0	2	2		CC
	31350	RBL001	RBL-1	0	0	0	0		
						TOTAL	21		

[1] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Programme / Branch: M.Tech. STR/ENV/CM/GT&EQ **Semester: II**

S. No.	Paper ID/Course ID	Subject Code	Subjects	Teaching Load L	T	P	Credits	Core/Elective Pre-Requisite/ Co Requisite	Type of Course[2]: 1. CC 2. AECC 3. SEC 4. DSE
THEORY SUBJECTS									
1	17385	CVL716	Advanced Concrete Technology	3	1	0	4		CC
	16293	CVL877	Health, Safety and Green Building Methodology	3	0	0	3	MATHS 1 & 2	
2			**DEPARTMENTAL ELECTIVE-4**	3	0	0	3		DSE
	16294	CVL862	Advanced Steel Structure Design					Maths and Physics	
	15243	CVL666	Renewable Energy Technologies					Geotech. Engg.	
	15570	CVL731	Reinforced Soil Structure					Geotech. Engg.	
	15645	CVL804	Estimation and Quantity surveying					None	
3			**DEPARTMENTAL ELECTIVE -5**	2	0	0	2		DSE
	16295	CVL864	Prestressed Concrete Member Design					Structural Analysis I & II	
	16296	CVL882	Air Pollution & Control Measures					Waste Water Tech.	
	16297	CVL871	Sub-Soil Exploration					Foundation Engg.	
	16298	CVL873	Quality Assurance and Quality Control					Project Management	
4			**DEPARTMENTAL ELECTIVE-6**	3	0	0	3		DSE
	16299	CVL860	Advanced Solid Mechanics					RCC Design	
	16365	CVL679	Environmental Planning using GIS					Hydrology	
	16300	CVL866	Advance Analysis of Shallow and Deep Foundation					Foundation Engg.	
	16301	CVL874	Operational Research in CM					Maths	
			DEPARTMENTAL ELECTIVE-7	3	0	0	3		DSE
	15568	CVL708	Earthquake Resistant Design of Structures					Str. Engg	
	15027	CVL642	Solid, Biomedical & Hazardous waste management					Env. Engg	
	16302	CVL867	Seismic Analysis of Geotechnical Structures					Geotech. Engg.	
	16303	CVL875	Advanced Construction Techniques					Construction Mgmt	
PRACTICAL									
7	16304	CVP876	Advance Concrete Technology Lab	0	0	2	1		SEC
			DEPARTMENTAL ELECTIVE-4 LAB	0	0	2	1		DSE
	16305	CVP870	Structural Modelling & Design Lab - 2					Structural Analysis	

[2] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

	16365	CVP679	Environmental Planning using GIS Lab					Env. Engg..	
	16306	CVP879	Computational and Numerical Methods in Geotechnical Engineering Lab					Geotech. Engg	
	16307	CVP872	MSP and financial accounting lab					Quantity Survey	
	16305	CVP870	Structural Modelling & Design Lab - 2					Structural Analysis	
			DEPARTMENTAL ELECTIVE-5 LAB	0	0	2	1		DSE
	15910	CVP853	Construction Management Lab-II (Estimator)					Quantity Survey	
	15145	CVP655	Environmental Modelling Lab					Env. Engg.	
	15910	CVP853	Construction Management Lab-II (Estimator)					Quantity Survey	
	16119	CCU101	Community Connect	0	0	4	2		CC
		RBL002	RBL-2	0	0	0	0		
							TOTAL	23	

Programme / Branch: M.Tech. STR/ENV/CM/GT&EQ **Semester: III**

S. NO.	Paper ID/Course ID	Subject Code	Subjects	Teaching Load			Credits		
				L	T	P		Core/Elective	Type of Course[1]:
								Pre-Requisite/	1. CC
								Co Requisite	2. AECC
									3. SEC
									4. DSE
1	15247	CVL681	SEMINAR	0	0	4	2	NA	AECC
2	15249	CVL691	DISSERTATION-I	0	0	20	10	NA	AECC
TOTAL							12		

Programme / Branch: M.Tech. STR/ENV/CM/GT&EQ **Semester: IV**

S. NO.	Paper ID/Course ID	Subject Code	Subjects	Teaching Load			Credits		
				L	T	P		Core/Elective	Type of Course[1]:
								Pre-Requisite/	1. CC
								Co Requisite	2. AECC
									3. SEC
									4. DSE
1	15249	CVL 692	DISSERTATION PART-II	0	0	32	16	NA	AECC
						TOTAL	16		

School: SSET		**Batch : 2023-25**	
Programme: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE (All)		**Semester: I**	
1	Course Code	CVL861	Course Name: Higher Engineering Mathematics
2	Course Title	Higher Engineering Mathematics	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	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	The students will be able to CO1: Demonstrate the application of Matrices and Determinants and Linear Equations in engineering. CO2: Apply various statistical methods that are relevant in engineering contexts. CO3: Utilize Finite Difference and Finite Element schemes for problem-solving in engineering. CO4: Apply the principles and theories of calculus of variation to engineering scenarios. CO5: Employ probability theory to analyse engineering situations and make informed decisions. CO6: Integrate mathematical concepts into engineering problems, fostering innovative solutions.	
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	**Statistical Methods**	
	A	Measures of Central Tendency, Dispersion	CO2, CO6
	B	Skewness and Kurtosis – Principles of least squares	
	C	Correlation and regression	
	Unit 3	**Introduction to Numerical Methods**	
	A	Introduction to Finite Difference Scheme	CO3, CO6
	B	Introduction to Finite Element Scheme	
	C	Unequal interval problems.	
	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	
		25%	25%	50%	
	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	2	2	2	3	1	1	-	2	3	-	2	2

School: SSET		**Batch : 2023-25**	
Programme: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE (Structures)		**Semester: I**	
1	Course Code	CVL702	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	
		25%	25%	50%	
	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**

School: SSET		**Batch: 2023-25**	
Programme: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE (Structures)		**Semester: I**	
1	Course Code	CVL 703 | 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	
		25%	25%	50%	
	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

School: SSET		**Batch : 2023-25**	
Programme: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE (STRUC. ENGG)		**Semester: II**	
1	Course No.	CVL862	
2	Course Title	Advanced Steel Structure Design	
3	Credits	3	
4	Contact Hours (L-T-P)	(3-0-0)	
5	Course Objective	Structural Steel is one of the commonly used materials for construction of high-rise buildings, bridges and other structures. This course is about studying properties of steel, behaviour of structural steel elements, and design procedures for these elements to withstand structural loads according to IS 875 and IS 800-2007. Objective of this course to get knowledge of design of beam-column, plastic design of indeterminate structure, Design of plate girder and role of steel as prestress member. Students will able to design complex structure member.	
6	Course Outcomes	The students will be able to CO1: Recall the various categories of failures that can occur in steel structures. CO2: Interpret the distinctions among diverse beam-column components; evaluate the impact of bending on these components. CO3: Apply the concept of Plastic Analysis to address the requirements of indeterminate structures. CO4: Analyze and create designs for Roof trusses by examining their structural properties and suitability for specific applications. CO5: Evaluate the different types of prestressing steel and their respective applications. CO6: Design steel structures in accordance with the recommendations outlined in the IS code.	
7	**Outline syllabus:**		
Unit A		**Introduction of steel structure**	
A		Structural steels.	CO1, CO6
B		Brittle fracture.	CO1, CO6
C		Fatigue.	CO1, CO6
Unit B		**Stability of beam columns, frames**	
A		Introduction of Beam-Column.	CO2, CO6
B		Modes of Failures.	CO2, CO6
C		Design Specification as per IS 800.	CO2, CO6
Unit C		**Plastic design of steel structures**	
A		Basic Assumptions, Shape Factors, Load Factors, Moment Redistribution, Static and Kinematic theorems.	CO3, CO6
B		Analysis of Single Bay and Two Bay Portal Frames, Methods of Plastic Moment Redistribution.	CO3, CO6
C		Effect of Axial Force and Shear Force on Plastic Moment.	CO3, CO6
Unit D		**Plate girders**	

A		Design of Sections.	CO4, CO6
B		Bearing and Intermediate Stiffeners, connections.	CO4, CO6
C		Flange and Web Splices.	CO4, CO6
Unit E		**Prestressed steel construction and Introduction of Gantry girder.**	
A		Introduction to Steel Property for prestress	CO5, CO6
B		Role of steel in prestress.	CO5, CO6
C		Introduction of gantry girder.	CO5, CO6
8	Course Evaluation		
8.1	Course work: 25 marks		
8.11	Attendance	75%	
8.12	Homework	05 assignments, 2 Assignment considered; 10 marks	
8.13	Quizzes	4 best quizzes (based on assignments) in tutorial hours; 20 marks	
8.14	Projects	none	
8.15	Presentations	none	
8.16	Any other		
8.2	MTE	One, 25 marks	
8.3	End-term examination: 50 marks		
9	References		
9.1	Text book	N. Subramanian, "Design of Steel Structures", Oxford University Press.	
9.2	Other references	1. IS: 875 – 1987 "Code of Practice for Design Loads" (Parts I to V). 2. IS: 800 – 2007 "Use of Structural Steel in General Building Constructions", BIS. 3. Steel Table by BIS 4. S SBhaviKatti, Design of Steel Structures (By Limit State Method as Per IS: 800 2007)I K International Publishing House, 2009. 5. Charles G. Salmon, John E. Johnson, FarisA.Malhass, "Steel Structures: Design and Behaviour," 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

School: SSET		**Batch : 2023-25**	
Programme: M.Tech.		**Current Academic Year: 2023-24**	
Branch: CE		**Semester: II**	
1	Course Code	CVL864 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, CO6
	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	**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	
		25%	25%	50%	
	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

School: SSET		**Batch : 2023-25**	
Programme: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE (STRUC. ENGG)		**Semester: II**	
1	Course Code	CVL860 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, formation of plastic hinge			CO5, CO6
	B	Spherical shells			
	C	Problems			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	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**

School: SSET		**Batch : 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (CM)		**Semester: II**		
1	Course Code	CVL875	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	
		25%	25%	50%	
	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

School: SSET		**Batch: 2023-25**	
Programme: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE (STR)		**Semester: I**	
1	Course Code	CVP863	
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 Description	Subject consists of practical related to structural analysis and design using the use of design software (STAAD-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	
		25%	25%	50%	
	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

School: SSET		**Batch: 2023-25**	
Programme: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE (STR)		**Semester: I**	
1	Course Code	CVP870	
2	Course Title	Structural Modelling and Design Lab-2	
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 (ETABS)	
6	Course Outcomes	The students will be able to CO1: Recognize appropriate software solutions for addressing structural engineering challenges. CO2: Investigate beams, frames, and trusses employing software instruments. CO3: Elucidate the processes of analysis and design for 2D buildings using software applications. CO4: Appraise the procedures of analysis and design for 3D buildings using software platforms. CO5: Formulate dynamic analysis methods using software utilities in conjunction with foundation design. CO6: Showcase the utilization of concepts in real-world situations through analysis and design procedures.	
7	Course Description	Subject consists of practical related to structural analysis and design using the use of design software (STAAD-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**	CO1, CO6
		Exp 1- Introduction of Structural Analysis and Design. Exp 2- General Guidelines for Design, Model Editing Tools, Model Generation.	
	Unit 2	**Analysis of Beams, frames and trusses**	CO2, CO6
		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	
	Unit 3	**Analysis and Design of 2D Buildings**	CO3, CO6
		Exp 6: Modelling, Static analysis and Design of 2D RCC Buildings Exp 7: Modelling, Static analysis and Design of 2D Steel Buildings	
	Unit 4	**Analysis and Design of 3D RCC Buildings**	CO4, CO6
		Exp 8: Modelling, Static analysis and Design of 3D RCC Buildings Exp 9: Modelling, Static analysis and Design of 3D Steel Buildings	
	Unit 5	**Dynamic Analysis and Foundation Design**	CO5, CO6
		Exp 10: Modelling, Analysis and Design of Multi-storey buildings	

		subjected to Wind load and seismic loads			
		Exp 11: Foundation Design			
	Mode of examination	Practical			
	Weightage Distribution	CA	CE-Viva	ETE	
		25%	25%	50%	
	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

School: SSET		**Batch: 2023-25**	
Programme: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE (Geotechnical)		**Semester: I**	
1	Course Code	CVL 868	
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: 25% / MTE: 25% / ETE: 50%	
	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

School: SSET		**Batch: 2023-25**	
Programme: M. TECH		**Current Academic Year: 2023-24**	
Branch: CE (Geotechnical)		**Semester: I**	
1	Course Code	CVL 869	
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	
		25%	25%	50%	
	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

School: SSET		**Batch: 2023-25**	
Programme: B.TECH		**Current Academic Year: 2023-24**	
Branch: CE		**Semester: I**	
1	Course Code	CVP878	
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	MTE	ETE	
		50%	0%	50%	
	Reference codes	1. ASTM Code 2. IS Code (IS2720)			

CO and PO Mapping

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
CO 1	3	2	-	-	2	1	2	1	3	2	1	2	-	1	1
CO 2	3	2	1	1	1	2	1	1	2	1	1	1	-	3	2
CO 3	3	3	-	1	3	1	2	1	3	2	1	1	1	1	2
CO 4	2	2	-	2	3	1	-	1	3	1	-	3	1	3	2
CO 5	3	3	-	-	2	1	1	-	-	-	-	2	1	3	1
CO 6	3	3	-	-	2	1	1	-	-	-	-	2	1	3	1

School: SSET		**Batch: 2023-25**	
Programme: M. TECH		**Current Academic Year: 2023-24**	
Branch: CE (Geotechnical)		**Semester: II**	
1	Course code	CVL867	
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	Yes	
9.17	Total Marks	25	25	50	
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

School: SSET		**Batch: 2023-25**	
Programme: M. TECH		**Current Academic Year: 2023-24**	
Branch: CE (Geotechnical)		**Semester: II**	
1	Course code	CVL866	
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	25%	
8.2	MTE	25%	
8.3	ETE	50%	
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

School: SSET		**Batch: 2023-25**	
Programme: M. TECH		**Current Academic Year: 2023-24**	
Branch: CE (Geotechnical)		**Semester: II**	
1	Course Code	CVL871	
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: 25% / MTE: 25% / ETE: 50%	
	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

School: SSET		**Batch: 2023-25**	
Programme: M. TECH		**Current Academic Year: 2023-24**	
Branch: CE (Geotechnical)		**Semester: II**	
1	Course Code	CVP879	
2	Course Title	**Computational and Numerical Methods in Geotechnical Engineering Lab**	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-2	
	Course Type	ELECTIVE	
5	Course Objective	1: To enable student with fundamentals of Finite element method. 2: To impart the knowledge and skill of analysing physical problems with FE software. 3: To Understand the basic functions of FE based software and its applications in Geotechnical engineering	
6	Course Outcomes	The students will be able to CO1: Identify a suitable element and mesh for Finite Element (FE) analysis in relation to a provided problem scenario. CO2: Describe and interpret the nature of a problem, and formulate an FE model based on the problem's characteristics. CO3: Analyse in-situ test results, interpret measurements, and make estimations of stress and strain in soil using FE analysis for a given real-world problem. CO4: Explain the fundamental principle by which finite elements generate approximate solutions for differential equations, relating to the field of study. CO5: Compare and contrast data from various computational models, drawing conclusions based on the analysis of their outputs. CO6: Utilize the fundamental features of FE-based software, demonstrating its applications within the context of Geotechnical engineering.	
7	Course Description	Load on Footing, Settlement of Foundations, Pile Foundations, Dynamic behaviour of footing, Footing on Marine Soil	
8	Outline syllabus		
	Unit 1	**Introduction**	CO1, CO6
	A	Matrix Algebra – Inversion of matrix – solution of large number of simultaneous equations	
	B	Concepts of FEM, Steps involved in Finite Element Analysis Procedure, Merits and Demerits.	
	C	Principles of Elasticity: Stress equations, Strain-Displacement relationships in matrix form, Plane stress, Plane strain and axi-symmetric bodies of revolution with Axi-symmetric loading.	

	Unit 2	**Displacement Based Element**	CO2, CO6
	A	Element Properties: Concept of an element, various element shapes, Displacement models, Generalized coordinates, Shape functions.	
	B	Convergent and Compatibility requirements, Geometric invariance, Natural coordinate system - area and volume coordinates.	
	C	Generation of Element Stiffness and Nodal Load Matrices.	
	Unit 3	**Geotechnical Problem Formulation**	CO3, CO6
	A	Techniques of nonlinear analysis, Constitutive modelling for soils, Non- linear soil parameters	
	B	Geotechnical Applications: Seepage analysis: Finite element discretization of seepage equation, computation of velocities and flows, treatment of free surface boundary,	
	C	Analysis of jointed rock mass: Characters and discontinuity of rock, model behaviour of jointed rocks, plane strain analysis	
	Unit 4	**FEM Software Application**	CO4, CO6
	A	Pre-processor & Post processing techniques	
	B	Geotechnical Applications: Applications to study of Bearing capacity and Settlement analysis.	
	C	Geotechnical Applications: Applications to study of embankment dams, Sequential construction, excavations, stress distribution around opening.	
	Unit 5	**Application of Computational Methods**	CO5, CO6
	A	Introduction to computational modelling in Geotechnical Engineering.	
	B	Geotechnical Applications: Applications to analyse geotechnical problems using AI and ML approach.	
	C	Geotechnical Applications: Applications to predict real life results using advance hybrid computational models.	
	Mode of examination	Theory	
	Weightage Distribution	CA | CE-Viva | ETE	
		25% | 25% | 50%	
	Text book/s*	1. Introduction to the Finite Element Method, C. S. Desai and J. F. Abel. Van Nostrand Reinhold Company. 2. Finite element analysis in geotechnical engineering Vol 1 and 2, D. M. Potts and L. Zdravkovic, Thomas Telford publishing, London. 3. Finite element analysis in geotechnical engineering, D. J. Naylor and G. N. Pande.	
	Other References	1. Introduction to the Finite Element Method, J. N. Reddy - McGraw-Hill Publishers. 2. Finite element analysis - Theory and programming, C.	

		S. Krishna Murthy - Tata McGraw-Hill. 3. Finite element Methods, O. C. Sienkiewicz - McGraw-Hill Publishers.	

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

School: SSET		**Batch: 2023-25**	
Programme: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE (Structures)		**Semester: I**	
1	Course Code	CVL873 | 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	
		25%	25%	50%	
	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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Structures)		**Semester: II**		
1	Course Code	CVL874	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	
		25%	25%	50%	
	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

School: SSET		**Batch: 2023-25**	
Program: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE		**Semester: II**	
1	Course Code	CVP876	
2	Course Title	Advanced Concrete Technology Lab	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status	Core	
5	Course Objective	The course will create the understanding between theoretical concept of concrete and its properties. This course will also enhance their skills for preparing various type of concrete as per Design requirements.	
6	Course Outcomes	The students will be able to CO1: Analyze concrete materials' properties. CO2: Develop a design mix and demonstrate the ability to create workable concrete. CO3: Connect theoretical knowledge to real-world scenarios. CO4: Comprehend the role of fibers and admixtures in concrete, and assess their impact on concrete properties. CO5: Apply research findings to formulate self-compacting concrete. CO6: Formulate mix proportions and assess concrete properties.	
7	Course Description	Testing the various types of material and concrete, properties like specific gravity, gradation, setting, impact, workability, and strength. Self-compacting concrete	
8	Outlines syllabus		
	Unit1	**Practical related to Cement and aggregates**	CO1, CO6
		Exp 1- Determination of Normal Consistency, soundness and Setting Time of Cement.	
		Exp2-.Determination of Specific Gravity and Compressive Strength Test	
		Exp3-Sieveanalysisof coarse and fine aggregates	
		Exp4-Determinationof Specific Gravity, water absorption and moisture content test of Aggregates	
		Exp5-DeterminationofImpact strength, Crushing value and Abrasion value of coarse aggregates	
	Unit2	**Practical related to Design Mix and Fresh concrete**	CO2, CO6
		Exp6-Design of concrete mixes as per IS10262: 2009	
		Exp7- To determine the workability of fresh concrete by slump test.	
		Exp8-To determine the compacting factor of fresh concrete.	
		Exp9-Vee-Bee consistency test	
	Unit 3	**Practical related to Hardened concrete**	CO3, CO6
		Exp10-Todeterminethecompressivestrengthof concrete specimens.	
		Exp11-To determine the split tensile strength of cylindrical concrete specimens.	

		Exp12-Todeterminetheflexuralstrength (modulus of rupture) of concrete.			
	Unit 4	**Practical related to Fibers, Mineral and chemical admixture**			CO4, CO6
		Exp13-To determine the effect of fibers on properties of concrete i.e. workability and strength			
		Exp14-To determine the effect of mineral admixture on properties of concrete i.e. workability and strength			
		Exp15-To determine the effect of chemical admixture on properties of concrete i.e. workability and strength			
	Unit 5	**Practical related to Self-Compacting Concrete**			CO5, CO6
		Exp 16-To determine the filling ability of SCC by using Slump Cone and V Funnel			
		Exp 17-To determine the passing ability of SCC by using L Box and U Box			
		Exp18-To determine the Segregation resistance by using V Funnel			
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE-Viva	ETE	
		25%	25%	50%	
	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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-25**		
Branch: CE (Structures)		**Semester: II**		
1	Course Code	CVL877	Course Name: Health, Safety and Green Building Methodology	
2	Course Title	Health, Safety and Green Building Methodology		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Core		
5	Course Objective	To provide students an understanding of the various aspects of Green buildings and their certification process.		
6	Course Outcomes	The students will be able to CO1: Recognize the importance of green buildings and identify their fundamental requirements. CO2: Describe the different constituents comprising a green building and their functions. CO3: Compare and contrast the distinct criteria involved in LEED certification comprehensively. CO4: Analyse the intricate certification criteria of GRIHA and its relevance in promoting sustainability. CO5: Evaluate various renewable energy systems suitable for integration into green buildings. CO6: Formulate a comprehensive understanding of the multifaceted dimensions of green buildings and the intricate procedures governing their certification.		
7	Course Description	This course teaches the Green buildings requirements and their certification process.		
8	Outline syllabus			
	Unit 1	**Components of Green Buildings**		CO1, CO6
	A	Sustainable site, Building materials		
	B	Heating & cooling systems, energy efficiency		
	C	Water management, indoor environmental quality		
	Unit 2	**Rating systems: LEED**		CO2, CO6
	A	Certification criteria		
	B	Certification process		
	C	LEED AP requirements & certification process		
	Unit 3	**Rating systems: GRIHA**		CO3, CO6
	A	Certification criteria		
	B	Certification process		
	C	GRIHA accredited professional- requirements & certification process		

	Unit 4	**Occupational Health and Hygiene**			CO4, CO6
	A	Definition of the term occupational health and hygiene. Categories of health hazards. Exposure pathways and human responses to hazardous and toxic substances			
	B	Advantages and limitations of environmental monitoring and occupational exposure limits. Hierarchy of control measures for occupational health risks			
	C	Role of personal protective equipment and the selection criteria. Effects on humans, control methods and reduction strategies for noise, radiation and excessive stress			
	Unit 5	**Workplace Safety and Safety Systems**			CO5, CO6
	A	Features of the satisfactory design of work premises HVAC, ventilation. Safe installation and use of electrical supplies. Fire safety and first aid provision.			
	B	Significance of human factors in the establishment and effectiveness of safe systems. Safe systems of work for manual handling operations. Control methods to eliminate or reduce the risks arising from the use of work equipment.			
	C	Requirements for the safe use of display screen equipment. Procedures and precautionary measures necessary when handling hazardous substances. Contingency arrangements for events of serious and imminent danger.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Notes by the instructor			
	Other References	1. LEED v4.0 Manuals available online 2. GRIHA Manuals available online 3. IGBC Manuals available online			

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

School: SSET		**Batch: 2023-25**	
Programme: M.Tech.		**Current Academic Year: 2023-24**	
Branch: CE		**Semester: I**	
1	Course Code	CVL823 | 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	
		25%	25%	50%	
	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

School: SSET		**Batch: 2023-25**	
Programme: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE (Structures)		**Semester: I**	
1	Course Code	**CVL 825** Course Name: Green Building Methodology	
2	Course Title	**Green Building Methodology**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	To provide students an understanding of the various aspects of Green buildings and their certification process.	
6	Course Outcomes	The students will be able to CO1: Recognize the importance of green buildings and their fundamental prerequisites. CO2: Describe the different constituents comprising a green building. CO3: Explain in-depth the criteria involved in LEED certification. CO4: Analyze thoroughly the certification criteria for GRIHA. CO5: Evaluate the various renewable energy systems applicable to green buildings. CO6: Formulate an understanding of the diverse facets of green buildings and the process of obtaining their certifications.	
7	Course Description	This course teaches the Green buildings requirements and their certification process.	
8	Outline syllabus		
	Unit 1	**Introduction**	CO1, CO6
	A	Need & importance of Green buildings	
	B	Basic requirements of a green building	
	C	Rating systems	
	Unit 2	**Components of Green Buildings**	CO2, CO6
	A	Sustainable site, Building materials	
	B	Heating & cooling systems, energy efficiency	
	C	Water management, indoor environmental quality	
	Unit 3	**Rating systems: LEED**	CO3, CO6
	A	Certification criteria	
	B	Certification process	
	C	LEED AP requirements & certification process	
	Unit 4	**Rating systems: GRIHA**	CO4, CO6
	A	Certification criteria	
	B	Certification process	
	C	GRIHA accredited professional- requirements & certification process	
	Unit 5	**Renewable energy systems for Green Buildings**	CO5, CO6

	A	Need of renewable energy, Solar cells			
	B	Grid-connected and off-grid systems, solar heaters			
	C	Components of a solar panel based electrical system			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Notes by the instructor			
	Other References	1. LEED v4.0 Manuals available online 2. GRIHA Manuals available online 3. IGBC Manuals available online			

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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE		**Semester: II**		
1	Course Code	CVL676	Course Name: Environmental health and Safety	
2	Course Title	Environmental health and Safety		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Compulsory		
5	Course Objective	This course is aimed at master's students of Environmental Engg to understand basic principles of environmental health and safety practices and creating awareness of public and occupational health and safety requirements associated with the environment		
6	Course Outcomes	The students will be able to CO1. Recognize the significance and advantages of environmental health and safety. CO2. Identify secure work practices within offices, industry, and construction settings, while also detecting and rectifying issues linked to occupational safety and health in these environments. CO3. Explain the fundamental concepts, advantages, and structure of a workplace safety and health program necessary for fostering safety excellence. CO4. Illustrate the methodologies for implementing, evaluating, and documenting environmental safety measures. CO5. Emphasize the value of training and knowledge pertaining to environmental health and safety. CO6. Formulate solutions to pinpoint the origins of occupational hazards and devise suitable strategies to enhance health outcomes.		
7	Course Description	The course introduces need of occupational health and hygiene, workplace safety, techniques of environmental safety and its training.		
8	Outline syllabus			
	Unit 1	**Introduction**		CO1, CO6
	A	Need for developing Environment, Health and Safety systems in work places		
	B	Status and relationship of Acts, Regulations and Codes of Practice. Role of trade union safety representatives		
	C	International initiatives. Ergonomics and work place.		
	Unit 2	**Occupational Health and Hygiene**		CO2, CO6
	A	Definition of the term occupational health and hygiene. Categories of health hazards. Exposure pathways and human responses to hazardous and toxic substances		
	B	Advantages and limitations of environmental monitoring and occupational exposure limits. Hierarchy of control measures for occupational health risks		

	C	Role of personal protective equipment and the selection criteria. Effects on humans, control methods and reduction strategies for noise, radiation and excessive stress			
	Unit 3	**Workplace Safety and Safety Systems**			CO3, CO6
	A	Features of the satisfactory design of work premises HVAC, ventilation. Safe installation and use of electrical supplies. Fire safety and first aid provision.			
	B	Significance of human factors in the establishment and effectiveness of safe systems. Safe systems of work for manual handling operations. Control methods to eliminate or reduce the risks arising from the use of work equipment.			
	C	Requirements for the safe use of display screen equipment. Procedures and precautionary measures necessary when handling hazardous substances. Contingency arrangements for events of serious and imminent danger.			
	Unit 4	**Techniques of Environmental Safety**			CO4, CO6
	A	Elements of a health and safety policy and methods of its effective implementation and review. Functions and techniques of risk assessment, inspections and audits			
	B	Investigation of accidents- Principles of quality management systems in health and safety management. Relationship between quality manuals, safety policies and written risk assessments			
	C	Records and other documentation required by an organization for health and safety. Industry specific EHS issues.			
	Unit 5	**Education and Training**			CO5, CO6
	A	Requirements for and benefits of the provision of information, instruction, training and supervision			
	B	Factors to be considered in the development of effective training programs			
	C	Principles and methods of effective training. Feedback and evaluation mechanism.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Environmental and Health and Safety Management by Nicholas P. Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995 2. The Facility Manager's Guide to Environmental Health and Safety by Brian Gallant, Government Inst Publ., 2007. 3. Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services 2005			

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

School: SSET		**Batch: 2023-25**	
Programme: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE		**Semester: II**	
1	Course Code	CVL833 | Course Name: R.C.C. Bridge Design	
2	Course Title	R.C.C. Bridge Design	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	Elective-5	
5	Course Objective	The objective of this Course is to introduce the basics of R.C.C. Bridge Design. The course will cover the Design of Slab and T beam Bridge in detail when they are subjected to various loads. It will introduce the students with IRC loading.	
6	Course Outcomes	The students will be able to CO1: Recognize the fundamental principles governing the selection of bridge types and comprehend the classification of IRC loading types. CO2: Comprehend and apply various methods of analysis for RCC bridges in problem-solving scenarios. CO3: Demonstrate the ability to apply IRC guidelines to design slab culverts under the influence of diverse loading conditions. CO4: Apply IRC specifications to design T-beam bridges considering a range of loading situations. CO5: Construct detailed plans for reinforcement in different bridge types, showcasing a deep understanding of structural requirements. CO6: Formulate innovative designs for complex RCC structures by integrating advanced concepts and principles.	
7	Course Description	Introduction to basics of Bridge Design, Analysis Methods. Slab Bridge, T Beam Bridge, Reinforcement Detailing	
8	Outline syllabus		
	Unit 1	**Introduction to Basics of Bridge Design**	CO1, CO6
	A	Site selection, various types of bridges and their suitability	
	B	Loads, forces and IRC Bridge loading	
	C	Permissible stresses	
	Unit 2	**Analysis Methods**	CO2, CO6
	A	Working Stress Method	
	B	Courbon's method of load distribution	
	C	Pigeaud's Method	
	Unit 3	**Slab Bridge**	CO3, CO6
	A	Components of Reinforced Concrete slab Bridge	
	B	Impact Factors	
	C	Design of R.C.C. Slab Culvert	
	Unit 4	**T Beam Bridge**	CO4, CO6

	A	R.C.C. T-Beam Bridge, Components of T-Beam Bridge,			
	B	Types of Superstructure			
	C	Design of T-Beam Bridge.			
	Unit 5	**Reinforcement Detailing**			CO5, CO6
	A	Detailing criteria			
	B	Reinforcement Derailing for R.C.C. slab Bridge,			
	C	Reinforcement Derailing for R.C.C. T-Beam Bridges.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	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)			

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

School: SSET		**Batch: 2023-25**	
Programme: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE (STRUC. ENGG)		**Semester: II**	
1	Course Code	CVL622 | Course Name: Theory of Elasticity and Plasticity	
2	Course Title	Theory of Elasticity and Plasticity	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	Elective-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: Recognize the concept of analysing structural behavior within the elastic limit. CO2: Apply the principles of plane stress and plane strain to solve practical scenarios. CO3: Comprehend the stress-strain relationships in linearly elastic materials and understand torsional behavior. CO4: Utilize the theory of plasticity to assess the response of structures to plastic deformation. CO5: Analyse various stress and strain scenarios in spherical and cylindrical structures. CO6: Employ the principles of elasticity and plasticity theory to solve engineering problems effectively.	
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		
	Unit 1	**Theory of Elasticity**	CO1, CO6
	A	Stress tensors, equations of equilibrium	
	B	Generalized Hooke's law, boundary conditions	
	C	Compatibility conditions	
	Unit 2	**Plane Stress and Strain**	CO2, CO6
	A	Plane stress and strain, relationship, stress functions	
	B	Stress at a point	
	C	Rectangular and polar coordinates, bending of beam loaded at end	
	Unit 3	**Inverse and Semi Inverse Methods**	CO3, CO6
	A	Inverse and Semi Inverse	
	B	Torsion of bars	
	C	Membrane analogy	
	Unit 4	**Theory of Plasticity**	CO4, CO6

	A	Introduction			
	B	Hydrostatic and Deviatorial Stress			
	C	Octahedral stresses			
	Unit 5	**Analysis of thick spherical and cylindrical tube**			CO5, CO6
	A	Analysis of bending of bars of narrow rectangular cross section, formation of plastic hinge			
	B	Spherical shells			
	C	Problems			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	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	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

School: SSET		**Batch: 2023-25**	
Programme: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE (Structures)		**Semester: II**	
1	Course Code	CVL 716 | Course Name: Advance Concrete Technology	
2	Course Title	Advance 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: 25% / MTE: 25% / ETE: 50%	
	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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Structures)		**Semester: II**		
1	Course Code	CVL 708	Course Name: Earthquake Resist Design of Structure	
2	Course Title	Earthquake Resist 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 / MTE / ETE	
		25% / 25% / 50%	
	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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE		**Semester: II**		
1	Course Code	CVL838	Course Name: Damage Assessment, Repair and Retrofitting of Structures	
2	Course Title	Damage Assessment, Repair and Retrofitting of Structures		
3	Credits	4		
4	Contact Hours (L-T-P)	3-1-0		
	Course Status	Core (Option)		
5	Course Objective	The objective of the course is to understand the importance of damage assessment of structures and adopt various methods for repair and retrofitting of structures.		
6	Course Outcomes	The students will be able to CO1: Recognize the importance of rehabilitation for structures. CO2: Describe various types of damages in structures, identify their sources, and explain their effects. CO3: Compare and contrast different evaluation models, justify the necessity of damage assessment, and outline the procedures involved in assessing damages in structures. CO4: Apply retrofitting techniques to enhance the structural integrity of buildings. CO5: Select the most suitable repair method for specific structural issues. CO6: Create a comprehensive understanding of the concepts related to damage assessment, the rationale behind repair and retrofitting, and their significance in maintaining structural integrity.		
7	Course Description	Introduction, Distress in structures, Damage Assessment and Evaluation Models, Retrofitting of structures, Repair of structures.		
8	Outline syllabus			
	Unit 1	**Introduction**		CO1, CO6
	A	Introduction		
	B	Deterioration of structures with aging		
	C	Need for rehabilitation		
	Unit 2	**Distress in Structures**		CO2, CO6
	A	Types of Damages		
	B	Sources of Damage		
	C	Effect of Damages and Case Studies		
	Unit 3	**Damage Assessment and Evaluation Models**		CO3, CO6
	A	Purpose of Assessment, Rapid Assessment, Surface and Structural Cracks		
	B	Damage Assessment Procedures		
	C	Destructive, Semi-Destructive and Non-Destructive Methods		
	Unit 4	**Retrofitting of Structures**		CO4, CO6

	A	Introduction, Consideration in retrofitting of structures, Source of weakness in RC framed buildings, Structural Damage due to discontinuous load path, Structural Damage due to lack of deformation, Quality of workmanship and material			
	B	Classification of retrofitting techniques, Retrofitting strategies for RC buildings, Global and Local Retrofitting Methods			
	C	Comparative Analysis of methods of retrofitting.			
	Unit 5	**Repair of Structures**			CO5, CO6
	A	Grouting, Detailing, Imbalance of Structural Stability, Rust eliminators and polymers coating for rebar during repair, foamed concrete, mortar and dry pack, vacuum concrete			
	B	Gunite and Shot Crete, Epoxy injection, Mortar repair for cracks, shoring and underpinning			
	C	Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Earthquake Resistant Design of Structures by Pankaj Agarwal and Manish Shrikhande, PHI, 2006.			
	Other References	1. Handbook on Repair and Rehabilitation of RCC buildings, Published by CPWD, Delhi, 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

School: SSET		**Batch: 2023-25**	
Programme: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE (STR)		**Semester: II**	
1	Course Code	CVP657	
2	Course Title	Structure Design Lab	
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/ETABS)	
6	Course Outcomes	The students will be able to CO1: Identify suitable software for solving structural engineering problems. CO2: Describe and execute the analysis of beams, frames, and trusses using selected software tools. CO3: Explain and demonstrate the analysis and design process of 2D buildings using software applications. CO4: Compare, contrast, and execute the analysis and design of 3D buildings using specialized software. CO5: Analyse and evaluate dynamic responses using software tools and formulate foundation designs accordingly. CO6: Apply structural analysis and design principles to address complex real-world problems effectively.	
7	Course Description	Subject consists of practical related to structural analysis and design using the use of design software (STAAD-Pro/ETABS). Students will learn the use of STAAD-Pro/ETABS in various structural engineering problems of analysis and design.	
8	Outline syllabus		
	Unit 1	**Basics of Structural Analysis and STAAD-Pro/ETABS**	CO1, CO6
		Exp 1- Introduction of Structural Analysis and Design. Exp 2- General Guidelines for Design, Model Editing Tools, Model Generation.	
	Unit 2	**Analysis of Beams, frames and trusses**	CO2, CO6
		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	
	Unit 3	**Analysis and Design of 2D Buildings**	CO3, CO6
		Exp 6: Modelling, Static analysis and Design of 2D RCC Buildings Exp 7: Modelling, Static analysis and Design of 2D Steel Buildings	
	Unit 4	**Analysis and Design of 3D RCC Buildings**	CO4, CO6
		Exp 8: Modelling, Static analysis and Design of 3D RCC Buildings Exp 9: Modelling, Static analysis and Design of 3D Steel Buildings	
	Unit 5	**Dynamic Analysis and Foundation Design**	CO5, CO6
		Exp 10: Modelling, Analysis and Design of Multi-storey buildings	

		subjected to Wind load and seismic loads			
		Exp 11: Foundation Design			
	Mode of examination	Practical			
	Weightage Distribution	CA	CE-Viva	ETE	
		25%	25%	50%	
	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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Env. Engg.)		**Semester: I**		
1	Course Code	CVL665	Course Name: Environmental Chemistry & Biotechnology	
2	Course Title	Environmental Chemistry & Biotechnology		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	ELECTIVE		
5	Course Objective	To provide students an understanding of the various aspects of the chemistry and biotechnology of the environmental contamination		
6	Course Outcomes	The students will be able to CO1: Recognize the importance of studying chemistry and biotechnology in relation to the decontamination of different environmental media. CO2: Summarize the diverse chemical reactions occurring within water. CO3: Calculate reaction rates. CO4: Estimate quantities such as cell mass, sludge, and oxygen requirements within biological systems. CO5: Examine the diverse utilizations of biotechnology in the context of environmental engineering. CO6: Elaborate on the technologies, tools, and techniques utilized in the realm of environmental chemistry and biotechnology.		
7	Course Description	The course introduces the understanding of water chemistry, reaction rates, microbial growth & Kinetics and applications of environmental biotechnology.		
8	Outline syllabus			
	Unit 1	**Introduction**		CO1, CO6
	A	Environment Media and Contamination		
	B	Sources of contamination of the environment		
	C	Chemistry and biotechnology of the environmental contamination		
	Unit 2	**Water Chemistry**		CO2, CO6
	A	Air-water reactions		
	B	Acid-base, complexation, solubility reactions		
	C	Redox, water-solid reactions		
	Unit 3	**Reaction Rates**		
	A	Rate of reaction, order and kinetics		CO3, CO6
	B	Energy and energy kinetics		
	C	Rate of water and water-solid reactions		

	Unit 4	**Microbial Growth & Kinetics**			CO4, CO6
	A	Microbial growth and energetic			
	B	Energetic modelling			
	C	Growth kinetics			
	Unit 5	**Applications of Environmental Biotechnology**			CO5, CO6
	A	In Wastewater treatment			
	B	Bioremediation, vermin-composting, phytoremediation			
	C	Microbial fuel cells & biogas			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Water chemistry by V. L. Snoeyink and D. Jenkins, Wiley, 1980. 2.Environmental Biotechnology: Principles and Applications, Bruce E. Rittmann and Perry L. McCarty, McGraw Hills, 2001			

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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Env. Engg.)		**Semester: I**		
1	Course Code	CVL642	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	
		25% / 25% / 50%	
	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	7.

		Environmental Science", TMH. India. 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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Env. Engg.)		**Semester: I**		
1	Course Code	CVL643	Course Name: Water & Wastewater Treatment	
2	Course Title	Water & Wastewater Treatment		
3	Credits	4		
4	Contact Hours (L-T-P)	3-1-0		
	Course Status	ELECTIVE		
5	Course Objective	To provide students an understanding of the various aspects of the water and wastewater treatment, including source characterization, water/wastewater characterization, etc.		
6	Course Outcomes	The Students will be able to CO1: Recognize the importance of addressing water and wastewater treatment requirements. CO2: Assess water source options; determine treatment levels by contrasting raw water quality with quality benchmarks. CO3: Devise unit operation plans for a standard water treatment facility and grasp the functioning of household water purifiers. CO4: Apply microbial concepts and BOD kinetics to describe sewage characteristics. CO5: Develop unit operation strategies for sewage treatment. CO6: Create an initial blueprint for a water and/or wastewater treatment plant design.		
7	Course Description	The course introduces drinking water characteristics, parameters, waste water characteristics, treatment processes and disposal techniques		
8	Outline syllabus			
	Unit 1	**Introduction**		CO1, CO6
	A	Necessity of Water Treatment		
	B	Necessity of Wastewater Treatment		
	C	Introduction to water & wastewater treatment		
	Unit 2	**Drinking Water**		CO2, CO6
	A	Water source selection		
	B	Water quality parameters		
	C	Drinking water standards		
	Unit 3	**Water Treatment**		CO3, CO6
	A	Conventional water treatment processes		
	B	Miscellaneous processes		
	C	Domestic water purification		
	Unit 4	**Wastewater**		CO4, CO6
	A	Wastewater sources and characteristics		
	B	Composition & microbiology of wastewater		
	C	BOD Kinetics, Effluent discharge standards		
	Unit 5	**Wastewater Treatment**		CO5, CO6
	A	Primary Treatment		

	B	Secondary Treatment			
	C	Tertiary treatment, sludge disposal			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Garg Santosh Kumar, Water Supply Engineering, Khanna Publishers 2. S. K. Garg: Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. – II), Khanna Publishers 3. Peavy, H.S., Rowe, D.R. and Tchobanoglous, G "Introduction to Environmental Engineering" McGraw Hill. 1986 4. Metcalf& Eddy Inc: Wastewater Engineering, Tata McGraw Hills CPHEEO, "Manual on sewerage and sewage Treatment", Bureau of Indian Standards, CPHEEO. 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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Env. Engg.)		**Semester: I**		
1	Course Code	CVL666	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	
		25%	25%	50%	
	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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Env. Engg.)		**Semester: II**		
1	Course Code	CVL667	Course Name: Contaminant Fate and Transport in Environment	
2	Course Title	Contaminant Fate and Transport in Environment		
3	Credits	4		
4	Contact Hours (L-T-P)	3-1-0		
	Course Status	ELECTIVE		
5	Course Objective	To provide students an in depth understanding on how contaminants move through sub-surface and surface water and how its movement can be mathematically represented through various models.		
6	Course Outcomes	The students will be able to- CO1. Grasp the concept of general contaminant types and subsurface characteristics, laying the foundation for further exploration. CO2. Comprehend the essential principles governing subsurface flow and transport mechanisms, building a solid understanding of their fundamental workings. CO3. Develop an understanding of the intricate processes guiding the destiny of contaminants within subsurface environments. CO4. Delve into the intricacies of how contaminants navigate the intricate channels of rivers, utilizing diverse models to comprehend their fate and transport. CO5. Gain insights into the management and restoration of contaminants, drawing from a range of case studies that showcase different approaches. CO6. Investigate the movement of contaminants through both sub-surface and surface water, and explore the mathematical representations that aptly capture their dynamic behaviors within various models.		
7	Course Description	The course introduces general contamination and subsurface characterization, fate and transport of contaminant in subsurface water, management and restoration		
8	Outline syllabus			
	Unit 1	**Introduction to General Contamination and Subsurface Characterization**		CO1, CO6
	A	Introduction: Contamination types, fate and transport (point and nonpoint)		
	B	Subsurface I: Characteristics of porous media and aquifer properties (saturated case only). Subsurface II: Iso/Anisotropy and homo/heterogeneity and groundwater flow characterization		

	C	Subsurface III: Well Dynamics	
	Unit 2	**Fate and Transport of Contaminant in Subsurface Water**	CO2, CO6
	A	Role of 1D advection in contaminant transport. Role of 1D dispersion and diffusion in contaminant transport	
	B	Introduction to transport and reaction. 1D Advection-Dispersion-Reaction Equation (Reaction limited to linear sorption	
	C	Capture zone design, capture size, and isochrones	
	Unit 3	**Fate and Transport of Contaminant in Surface Water (Focus River)**	CO3, CO6
	A	River types and their contamination potential	
	B	Models (1D and First Order only): spills, dissolved oxygen (Streeter-Phelps model), nutrients and pathogens	
	C	Contaminant Loads: Total maximum daily loads (load-duration curve and its application), long-term contaminant loads	
	Unit 4	**Management and Restoration**	CO4, CO6
	A	Subsurface water contamination: Pump-and Treat System (introductory),	
	B	Bioremediation, and Natural Attenuation	
	C	Surface water contamination MR: Non-structural Techniques and Structural Techniques	
	Unit 5	**Case studies:**	CO5, CO6
	A	Emerging contaminants, River restoration, Surface Water-Groundwater interaction	
	B	Numerical modelling of fate and transport, Metal/Nonmetal contamination of river/groundwater	
	C	Agriculture related contamination, fate and transport modelling approaches etc.	
	Mode of examination	Theory	
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	Text book/s*	1. Natural Attenuation of Fuels and Chlorinated Solvents in the Subsurface by Wiedemeier, et al., Wiley, ISBN: 9780471197492. 2. Water-quality engineering in natural systems by David Chin, John Wiley & Sons, ISBN: 9781118078600.	

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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Env. Engg.)		**Semester: II**		
1	Course Code	CVL645	Course Name: Application of Remote Sensing and GIS for Environmental Planning	
2	Course Title	Application of Remote Sensing and GIS for Environmental Planning		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Elective		
5	Course Objective	This course is aimed at master's students of Environmental Engg to understand the usage of geo-informatics tool for environmental planning and other applications.		
6	Course Outcomes	The students will be able to CO1: Comprehend the foundational principles of geo-informatics. CO2: Grasp the fundamental aspects of maps and the elements that constitute them. CO3: Gain an understanding of the principles underlying remote sensing. CO4: Acquire knowledge about the fundamental principles of aerial photogrammetric. CO5: Demonstrate comprehension of the process of data collection and the effective management of data. CO6: Apply geographic information system (GIS) software tools for environmental planning and various other applications.		
7	Course Description	The course introduces Remote sensing and Image Interpretation, Advance remote sensing, GIS and Cartography, Application of RS and GIS.		
8	Outline syllabus			
	Unit 1	**Introduction**		CO1, CO6
	A	Introduction to Geo-Informatics		
	B	GIS system definition, terminology & data types, Map projection, Co-ordinate system, Scale and other map basics		
	C	Basic components of GIS software, data models		
	Unit 2	**Remote Sensing and Image Interpretation**		CO2, CO6
	A	Introduction to Aerial and space borne platforms, Remote Sensing: Introduction, concepts & physical basis, Electromagnetic spectrum, radiation laws, atmospheric effects, image characteristics, Sources of remote sensing information, spectral quantities spectral signatures and resolutions		
	B	Characteristics spectral reflectance curves for rocks, soil, vegetation and water. Different satellites, type, resolution and usage. Salient features of some of operating Remote Sensing satellite		

	C	Global positioning system (GPS), Introduction to Aerial Photography and photogrammetric, Analog, analytical and digital photogrammetric, height and plan metric			
	Unit 3	**Advanced Remote Sensing**			CO3, CO6
	A	Advanced Remote Sensing techniques: Optical, thermal and microwave sensors & their resolutions			
	B	Digital image processing, Introduction, Image rectification and Restoration			
	C	Image enhancement, Manipulation, Image classification, Fusion.			
	Unit 4	**GIS and Cartography**			CO4, CO6
	A	GIS Data acquisition, both raster based and vector based data input and data processing and management including topology, overlaying			
	B	Integration and final data product and report generation. Principle of cartography and cartographic design. Map Layout			
	C	Introduction to Geo Statistics			
	Unit 5	**Application of RS and GIS**			CO5, CO6
	A	Application of Geo-spatial technology in Environmental Management, Assessment of cyclones, rainfall, atmospheric humidity etc.			
	B	Application of RS in weather analysis, forecasting and modelling			
	C	Applications in Land use, inventory and monitoring, forestry, urban planning, snow and glaciers, coastal zone management, pollution-land, air, and water, sustainable development, climate change			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Reference books				

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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Env. Engg.)		**Semester: II**		
1	Course Code	CVL668	Course Name: Management of Industrial Effluents	
2	Course Title	Management of Industrial Effluents		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	ELECTIVE		
5	Course Objective	The aim of the course is to provide an understanding of the mechanisms and processes used to treat waters that have been contaminated in some way by anthropogenic industrial or commercial activities prior to its release into the environment or its re-use. To understand various terms used in industrial wastewater treatment and to acquaint with different steps involved in treatment of industrial wastewater.		
6	Course Outcomes	The students will be able to CO1. Understand the need and standards for disposal of industrial waste. CO2. Understand the characterization of various waste generated from industries CO3. Understand the various physical chemical and biological techniques for treatment of waste water. CO4. Understand the characteristics of effluent generated from different industries and suggest treatment technologies based of type of waste. CO5. Understand the economic feasibility of suggested effluent treatment techniques along with its management in practical field CO6. To examine various terms used in industrial wastewater treatment and to acquaint with different steps involved in treatment of industrial wastewater		
7	Course Description	The course introduces various physical chemical biological treatment of industrial waste water along with planning and management of waste.		
8	Outline syllabus			
	Unit 1	**Introduction**		CO1, CO6
	A	Standards for disposal of treated industrial wastewaters into water bodies, municipal sewer and land		
	B	Standards for disposal of industrial solid wastes and gaseous emission from various industries		

	C	Industrial waste generation (solid & liquid waste and gaseous emission) and their characteristics, variation in its quality and quantity, Estimation of capacity of equalization tank			
	Unit 2	**Introduction to Physical-Chemical-Biological techniques for industrial wastewater treatment**			CO2, CO6
	A	Equalizations - Neutralization – Oil separation – Flotation – Precipitation – Heavy metal Removal– Aerobic and anaerobic biological treatment – Sequencing batch reactors – High Rate reactors			
	B	Chemical oxidation – Ozonation – carbon adsorption - Photocatalysis – Wet Air Oxidation – Evaporation			
	C	Ion Exchange – Membrane Technologies – Nutrient removal. - Treatability studies			
	Unit 3	**Industrial Wastewater treatment of industries**			CO3, CO6
	A	Manufacturing process, Waste streams (solid, liquid and gaseous)			
	B	Effluent characteristics			
	C	Treatments of effluent from paper/pulp industry, tannery, dairy, sugar mill			
	Unit 4	**Industrial Wastewater treatment of industries**			CO4, CO6
		Treatments of effluent from fertilizer plant, thermal power plant and dairy			
		Treatments of effluent from integrated steel plant, distillery/brewery and oil refinery.			
		Treatments of effluent textile unit- cotton, jute, rayon and silk.			
	Unit 5	**Planning and Management**			CO5, CO6
	A	Economic feasibility of joint treatment of raw industrial effluent with municipal sewage			
	B	Planning and management of industrial wastes (solid, liquid and gaseous) from small scale industries			
	C	Case studies			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Reference books	1. S. P. Mahajan, "Pollution Control in Process Industries", Tata Mc Graw Hill Publications. 2. W. Wesley Eckenfelder Jr.," Industrial Water Pollution Control", Mc Graw Hill Publications. 3. Ronald W. Crites Sherwood C. Reed and Robert Bastion, "Land Treatment Systems for Municipal & Industrial Wastes " Mc Graw Hill Publications. 4. Neal K. Ostler, "Industrial Waste Stream Generation", Prentice Hall. 5. A.D. Patwardhan, Industrial waste water treatment, PHI			6.

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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Env. Engg.)		**Semester: I**		
1	Course Code	CVL644	Course Name: Air Pollution Control	
2	Course Title	Air Pollution Control		
3	Credits	4		
4	Contact Hours (L-T-P)	3-1-0		
	Course Status	ELECTIVE		
5	Course Objective	This course is designed to provide students an understanding of the various aspects of the air pollution effects, control, including techniques for air quality monitoring and modelling.		
6	Course Outcomes	The students will be able to CO1. Recognize the classification and impacts of air pollution. CO2. Demonstrate familiarity with a range of legislations and standard pertaining to air pollution management. CO3. Illustrate an understanding of air quality monitoring technique through various sampling methods. CO4. Analyse and compare different plume characteristics, along with th dispersion of air pollutants using diverse models. Assess indoor ai quality analysis methods. CO5. Evaluate different strategies for emission control and th establishment of air pollutant standards. CO6. Appraise various dimensions of air pollution, encompassing effects regulation, and methodologies for both air quality assessment an modeling.		
7	Course Description	The course introduces various effects of air pollution, air quality standards, monitoring techniques, air pollutant dispersion and modelling techniques, prevention & control, vehicular emission control.		
8	Outline syllabus			
	Unit 1	**Air pollution and its Effects**		CO1, CO6
	A	Air Pollutants - Sources, Classification, Effect on Health, Vegetation, Materials, and Atmosphere.		
	B	Chemical and Photochemical Reactions in the Atmosphere and their Effects - Smoke, Smog, Acid Rain and Ozone Layer Depletion		
	C	Green House Gases, Global Warming and its Implications		
	Unit 2	**Air Pollution Legislation and Standards**		CO2, CO6
	A	The Factories Act and Amendment, 1981 - The Air (Prevention and Control of Pollution) Act		
	B	1982 - The Air (Prevention and Control of Pollution) Rules, 1982 - The Atomic Energy Act		
	C	1987 - The Air (Prevention and Control of Pollution) Amendment Act, 1988 - The Motor Vehicles Act.		

	Unit 3	**Ambient air quality monitoring techniques**			CO3, CO6
	A	High-Volume Sampling, Handy Sampler, Bio-aerosols sampler			
	B	Indoor Air Sampler, Stack Sampling			
	C	Meteorology and Air Pollution: Atmospheric Stability and Inversions, Behaviour of Air Pollutant Plumes as Affected by Nature of Source, Meteorology, Obstacles and Terrain, Maximum Mixing Depth			
	Unit 4	**Air pollution Dispersion and Modelling**			CO4, CO6
	A	Effluent Dispersion Theories - Models for Point and Line Sources Based on Gaussian Plume Dispersion and their Limitations			
	B	Models for Heavy Gas Dispersion. Issues of Indoor Air Quality.			
	C	Control of Air Pollutants - Concepts and the Design Elements of Gravitational Settlers, Centrifugal Collectors, Wet Collectors, Electrostatic Precipitators, Fabric Filters, Condensers			
	Unit 5	**Air pollution Prevention and Control and Vehicular emission control**			CO5, CO6
	A	Air Pollution Control by Absorption, Adsorption, Condensation, Incineration, Bio-scrubbers, Bio-filters, etc and Case Studies.			
	B	Emission standards for automobiles, Origin of exhaust emissions from gasoline, Diesel, CNG & LPG engines, Crankcase and evaporative emissions			
	C	Emission reduction by fuel changes, Emission reduction by engine design changes, Catalytic converters, Diesel engine emissions.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text books	1. Introduction to Environmental Engineering and Science, G. M. Masters, Prentice-Hall of India, New Delhi, 2011. 2. Air Pollution Control Engineering, N. de Nevers. McGraw Hill, Singapore, 2011. Fundamentals of Air pollution, R. W. Boubel, D. L. Fox, and A. C. Stern, Academic Press, NY, 2011. 3. M.N. Rao & H.V.N. Rao, "Air Pollution", Tata McGraw- Hill			

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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Env. Engg.)		**Semester: II**		
1	Course Code	CVL678	Course Name: Environmental Economics and Management	
2	Course Title	Environmental Economics and Management		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	ELECTIVE		
5	Course Objective	The aim of the course is to provide students with understanding and confidence with environmental management techniques and to understand their importance		
6	Course Outcomes	The students will be able to CO1: Recognize the fundamental procedures, tools, and techniques employed in Environmental Impact Assessment (EIA). CO2: Comprehend the process involved in planning and executing environmental audits. CO3: Demonstrate an understanding of environmental management by examining procedures, tools, techniques, and strategies. CO4: Analyze various ISO certifications pertaining to environmental management, incorporating practical case studies for enhanced insight. CO5: Evaluate and interpret the concepts of environmental design and economics, fostering a clear and structured understanding. CO6: Apply environmental management techniques to address real-world issues, showcasing their significance within practical scenarios.		
7	Course Description	This course includes EIA, environmental audit, planning &monitoring, EMS, ISO certification and various case studies.		
8	Outline syllabus			
	Unit 1	**Environmental Impact Assessment**		CO1, CO6
	A	EIA Origin, Concepts, Methodologies, Screening, Scoping, Base Line Studies, Mitigation, Matrices and Check list		
	B	Types of EIA - Rapid & Comprehensive, Legislative and Environmental Clearance Procedures in India, Prediction Tools for EIA;		
	C	Documentation of EIA, Environmental Management Plan, Post Project Monitoring.		
	Unit 2	**Environmental Audit**		CO2, CO6
	A	Guidelines for Environmental Audit (EA), Environmental Auditing Procedure		
	B	Types of EA, Waste Audits and Pollution Prevention Assessments		
	C	EA in Industrial Projects; Liability Audits and Site Assessment;		

		Auditing of EMS.			
	Unit 3	**Environmental Management Systems**			CO3, CO6
	A	Elements of LCA – Life Cycle Costing – Understanding the process, its purpose			
	B	evolution and stages, limitations of LCA, procedure for conducting LCA and its applications			
	C	concept of Eco Labelling			
	Unit 4	**ISO Certification**			CO4, CO6
	A	Environmental Management – core elements, benefits, certification body assessments of EMS, documentation for EMS			
	B	EMS Standard: ISO 14000 - Need of Certification, ISO Principles; Certification body assessments of EMS; documentation for EMS			
	C	Implementation of ISO 14001; Difference between ISO 9000 & ISO 14000 and OHSAS 18000;			
	Unit 5	**Environmental Design & Environmental Economics**			CO5, CO6
	A	Introduction to the concept of Environmental Design – for manufactured products, buildings and developmental planning, concept of Green Building, LEED requirements			
	B	Introduction to the concept of Environmental Economics – basic definitions, demand-supply curve			
	C	Classification of costs, concept of Environmental taxes, economics of natural resources.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Reference Books	1. Complete Guide to ISO 14000, R. B. Clements. Simon & Schuster, 2011. 2. Environmental Management: Principles & Practices, Christopher J. Barrow, Routledge, 1999 - Business & Economics 3. Handbook of Environmental Impact Assessment Vol. I and II, J. Petts, Blackwell Science, London, 2010. 4. Canter R.L., Environmental Impact Assessment, Mc Graw Hill International Edition, 1997 5. John G. Rau and David C. Wooten (Ed), Environmental Impact Analysis Handbook, McGraw Hill Book Company. 6. Environmental Impact Assessment by R. K. Jain. 7. W. Kurge: ISO 14001 Certification – Environmental Management System, Prentice Hall, 1995.			

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

School: SSET		**Batch: 2023-25**	
Programme: M. TECH		**Current Academic Year: 2023-24**	
Branch: CE (Geotechnical)		**Semester: I**	
1	Course Code	CVL831	
2	Course Title	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 gain knowledge of sustainable remediation technique. 5. To understand the method of waste utilization in geotechnical engineering.	
6	Course Outcomes	The students will be able to: CO1: Recognize the polluted location and comprehend the movement of contaminants. CO2: Develop and appraise a system for waste disposal. CO3: Modify the concentration of pollutants at the contaminated site. CO4: Apply environmentally sustainable techniques to remediate the polluted area. CO5: Employ solid waste as geo-material to diminish waste storage requirements. CO6: Investigate and evaluate diverse geo-environmental subjects through research studies.	
7	Course Description		
8	Outline syllabus		
	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	Pollution of aquifers by mixing of liquid waste – protecting aquifers, Site investigation at polluted sites (Geophysical techniques, Hydrological investigations etc.)	
	Unit 2	**Containment of Solid and Slurry Waste**	CO2, CO6
	A	Disposal of solid waste, Environmental impact of waste dump,	

		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, Embankment construction, Design aspects, 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	**Phytoremediation: Research and Application**	CO4, CO6
	A	Case study of site with mixed contamination, Identification of contaminations, Survival and growth of plant, Effect of plant implementation in soil characteristic.	
	B	Study of fate and heavy metal, Effect of compost addition.	
	C	Research methodology-Soil characterization, Test selection, plant selection, soil and plant sample testing.	
	Unit 5	**Geotechnical Reuse of Waste Material**	CO5, 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.	
	Mode of examination	Theory	
	Weightage Distribution	CA: 25% / MTE: 25% / ETE: 50%	
	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

School: SSET		**Batch: 2023-25**	
Programme: M. TECH		**Current Academic Year: 2023-24**	
Branch: CE (Geotechnical)		**Semester: I**	
1	Course Code	CVL 728	
2	Course Title	Soil Foundation 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: 25% / MTE: 25% / ETE: 50%	
	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.

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

School: SSET		**Batch: 2023-25**	
Programme: M. TECH		**Current Academic Year: 2023-24**	
Branch: CE (Geotechnical)		**Semester: I**	
1	Course Code	CVL 744	
2	Course Title	Dynamics of Soils	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	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: Demonstrate a foundational comprehension of vibrations, including the formulation of concepts and utilization of mathematical equations in their description. CO2: Explain the influence of vibrations on soil properties, illustrating how the dynamic forces impact and potentially alter the characteristics of the soil. CO3: Apply knowledge of various laboratory tests for dynamic loading and liquefaction, demonstrating an understanding of their procedures and purposes. CO4: Construct designs for piles subjected to dynamic loading, employing both manual methods and finite element software (Plaxis 2D) to address real-world scenarios. CO5: Formulate designs for shallow foundations exposed to dynamic loading, utilizing manual techniques and finite element software (Plaxis 2D) to address complex conditions. CO6: Evaluate and assess the dynamic properties of soil, examining their behavior under varying vibration conditions and drawing conclusions from observed outcomes.	
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		
	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	**Dynamic Analysis of Shallow Foundation**			CO5, CO6
	A	Analysis of shallow foundation under vertical vibrations			
	B	Analysis of shallow foundation under translation and rocking, Analysis of piles under torsion			
	C	Design procedure for a block foundation supporting the machine.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	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.			
	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

School: SSET		**Batch: 2023-25**	
Programme: M. TECH		**Current Academic Year: 2023-24**	
Branch: CE (Geotechnical)		**Semester: I**	
1	Course Code	CVL727	
2	Course Title	Site Investigation and Improvement Techniques	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	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: To predict and to solve potential foundation problems. CO2: To investigate the safety of existing structures and to suggest the remedial measures. CO3: To estimate the probable maximum and differential settlements. CO4: To observe the soil the soil performance after construction. CO5: Establish procedures for soil improvement to suit design purpose. CO6: Perform complex geological investigation of a 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 - Stabilization of boreholes.	
	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 - Methods to minimize sample disturbance	
	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	
		25%	25%	50%	
	Text book/s*	1. Purushottam 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. RamanathanAyer, 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 Geo-environmental 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

School: SSET		**Batch: 2023-25**	
Programme: M. TECH		**Current Academic Year: 2023-24**	
Branch: CE (Geotechnical)		**Semester: I**	
1	Course code	**CVL730**	
2	Course Title	**Geotechnical Earthquake Engineering**	
3	Credits	**(3-1-0)**	
4	Contact Hours (L-T-P)	**4**	
5	Course Objective	3. 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. 4. To enable the student to perform an equivalent-linear site response analysis.	
6	Course Outcomes	The students will be able to CO1: Recognize the essential elements involved in assessing seismic hazard and describing earthquake actions. CO2: Apply the fundamental principles of wave propagation to solve engineering problems and scenarios. CO3: Explain the basic aspects of soil behavior under dynamic loading, relating them to real-world situations. CO4: Analyze the influence of soil deposits on altering seismic ground motion and its effects. CO5: Demonstrate the process of conducting a site response analysis using both analytical and numerical methods. CO6: Evaluate the potential for liquefaction using various simplified methodologies, while also comprehending the underlying principles of mitigation strategies.	
7	**Prerequisite**	Students should have basic knowledge of soil foundation interaction	
8	**Course Contents**		
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	**Wave Propagation and Analysis of Site Effects**	CO3, CO6
8.10	Unit C Topic 1	Wave propagation Analysis - Site Amplification Need for Ground Response Analysis, Method of analysis	
8.11	Unit C Topic 2	One Dimensional Analysis, Equipment linear Analysis site effects	
8.12	Unit C Topic 3	Design Ground Motion, Developing Design Ground Motion. Application of software package Shake-2000	
8.13	Unit D	**Design of Foundations**	CO4, CO6
8.14	Unit D Topic 1	Earthquake Resistant Design of foundation of buildings, Design considerations, Geotechnical Architectural Structures od	
8.15	Unit D Topic 2	Seismic analysis. Earthquake Response of slopes, Evaluation of slope stability, Pseudostatic Analysis	
8.16	Unit D Topic 3	Newmark's Study of Block Analysis , Dynamic Analysis - Earth pressure due to ground shaking Evaluation,	
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	Yes	
9.17	Total Marks	25	25	50	
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 Geotechnics, 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

School: SSET		**Batch: 2023-25**	
Programme: M. TECH		**Current Academic Year: 2023-24**	
Branch: CE (Geotechnical)		**Semester: II**	
1	Course Code	CVL837	
2	Course Title	FEM APPLICATION IN GEOTECHNICAL ENGINEERING	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Type	ELECTIVE	
5	Course Objective	1: To enable student with fundamentals of Finite element method. 2: To impart the knowledge and skill of analysing physical problems with FE software. 3: To Understand the basic functions of FE based software and its applications in Geotechnical engineering	
6	Course Outcomes	The students will be able to: CO1: Identify the suitable element and mesh for FE analysis to solve a given problem. CO2: Formulate the FE-model after assessing the nature of the problem. CO3: Apply transformation techniques to in-situ test results, and then estimate stresses and strains in soil using FE analysis for a specific physical problem. CO4: Comprehend the general concept of how finite elements provide approximate solutions to differential equations. CO5: Analyse data from various structures using Finite Difference Method (FDM) and Finite Element Method (FEM). CO6: Utilize the fundamental features of FE-based software and its applications in the field of Geotechnical engineering.	
7	Course Description	Load on Footing, Settlement of Foundations, Pile Foundations, Dynamic behaviour of footing, Footing on Marine Soil	
8	Outline syllabus		
	Unit 1	**Introduction**	CO1, CO6
	A	Matrix Algebra – Inversion of matrix – solution of large number of simultaneous equations	
	B	Concepts of FEM, Steps involved in Finite Element Analysis Procedure, Merits and Demerits.	
	C	Principles of Elasticity: Stress equations, Strain-Displacement relationships in matrix form, Plane stress, Plane strain and axi-symmetric bodies of revolution with Axi-symmetric loading.	
	Unit 2	**Displacement Based Element**	CO2, CO6
	A	Element Properties: Concept of an element, various element shapes, Displacement models, Generalized coordinates, Shape functions.	

	B	Convergent and Compatibility requirements, Geometric invariance, Natural coordinate system - area and volume coordinates.	
	C	Generation of Element Stiffness and Nodal Load Matrices.	
	Unit 3	**Isoperimetric Formulation**	CO3, CO6
	A	Isoperimetric Formulation: Concept, Different isoperimetric elements for 2D analysis, formulation of 4-noded and 8-noded isoperimetric quadrilateral elements, Lagrangian elements, Serendipity elements	
	B	Discretization of a structure, numbering systems, Aspect ratio its effects, Assemblage, Direct Stiffness method.	
	C	Strain laws: Introduction, Bilinear elastic model, K-G model, hyperbolic model, comparison of models and critical state model with numerical examples.	
	Unit 4	**Geotechnical Problem Formulation**	CO4, CO6
	A	Techniques of nonlinear analysis, Constitutive modelling for soils, Non- linear soil parameters	
	B	Geotechnical Applications: Seepage analysis: Finite element discretization of seepage equation, computation of velocities and flows, treatment of free surface boundary,	
	C	Analysis of jointed rock mass: Characters and discontinuity of rock, model behaviour of jointed rocks, plane strain analysis	
	Unit 5	**FEM Software Application**	CO5, CO6
	A	Pre-processor & Post processing techniques	
	B	Geotechnical Applications: Applications to study of Bearing capacity and Settlement analysis.	
	C	Geotechnical Applications: Applications to study of embankment dams, Sequential construction, excavations, stress distribution around opening.	
	Mode of examination	Theory	
	Weightage Distribution	CA | MTE | ETE 25% | 25% | 50%	
	Text book/s*	1. Introduction to the Finite Element Method, C. S. Desai and J. F. Abel. Van Nostrand Reinhold Company. 2. Finite element analysis in geotechnical engineering Vol 1 and 2, D. M. Potts and L. Zdravkovic, Thomas Telford publishing, London. 3. Finite element analysis in geotechnical engineering, D. J. Naylor and G. N. Pande.	
	Other References	1. Introduction to the Finite Element Method, J. N. Reddy - McGraw-Hill Publishers. 2. Finite element analysis - Theory and programming, C. S. Krishna Murthy - Tata McGrawHill. 3. Finite element Methods, O. C. Zienkiewicz - McGraw-Hill Publishers.	

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

School: SSET		**Batch: 2023-25**	
Programme: M. TECH		**Current Academic Year: 2023-24**	
Branch: CE (Geotechnical)		**Semester: II**	
1	Course Code	CVL 731	
2	Course Title	Reinforced Soil Structure	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Type	ELECTIVE	
5	Course Objective	1. To introduce the concepts of geo-synthetics. 2. Detailed understanding of the history and mechanism of reinforced soil 3. Knowledge of the various types of geo-synthetics, their functions and applications. 4. Detailed knowledge about the design of few reinforced soil structures.	
6	Course Outcomes	The students will be able to: CO1: Demonstrate an awareness of reinforced soil technique as an alternative to conventional techniques. CO2: Choose an appropriate reinforcement material and type based on the functional requirements. CO3: Apply analysis and design principles to reinforced soil structures. CO4: Formulate a solid foundation for making informed decisions in the design of geo-synthetic-reinforced steep slopes and walls. CO5: Comprehend the application of geo-synthetics for soil improvement purposes. CO6: Create designs for reinforced soil structures using acquired knowledge and skills.	
7	Course Description	Introduction to geo-synthetic, Geo-synthetics and Design Considerations, Geo-synthetics in Slope Stabilization and Retaining Walls, Corrosion and Its Measurements, Reinforcement in Pavement and Embankment	
8	Outline syllabus		
	Unit 1	**Introduction**	CO1, CO6
	A	Historical back ground – Introduction to reinforced soil structures, comparison with reinforced cement concrete structures - advantages- recent developments - area of application	
	B	Different, types of geo-synthetics – Different Materials, properties and testing	
	C	Functions of geo-synthetics –Reinforcement, separation, filtration, drainage, moisture barrier - mechanism of reinforced soil.	
	Unit 2	**Geo-synthetics and Design Considerations**	CO2, CO6
	A	Materials used properties, laboratory testing and constructional details.	

	B	Functions and design principles of metallic strips, metallic grids, geo-textiles.			
	C	Functions and design principles of geo-grids, geo-membranes and geo-composites,			
	Unit 3	**Geo-synthetics in Slope Stabilization and Retaining Walls**			CO3, CO6
	A	Analysis, design and construction of reinforced soil retaining walls – Problems			
	B	Construction methods - Concertina method, telescopic method, sliding method			
	C	Various types of facings - Application of geo-synthetics for stabilisation of slopes- Introduction to soil nailing.			
	Unit 4	**Corrosion and Its Measurements**			CO4, CO6
	A	Measurement of corrosion factors			
	B	resistivity - redox potential, water content, pH			
	C	Electrochemical corrosion, bacterial corrosion.			
	Unit 5	**Reinforcement in Pavement and Embankment**			CO5, CO6
	A	Design applications of reinforced soil structures in pavements. Embankments, slopes.			
	B	Case studies of reinforced soil structures, discussion on current literature.			
	C	Design considerations of reinforcements in retaining walls and foundations. **Latest research in foundation on reinforced soil.**			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Koerner, R.H. Designing with geosythetics, Prentice Hall Inc, 1994. 2. Jones, C.J.E.P. Reinforcement and soil structures, Butterworth Publications, 1996. 3. Jewel, R.A. Soil reinforcement with geotextiles, CIRIA, 1996. 4. Ingold, J.S. and Miller, K.S., Geotextiles hand book, Thomas Telford Ltd, 1988			
	Other References	1. Rankilor, P.R., Membranes in ground engineering, John Wiley & Sons, 1985.			

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

School: SSET		**Batch: 2023-25**	
Programme: M. TECH		**Current Academic Year: 2023-24**	
Branch: CE (Geotechnical)		**Semester: I**	
1	Course Code	CVL 735	
2	Course Title	Foundation on Expansive Soil	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Type	ELECTIVE	
5	Course Objective	To provide an understanding of the tools necessary to design and construct foundations on expansive soils sites for a variety of soil types and to solve various problems encountered when building on expansive soils.	
6	Course Outcomes	The students will be able to: CO1: Recognize various soil types and their chemical characteristics. CO2: Comprehend the principles governing soil and structural designs of foundations and retaining walls. CO3: Apply acquired knowledge to confidently address practical situations demanding special foundations. CO4: Demonstrate the ability to construct foundations under challenging soil conditions. CO5: Analyse and select appropriate treatments for problematic soils. CO6: Solve complex problems that arise during the construction on expansive soils.	
7	Course Description	Properties of Expansion Soil and its Effects, Evaluation of Swelling, Drainage and Cushion Techniques, Piling on Expansive Soil, Remedial Techniques	
8	Outline syllabus		
	Unit 1	**Properties of Expansion Soil and its Effects**	CO1, CO6
	A	Origin of expansive soils – Physical properties of expansive soils	
	B	Mineralogical composition – Identification of expansive soils	
	C	Field conditions that favour swelling – Consequences of swelling.	
	Unit 2	**Evaluation of Swelling**	CO2, CO6
	A	Swelling characteristics, Laboratory tests.	
	B	Prediction of swelling characteristics,	
	C	Evaluation of heave.	
	Unit 3	**Drainage and Cushion Techniques**	CO3, CO6
	A	Horizontal moisture barriers – Vertical moisture barriers	
	B	Surface and subsurface drainage	
	C	Pre-wetting – Soil replacement – Sand cushion techniques – CNS layer technique.	
	Unit 4	**Piling on Expansive Soil**	CO4,

					CO6
	A	Belled piers – Bearing capacity and skin friction –Advantages and disadvantages			
	B	Design of belled piers			
	C	Under reamed piles – Design and construction.			
	Unit 5	**Remedial Techniques**			CO5, CO6
	A	Lime stabilization – Mechanisms – Limitations			
	B	Lime injection – Lime columns			
	C	Mixing – Chemical stabilization – Construction.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Terzaghi, K., and Peck, R.B., "Soil Mechanics in Engineering Practice", Asia Publishing House, Bombay. 2. Terzaghi, K., "Theoretical Soil Mechanics, Wiley, New York. 3. Kurian, N.P., "Design of Foundation Systems – Principles and Practices", 2nd Edition, New Delhi, Narosa publishing House. 4. Ranjan, G., and Rao, A.S.R., "Basic and Applied Soil Mechanics", 2nd Edition, New Age International (P) Limited.			
	Other References	1. Das, M.B., "Advanced Soil Mechanics", 2nd Edition, Taylor & Francis, New York. 2. Teng, W.C., 'Foundation Design", Prentice-Hall of India Pvt. 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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Structures)		**Semester: I**		
1	Course Code	CVL826	Course Name: Quality Control and Safety Practices In Construction	
2	Course Title	Quality Control and Safety Practices In Construction		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	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: Understanding the concept of quality planning and assurance (QA/QC). CO2: Familiarizing oneself with quality control principles. CO3: Applying management techniques for effective implementation. CO4: Analysing quality management standards and principles. CO5: Recognizing the importance of safety and promoting safe work behavior. CO6: Evaluating safety measures and selecting 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	
		25%	25%	50%	
	Text book/s*	1. Abdul Razzak Rumane, "Quality Management in Construction Projects", Taylor & Francis, 2010 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 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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Construction Management)		**Semester: I**		
1	Course Code	CVL836	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	ELECTIVE		
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 Description	This course will provide students an understanding and ability in areas of project management and general management. The emphasis is on 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	
		25%	25%	50%	
	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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Structures)		**Semester: I**		
1	Course Code	CVL 829	Course Name: Analysis of Construction Cost and Finances	
V2	Course Title	Analysis of Construction Cost and Finances		
3	Credits	4		
4	Contact Hours (L-T-P)	3-1-0		
	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	
		25%	25%	50%	
	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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Structures)		**Semester: I**		
1	Course Code	CVL827	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	
		25%	25%	50%	
	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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Structures)		**Semester: II**		
1	Course Code	CVL806	Course Name: Quantitative Methods in Construction Management	
2	Course Title	Quantitative Methods in Construction Management		
3	Credits	4		
4	Contact Hours (L-T-P)	3-1-0		
	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 summarize the foundational concepts of probability and statistics relevant to construction management. CO2 – Demonstrate comprehension and insight into the concept of linear programming, along with its resolution using graphical and simplex methods. CO3 – Illustrate understanding and proficiency in the concept of transportation and assignment problems in the context of construction management. CO4 – Display understanding and insight into the concept of dynamic programming and queuing theory as applied to the construction field. CO5 – Appraise the concept of game theory and simulation problems within the construction field, showcasing an understanding of their potential applications. CO6 – Apply fundamental technical knowledge and skills related to Probability, decision science, and quantitative techniques in construction management, demonstrating a high level of competence in their practical implementation.		
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**		CO2, CO6
	A	Linear programming		
	B	Graphical method of solving Linear programming		
	C	Simplex method		

	Unit 3	**Transportation Problems**			CO3, CO6
	A	Transportation			
	B	Assignment problems-I			
	C	Assignment problems-I			
	Unit 4	**Introduction to 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	
		25%	25%	50%	
	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

School: SSET		**Batch: 2023-25**	
Programme: M.TECH		**Current Academic Year: 2023-24**	
Branch: CE (Structures)		**Semester: II**	
1	Course Code	CVL804 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	
		25%	25%	50%	
	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

School: SSET		**Batch: 2023-25**		
Programme: M.TECH		**Current Academic Year: 2023-24**		
Branch: CE (Structures)		**Semester: II**		
1	Course Code	CVL828	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	
		25%	25%	50%	
	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