School of Technology: Department of Civil Engineering
Post Graduate Program: M. Tech. Structural Engineering
Curriculum Structure **Academic Year 2018-19**

Semester I									
Course Code	**Course Title**	**L**	**T**	**P**	**C**	**Evaluation Scheme**			
						Component	**Exam**	**WT (%)**	**Min. Pass %**
CSE501 (PC|ST) Version:1.0	Advanced Structural Analysis	3	1	-	4	Theory (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
CSE503 (PC|ST) Version:1.0	Advanced Solid Mechanics	3	-	-	3	Theory (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
CSE505 (PC|ST) Version:1.0	Structural Dynamics	3	-	-	3	Theory (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
CSE507. - (PE|ST) Version:1.0	Program Elective - I	3	-	-	3	Theory (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
CSE509. - (DE|ST) Version:1.0	Department Elective- I	3	-	-	3	Theory (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
CSE511 (UC/ST) Version:1.0	Research Methodology	3	1	-	4	Theory (100)	FET	20	40
							CAT	30	
							CAT II	15	
							ESE	50	40
CSE513 (PC|ST) Version:1.0	Structural Dynamics lab	-	-	2	1	Practical	FEP	50	40
							POE	50	
CSE515 (PC|ST) Version:1.0	Concrete Structure Design Lab	-	-	2	1	Practical	FEP	50	40
							POE	50	
CSE517 (PW|ST) Version:1.0	Mini Project - I	-	-	2	1	Project	FEP	100	40
		18	**02**	**06**	**23**	Total Hours: **26**, Total Credits: **23**			

FET – Faculty Evaluation Theory; **CAT –** Continuous Assessment Test; **ESE –** End Semester Examination; **FEP –** Faculty Evaluation Practical; **POE** – Practical Oral Examination

School of Technology: Department of Civil Engineering
Post Graduate Program: M. Tech. Structural Engineering
Curriculum Structure **Academic Year 2018-19**

Semester II									
Course Code	**Course Title**	**L**	**T**	**P**	**C**	**Evaluation Scheme**			
						Component	**Exam**	**WT (%)**	**Min. Pass %**
CSE502 (PC|ST) Version:1.0	Theory of Plates and Shell	3	1	-	4	Theory (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
CSE504 (PC|ST) Version:1.0	Finite Element Method	3	1	-	4	Theory (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
CSE506 (PC|ST) Version:1.0	Earthquake Resistant Design of Structures	3	1	-	4	Theory (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
CSE508. - (PE|ST) Version:1.0	Program Elective - II	3	-	-	3	Theory (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
CSE510. - (DE|ST) Version:1.0	Department Elective- II	3	-	-	3	Theory (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
CSE512 (PC|ST) Version:1.0	Finite Element Analysis Lab	-	-	2	1	Practical	FEP	50	40
							POE	50	
CSE514 (PC|ST) Version:1.0	Steel Structure Design Lab	-	-	2	1	Practical	FEP	50	40
							POE	50	
CSE516 (PW|ST) Version:1.0	Mini Project - II	-	-	2	1	Project	FEP	100	40
CSE518 (PC|ST) Version:1.0	NPTEL Online Courses	-	-	-	2	Online	FEP	100	40
		15	**03**	**06**	**23**	Total Hours: **24**, Total Credits: **23**,			

FET – Faculty Evaluation Theory; **CAT –** Continuous Assessment Test; **ESE –** End Semester Examination; **FEP –** Faculty Evaluation Practical; **POE** – Practical Oral Examination

Semester III									
Course Code	**Course Title**	**L**	**T**	**P**	**C**	**Evaluation Scheme**			
						Component	**Exam**	**WT (%)**	**Min. Pass %**
CSE601 (PW|ST) Version:1.0	Construction Industry Internship	-	-	-	4	Report and Presentation	FEP	50	50
							ESE	50	
CSE603 (PW|ST) Version:1.0	Dissertation Phase - I	-	-	-	4	Presentation	FEP	100	50
CSE605 (PW|ST) Version:1.0	Dissertation Phase - II	-	-	-	8	Presentation , Report and Demo	ISE	100	50
							ESE	50	
		-	**-**	**-**	**16**	Total Hours: **-**, Total Credits: **16**,			

FET – Faculty Evaluation Theory; **CAT –** Continuous Assessment Test; **ESE –** End Semester Examination; **FEP –** Faculty Evaluation Practical; **POE** – Practical Oral Examination

Semester IV									
Course Code	**Course Title**	**L**	**T**	**P**	**C**	**Evaluation Scheme**			
						Component	**Exam**	**WT (%)**	**Min. Pass %**
CSE602 (PW|ST) Version:1.0	Dissertation Phase - III	-	-	-	8	Presentation & Demonstration	ISE	100	50
CSE604 (PW|ST) Version:1.0	Dissertation Phase - IV	-	-	-	8	Viva Voce Exam	ESE	50	50
CSE606 (PW|ST) Version:1.0	Dissertation outcome Dissemination	-	-	-	2	Publications and Patents	ESE	100	50
		-	**-**	**-**	**18**	Total Hours: **-**, Total Credits: **18**,			

FET – Faculty Evaluation Theory; **CAT –** Continuous Assessment Test; **ESE –** End Semester Examination; **FEP –** Faculty Evaluation Practical; **POE** – Practical Oral Examination

Total Credits: **80**

Program Elective

CSE507.1 Advanced Design of Concrete Structures
CSE507.2 Structural Design of Bridges
CSE507.3 Repair and Rehabilitation of Concrete Structures
CSE508.1 Advanced Design of Steel Structures
CSE508.2 Stability of Structures
CSE508.3 Design of Foundations

Department Elective

CSE509.1 / CEM509.1 Structural Optimization
CSE509.2 / CEM509.2 Structural Health Monitoring
CSE509.3 / CEM509.3 Green Building Technology
CSE510.1 / CEM510.1 Disaster Management
CSE510.2 / CEM510.2 Underwater Construction
CSE510.3 / CEM510.3 Environmental Impact Assessment and Management

CSE501: Advanced Structural Analysis

(Ver 1.0, Program Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	1	-	4	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: This includes analysis of indeterminate structures sections Continuous beams, truss, portal frames and plane frame grids, beam- column. This course is divided into six units in two sections. section – I contains beam covered in plan ILDS for indeterminate structures and beam on Elastic foundations. section –II includes beam – column analysis, flexibility and stiffness methods of structural analysis.

Course Outcomes: after the end of this course students will able to

CO1 Analyze beam (determinate & indeterminate) curved in plan
CO2 Construct I.L.D for various indeterminate structures.
CO3 Analyze beam resting on elastic foundations
CO4 Analyze beam – column subjected to different loading with different end conditions
CO5 Generate stiffness and flexibility matrix.
CO6 analyze different structures using stiffness & flexibility method.

Syllabus (Theory)

Units	Description	Hours
I	Beams curved in plan: - Determinate and indeterminate beams curved in plan.	06
II	Influence line diagram: - ILD for indeterminate structures, Muller Breslaus Principle, and moments distribution methods, Applications to continues beams, portal frame and two hinged arches.	06
III	Beams on Elastic foundations: - Classification and Winkler's theory, Analysis of infinite, semi- infinite, and finite beams.	06
IV	Beams – columns: - Governing differential Equation, Analysis of beam-column subjected to different loading and support conditions, stiffness and carry over factors for beam- columns, fixed end actions due to various loads.	06
V	Flexibility Method: - Analysis concept of flexibility coefficient, flexibility matrix, analysis of continuous beam, truss and portal frame, and relation between stiffness and flexibility matrix.	06

VI	Stiffness Method: - Member and structure-oriented stiffness Approach, stiffness Matrices of beam truss, portal frame, plane frame grid, transformation matrix, Assembly rules and band width.	06

Text Book

- "Analysis of Structure", Vol. II, Vazirami & Ratwani., Khanna Publications, New Delhi.

References

- "Matrix Analysis & Framed Structure", William Weaver and James Gere, VAN Nostrand Reinhold International Company Ltd.
- "Theory of Elastic Stability", Timoshenko, Gere, Dover Publication, NewYork,2009.
- "Structural Analysis a Matrix Approach", Pandit & Gupta, TataMc Graw Hill Publising Ltd. 2009.
- "Basic structural Analysis", C. S. Reddy, TataMc Graw Hill Publising Ltd. 1996.
- "Structural Analysis" Negi & Jangid, TataMc Graw Hill, 1997.

CSE503: Advanced Solid Mechanics

(Ver 1.0, Program Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: This course intends to provide students a comprehensive knowledge on the theory of elasticity and plasticity. The course focuses on the following topics: continuous and discrete mechanics, Stress and Strain at a point, tensors, deformation and displacement, equilibrium equation in 3D state, compatibility conditions, principal stresses, invariants and stress deviators, constitutive law, Airy′s stress function approach, Torsion, plasticity theory, yield and failure criteria, plane stress and plane strain problems, variational principles, general theory of plastic flow for perfectly plastic materials.

Course Outcomes: after the end of this course students will able to

CO1	Derive equations of equilibrium in 3D state of stress and expression for principal stresses and their planes in 3D state of stress
CO2	Solve elasticity problems using Airy's stress function.

CO3	Derive twisting moment and warping displacement of a non-prismatic basr subjected to torsion.
CO4	Define yield criterions based on various failure theories.

Syllabus (Theory)

Units	Description	Hours
I	Elasticity: Analysis of Stress, Concept of Stress at a point, Rectangular stress components, Stresses on an arbitrary plane, Principal stresses and planes, Stress invariants, Planes of maximum shear, Octahedral stresses, State of pure shear, Hydrostatic and Pure shear states, Plane stress and plane strain, Equilibrium equations in 3D and 2D state of stress.	06
II	Analysis of Strains: Deformations, State of strain at a point, Shear strain components, compatibility equations, Strain deviator and its invariants, Stress-Strain material constitutive relationships, composite materials, Relationships between elastic constants, Equations of equilibrium in terms of displacements, Airy's stress function approach, bending of beams.	06
III	Axisymmetric problems: Thick walled cylinder subjected to internal and external pressures. Stress concentration: Members under tension, Plate with circular hole. Torsion: Circular and Non-circular shafts, warping function approach, Membrane analogy, Torsion of rolled sections.	06
IV	Plasticity: Plastic deformation of metals and its mechanism, factors affecting, Strain hardening, Stress-Strain relationships for various types of materials and empirical equations. Theories of plastic flow, Concept of Plastic Potential.	06
V	Yield criterions, Tresca and von-Mises-Henky yield criterions, Lode's, Taylor and Quinney's experiments for yield criterions, Haigh-Westergaard stress space, Geometrical representation of yield criterions, Yield surfaces in 3D and 2D stress space.	06
VI	Plastic bending of Beams, Stress-Strain curve, Plastic hinge, Incipient and elasto-plastic yielding, Nonlinear stress-strain curve, Shear stress distribution, Residual stresses, unsymmetrical bending, Shape factor, Plane-strain bending of beams.	06

Text Book

- "Theory of Elasticity", Timoshenko S P and Goodier J N, McGraw Hill Education (India) Private Limited, New Delhi, Third Edition, 2010.

References

- "Advanced Mechanics of Solids", Srinath L S, Tata McGraw Hill Education Private Limited, New Delhi, Third Edition, 2009.
- "Theory of Plasticity", Singh Sadhu, Khanna Publishers, Delhi, Third Edition, 2009.

CSE505: Structural Dynamics

(Ver 1.0, Program Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: This is to expose student to understand the basic theory of structural dynamics, structural response due to vibration, mathematical model of structure, free & forced vibrations without and with damping, numerical evaluation of response integral. The course learns through prerequisite of engineering mathematics, engineering mechanics, solid mechanics, and RCC structure. Student should have a clear understanding of methods of analysis & design of structure.

Course Outcomes: after the end of this course students will able to

CO1 Explain the basics of structural dynamics and equation of motion.
CO2 Analyze dynamic response of SDOF & MDOF systems.
CO3 Compute parameters like natural frequency, damping of SDOF & MDOF systems.
CO4 Compute the response parameters of vibrations like displacement, velocity, acceleration
CO5 Compute the mode shape of MDOF system.

Syllabus (Theory)

Units	Description	Hours
I	Single- Degree -of- freedom system - Fundamentals of vibration, types of exciting forces, equivalent stiffness, Damping and types of damping, response to harmonic loading, resonance, transmissibility, support motion and vibration isolation.	06

II	SDOF system subjected to periodic & impulse loading, fourier series loading, sine wave pulse, rectangular pulse and triangular pulse, Intrduction to frequency- domain analysis.	06
III	SDOF system subjected to general dynamic loading- Duhamel's integral, application to simple loading cases, numerical evaluation of response integral, Piecewise exact method, Newmark- Beta method.	06
IV	MDOF system: - Formulation of equation of motion, structure matrices, static condensation, free vibration, Eigen value problem, Frequencies and mode shapes, Determination of natural frequencies and mode shapes by Stodola method, orthogonality conditions, Proportional Damping Matrics, Rayleigh damping.	06
V	Discrete systems, Fundamental mode analysis, Rayleigh method, Rayleigh-Ritz method, Dunkerly method, Response of MDOF system to dynamic loading, Mode superposition method, coupled and uncoupled equations of motions, Modal contributions.	06
VI	Lateral vibration of beam – Equation of motion, free and force vibrations, boundary condition's, partial differential equation of motion, concept of wind loading, moving loading, vibration caused by traffic, blasting and pile driving.	06

Text Book

- "Dynamics of Structures- Theory and applications to Earthquake Engineering, Fourth Edition, Anil K. Chopra, Prentice Hall

References

- "Structural Dynamics-Theory and Computations, Fifth edition", Mario Paz and William Leigh, Kluwer Academic Publishers, Norwell, Massachusetts 02061 USA.
- "Earthquake Engineering-Theory and Implementation, Second edition", Nazzal S. Armouti, International Code Council, California, USA.
- "Earthquake Engineering for structural Design", W.F. Chen and E.M. Lui, CRC press, Taylor and Francis Group.
- "Dynamics of Structures, Third edition", Clough & Penzien, McGraw-Hill Companies, New York, USA.
- "Fundamentals of Structural Dynamics, Second Edition", Roy R. Craig, Andrew J. Kurdila, John Wiley & Sons.

CEM511: Research Methodology

(Ver 1.0, University Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	1	-	4	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: To develop adequate understanding on basic concepts of research and its methodologies, select and define appropriate research problem, prepare a project proposal, write a research report and thesis, write a research proposal, process for filing patent.

Course Outcomes: after the end of this course students will able to

- **CO1** Design[5] research problem
- **CO2** Organize[5] research related information
- **CO3** Acept[7] research ethics
- **CO4** Compare[6] tomorrow world will be ruled by ideas, concept, and creativity
- **CO5** Criticize[5] IPR in growth of individuals & nation
- **CO6** Evaluate[4] research problem with economic growth and social benefits

Syllabus (Practical)

Units	Description	Hours
I	**Research:** Definition of research, Applications of research and types, Research process and steps in it, Deductive and inductive reasoning; Validity-conclusion, internal, construct and external; Problem Solving – Types, Process and Approaches – Logical, Soft System and Creative; Creative problem-solving process, Development of Creativity, Group Problem Solving Techniques for Idea Generation – Brain storming and Delphi Method.	06
II	**Single Factor Experiment**: Analysis of Variance (ANOVA) for fixed effect model; Total treatment and error sums of squares, Decomposition of total sum of squares, ANOVA for Randomized complete block design to control effects of nuisance factors. **Two factor Factorial Design:** Basic definitions and principles, main effect and interaction, response surface and contour plots, Blocking, General arrangement for a two-factor factorial design; Models- Effects, means and regression	06

III	**Taguchi Techniques for Experimental Design:** Taguchi loss function, Average loss, nominal-the-best, smaller-the-best, larger-the-best, design process steps, selection of factors affecting- methods, factor levels, Test strategies- Full factorial experiment, fractional factorial experiment, Orthogonal arrays and their selection; Interaction effects, Parameter Design- Control and noise factors and parameter design, signal to noise ratio, types, parameter design strategy, tolerance design, robust design.	06
IV	**Design of Experiments (DOE):** Objectives, strategies, Factorial experimental design, designing engineering experiments, basic principles- replication, randomization, blocking, Guidelines for design of experiments, process of DOE, Simple Comparative Experiments- Basic statistical concepts, random variable, sample mean and variance, degrees of freedom, standard normal distribution, statistical hypothesis, Two sample t test-value, Confidence intervals, Paired comparison.	06
V	**Literature review:** Need, Procedure- Search for existing literature, Review the literature selected, develop a theoretical and conceptual framework, writing up the review, Formulating a research problem: Sources, Considerations, Steps in formulation of a problem, formulation of objectives, Definition of variables – Concepts, indicators and variables, Types of variables, Types of measurement scales, Constructing the Hypothesis- Null(Research) and alternative, one-tailed and two-tailed hypotheses, Hypothesis testing, errors in testing.	06
VI	**Research Modeling:** Types of Models, Model building and stages, Data consideration and testing, Heuristic and Simulation modeling, Data collection methods, Surveys-types and method selection. Research Proposal: Contents-Preamble, the problem, objectives, hypothesis to be tested, study design, setup, measurement procedures, analysis of data, organization of report; Displaying data- tables, graphs and charts, Writing a research report-Developing an outline, Key elements- Introduction, Methods, Measurement section, Design& procedure section, Results, conclusion section, Referencing of books and research papers, Report Writing- Prewriting considerations, Thesis writing, Formats of report writing, Formats of publications in Research journals.	06

Text Book

- Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"

References

- Krishnaswamy, K. N., Sivakumar, Appa Iyer and Mathirajan, M. (2006), Management Research Methodology: Integration of Principles, Methods and Techniques (Pearson Education, New Delhi)

- Montgomery, Douglas C. (2007) – Design & Analysis of Experiments, 5/e. (New Delhi,Wiley Student Edition, Wiley India Pvt. Ltd.) ISBN: 978-81-265-1048-1
- Montgomery, Douglas C. & Runger, George C. (2007) – Applied Statistics & Probability for Engineers, 3/e, (New Delhi, Wiley Student Edition, Wiley India Pvt. Ltd.), ISBN:978-81-265-1424-3
- Trochim, William M.K., (2003), 2/e, Research Methods, (Biztantra, Dreamtech Press,New Delhi), ISBN: 81-7722-372-0
- Kothari, C.K., (2004), 2/e, Research Methodology- Methods and Techniques, (NewAge International, New Delhi)
- Ross, Philip J. (1996), 2/e, Taguchi Techniques for Quality Engineering, (McGraw Hill,New York)

CSE513: Structural Dynamics lab

(Ver 1.0, Program Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	50
					POE	25	

Course Description: The aim of the lecture is to revise the general theory of vibration in solids and structures, understand the various analysis types (free vibrations, harmonic analysis and time response), and to have a thorough understanding of the important numerical procedures necessary to perform the modelling and simulation of real engineering problems.

Course Outcomes: after the end of this course students will able to

CO1	evaluate what structural analysis steps are required to solve different types of dynamic problems
CO2	analyze the outcome of the dynamics analysis performed with computer codes
CO3	compute the dynamic response of a structural model in terms of modal superposition

Syllabus (Practical)

Units	Description	Hours
I	One assignment from each unit.	04
II	Write a program to determine the Eigen values and Eigen vectors for a multi degree of freedom system.	04

III	Performance of shake table experiments to determine the natural frequencies and the mode shapes for various shear building frames subjected to harmonic base excitations. The results from the experiments should be reported in a standard format.	04

Text Book

- "Dynamics of Structures- Theory and applications to Earthquake Engineering, Fourth Edition, Anil K. Chopra, Prentice Hall

References

- "Structural Dynamics-Theory and Computations, Fifth edition", Mario Paz and William Leigh, Kluwer Academic Publishers, Norwell, Massachusetts 02061 USA.
- "Earthquake Engineering-Theory and Implementation, Second edition", Nazzal S. Armouti, International Code Council, California, USA.
- "Earthquake Engineering for structural Design", W.F. Chen and E.M. Lui, CRC press, Taylor and Francis Group.
- "Dynamics of Structures, Third edition", Clough & Penzien, McGraw-Hill Companies, New York, USA.
- "Fundamentals of Structural Dynamics, Second Edition", Roy R. Craig, Andrew J. Kurdila, John Wiley & Sons.
- "Structural Dynamics: Vibrations and Systems", Mukhopadhyay, Ane Books India, 2008.
- "Seismic Analysis of Structures", T.K. Datta, John Wiley& sons (Asia) Pte. Ltd.

CSE515: Concrete Structure Design Lab

(Ver 1.0, Program Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	50
					POE	25	

Course Description: To The course covers the design of reinforced concrete structural elements of a building. It introduces you to structural analysis techniques and their application in the structural design of concrete buildings. In addition, the material properties of concrete and its use as a construction material are addressed

Course Outcomes: after the end of this course students will able to

CO1 Interpret ultimate and serviceability limit state approaches in current structural design philosophy

CO2 Estimate primary design loads on structural elements such as beams and columns consulting appropriate standards
CO3 Model building structure and analyse structural elements for design actions

Syllabus (Practical)

Units	Description	Hours
I	A mini-project to be completed individually which shall be based on the analysis and design of a G + 4 storeys building having a plan area not less than 150 m2. The analysis shall be done using any commercially available software and the design of all structural members shall be done manually. The detailing shall be prepared using any commercially available drafting software.	08
II	Site visit with report to study reinforcement detailing and pre-stressed concrete structure	02
III	Report on non-destructive testing of concrete structures	02

References

- Reinforced concrete, limit state design by Ashok K. Jain, new chand and bros. Roorkee.
- Advanced reinforced concrete design by P.C. Varghese- Prentice Hall of India
- Advanced reinforced concrete design by N. Krishnaraju – CBS publishers and Distributers.
- Reinforced concrete structures VOL I & VOL II BY Jain and Jaikrishna.
- Prestressed concrete by N. Krishnaraju
- Reinforced concrete structures VOL I & VOL II by B.C. Punmia A.K. Jain, Arun K. Jain.
- Advance RCC Design by S S. Bhavekatti new Ag – Publisher

CSE517: Mini Project - I

(Ver 1.0, Program Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	50

Course Outcomes: after the end of this course students will able to

CO1 Acquired[4] knowledge within the chosen area of technology for project development
CO2 Justify[6] the technical aspects of the chosen project with a comprehensive
CO3 Reproduce[5], improve and refine technical aspects for engineering projects
CO4 Work[4] as an individual in development of technical projects

CO5 Communicate[5] and report effectively project related activities and findings

Syllabus

Mini project may be carried out in one or more form of following:

- Product preparations, working/non-working models, prototype development, fabrication of setups, laboratory experiment development, process modification/development, simulation, software development, integration of software and hardware, statistical data analysis, survey, creating awareness in society.
- The student is required to submit a report based on the work. The evaluation of the project shall be on continuous basis.

CSE502: Theory of Plates and Shell

(Ver 1.0, Program Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	1	-	4	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: The primary objective of this course is to learn methods of analysis of plates and shells. In section first, this course is dealing with theory of thin plate using Classical Plate Theory for all sides simply supported under doubly sinusoidal loading using Naviers' technique for rectangular plates. Levy's method will be used for other boundary and loading conditions. Circular plates will be studied under various boundary and loading conditions. In second section, students will learn membrane and bending theories of cylindrical and doubly curved shells, Synclastic and Anticlastic shells, Conoids. Students will also learn other aspects of shells i.e. Shell foundations, Funicular shell floors, Ferrocement shells etc

Course Outcomes: after the end of this course students will able to

CO1 Apply knowledge of mathematics, and engineering to understand classical plate theory.
CO2 Identify, formulate and solve theoretical problems of plate with various boundary and loading conditions.
CO3 Analysis[5] Circular Plates under axisymmetric loading.
CO4 Evaluate[6] membrane theory for cylindrical and doubly curved shells.
CO5 Evaluate[6] bending theory for cylindrical and doubly curved shells.

CO6 Evaluate[6] concepts of Shell foundations, Funicular shell floors, Ferro cement shells.

Syllabus (Theory)

Units	Description	Hours
I	Introduction to thin and thick plates and aspect ratio. Classical Plate Theory (CPT) of Kirchhoff and assumptions, displacement model. Material constitutive relationships for isotropic, orthotropic materials. Moment curvature relationships. Derivation of governing differential equation of equilibrium using Newtonian approach for isotropic plates. Introduction to energy principles to obtain equilibrium equations.	06
II	Navier's method for solution of rectangular plate with all sides simply supported (SSSS under transverse doubly sinusoidal static load, uniformly distributed load, patch and point loads. Levy's method for solution of rectangular plates with various boundary and loading conditions.	06
III	Circular Plates: Governing equations, Displacements and stresses for standard boundary conditions and axisymmetric loadings for solid and annular plates. Introduction to shear deformation and other theories. Discussion on comparison of results of displacements and stresses from CPT with results from other theories and finite element tool.	06
IV	Classification of shells. Membrane theory: Cylindrical thin shells, Equations of Equilibrium, Expressions for stresses under dead load for cylindrical shells with circular, cycloidal, parabolic directrix. Shells of double curvature, Synclastic and Anticlastic shells, Conoid. Discussions and Comments on membrane theory.	06
V	Bending theory: Cylindrical Shells, Strains and Stresses, Stress Resultants, Finsterwalder theory, Equations of Equilibrium, D-K-J Theory, Expresions for stress resultants and displacements, Schorer Theory, Expression for displacement. Discussions and comments on various bending theories of cylindrical shells. Approximate bending theory for shallow shells of double curvature.	06
VI	Beam theory for cylindrical shells with or without edge beams. Shell foundations: Characteristics, Selection of Shell dimensions, Hypar Shell footings. Funicular Shell Floors, Concrete Shells for Floors, Waffle-Slab and Shells floor. Ferrocement Shells: Definition and Properties.	06

Tutorial

One hour per week per batch tutorial is to be utilized for problem solving to ensure that students have properly learnt the topics covered in the lectures. This shall include assignments, tutorials,

quiz, and surprise test, declared test, seminar, final orals and any others. The teacher may add any of other academic activity to evaluate student for his/her in semester performance.

Test Book

- "Theory of Plates and Shells", Stephen P. Timoshenko and S. Woinowsky-Krieger, Tata McGraw Hill, New Delhi, International Edition, 2010.

References

- "Design and Construction of Concrete Shell Roofs", G S Ramaswamy, CBS Publishers and Distributors Pvt. Ltd., New Delhi, First Edition, 1986.
- "Energy Principles and Variational Methods in Applied Mechanics", J N Reddy, John Wiley and Sons, Inc., New Jersey, 2nd Edition, 2002.
- "Theory of Plates", K. Chandrashekhara, Universities Press, Hyderabad, 1st Edition, 2001
- "Theory and Analysis of Elastic Plates and Shells", J N Reddy, CRC Press, Boka Raton, Second Edition, 2007.
- 6. "Theories and Applications of Plate Analysis: Classical, Numerical and Engineering Methods" Szilard Rudolph, John Wiley and Sons, Inc., New Jersey, Revised Edition, 2004.
- "Theory and design of Concrete Shells" B. K. Chatterjee, Oxford and IBH, New Delhi, 1998.

CSE504: Finite Element Method

(Ver 1.0, Program Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	1	-	4	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: The FEM is powerful tool for the numerical solution of a wide range of Engineering Problems. The section I of this course consists of understanding of basic concepts of FEM, Development of [k] for 1-D,2-D and 3-D elements, Relevant structural applications. The section–II consists of Isoperimetric formulation of FEM, axisymmetric elements, Plate and shell elements and application of FEM to Structural dynamics. With advance in computer technology and CAD systems, complex problems can be modeled with relative case.

Course Outcomes: after the end of this course students will able to

- **CO1** Understand basic concept, discretization and application to 1-D problem.
- **CO2** Develop formulation for [k] for 2-D and 3-D elements.
- **CO3** Apply the knowledge of FEM to analyze continues structure.
- **CO4** Understand and apply finite element formulation on Isoperimetric basis.
- **CO5** Apply knowledge of FEM to structural Dynamics.

Syllabus (Theory)

Units	Description	Hours
I	Fundamental Concept and 1-D problem- Basic concepts and procedure of FEM, principle of minimum P.E., Rayliegh-Ritz method, point collocation method, Gallerkin's method, Varational Principle. Development of [k] for spring, bar, truss, beam and frame element, relevant structural applications.	06
II	Two-Dimensional Problem- Displacement function, convergence requirement and compatibility condition, Pascal's triangle, triangular and rectangular elements for plane stress and strain problems, element aspect ratio, applications to continuum.	06
III	Three – Dimensional problems in stress – strain analysis - Various types of 3D element, development of [k] for tetrahedron, hexahedral elements. Concept of axisymmetric element, development of [k] and nodal load vector.	06
IV	Isoparametric Elements - Shape function, natural co-ordinate systems, classification- Isoparimetric, sub-parametric, super-parametric elements, 1-D and 2 D Isoperimetric elements, Gauss- quadrature integration.	06
V	Plate and shell elements – Formation of stiffness matrix for plate bending elements of triangular and quadrilateral shape, cylindrical thin shell elements.	06
VI	Finite element applications to structural dynamics- Formulation Hamilton's principle, element mass matrices, evaluation of eigenvalues and eigenvectors.	06

Tutorial

One hour per week per batch tutorial is to be utilized for problem solving to ensure that students have properly learnt the topics covered in the lectures. This shall include assignment, tutorials, quiz, and surprise test, declared test, seminar, final orals and any others. The teacher may add any of other academic activity to evaluate student for his/her in semester performance.

Text Book

- The Finite Element Method" Vol.I & II, O.C. Zienkiewicz & R.L. Taylor, Tata McGraw Hill

- "An introduction to the Finite Element Method", J. N. Reddy, Tata McGraw Hill Pub.

References

- "Concept and Application of Finite Element Analysis", R. D. Cook, John Wiley & sons.
- " Fundamentals of Finite Element Analysis", Hutton D.V, Tata McGraw Hill Pub.
- "Introduction to the Finite Element Method", C. S. Desai & J. F. Abel, CBS Publications
- "Programming in the Finite Element Method", C. S. Krishnamoorthy,,Tata McGraw Hill.
- "Introduction to the Finite Element in Engineering", T.R.Chandrupatla and Belegundu, Prentice Hall of India Pvt.Ltd.
- "Finite Element Procedures", Bathe K.J, PHI learning Pvt.Ltd.
- "Finite Element Method with application in Engineering", Y.M. Desai, T.I Eldho, Pearson, Delhi

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CSE506: Earthquake Resistant Design of Structures

(Ver 1.0, Program Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	1	-	4	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: This course provides an overview of the breadth of earthquake engineering as a discipline, providing the most important knowledge and intellectual skills for students to be able to assess earthquake hazards and ground motions (shaking), and then to analyse and design structures for earthquake resistance.

Course Outcomes: after the end of this course students will able to

CO1	explain and demonstrate the elements of seismology
CO2	evaluate response of SDOF systems subjected to free and forced vibrations
CO3	compute lateral loads due to earthquake on multistory buildings as per IS 1893 – 2002
CO4	explain and draw planning aspects
CO5	evaluate and interpret ductile detailing of beam and columns using IS 13920
CO6	develop awareness to control the earthquake hazards by using Base isolation and Dampers

Syllabus (Theory)

Units	Description	Hours
I	Basic seismology and earthquake effects - Definition of earthquake, causes of earthquakes, theories of earthquakes, seismic zones, generation of seismic waves and its composition, measurement of earthquakes. Seismic effects on structures, liquefaction and its effect on structure. Peak ground acceleration, peak velocity, peak displacement, response spectra, tripartite plot.	06
II	Earthquake design philosophy - Effect of irregularities and architectural planning, center of mass and center of rigidity, philosophy of earthquake resistant design, maximum considered earthquake, design-based earthquake, concept of stiffness, flexibility and ductility, P – Δ effect.	06
III	Methods of analysis - Equivalent linear static analysis (with numerical), modal spectrum analysis (with numerical), linear time history analysis, static push over analysis, capacity-based design, performance-based design, IS 1893 code provisions.	06
IV	Design of RC members - Load combinations, concept of strong column weak beam design, design and detailing of beams, columns and beam-column joint as per IS 1893 and IS 13920.	06
V	Lateral load resisting systems - Types of lateral load resisting systems, computation of design lateral forces on RC shear walls, design of RC shear walls.	06
VI	Introduction to Vibration control techniques and retrofitting; Base isolation, Dampers for seismic response mitigation.	06

Tutorial

One hour per week per batch tutorial is to be utilized for problem solving to ensure that students have properly learnt the topics covered in the lectures. This shall include assignment, tutorials, quiz, and surprise test, declared test, seminar, final orals and any others. The teacher may add any of other academic activity to evaluate student for his/her in semester performance

Text Book

- Earthquake Resistant Design of Structures", Pankaj Agarwal and Manish Shrikhande, Prentice- Hall of India, 2007, New Delhi

References

- "Earthquake Resistant Design of Structures", S K Duggal, Oxford University Press, 2007.
- "Aseismic Design of Reinforced Concrete and Masonry buildings", Paulay,T and Priestly, M.N.J., John Wiley and Sons, 1991.

- "Dynamics of Structures (Theory and Applications to Earthquake Engineering)", Anil.K. Chopra, 3rd Edition, Prentice Hall of India Private Limited. New Delhi, 2009
- Short course on Seismic Design of Reinforced Concrete Buildings IIT, Kanpur, Dec.1995
- IS: 1893 (Part-1) -2002. "Criteria for Earthquake Resistant – Design of structures." B.I.S., New Delhi.
- IS: 4326-1993, "Earthquake Resistant Design and Construction of Building", Code of Practice B.I.S., New Delhi.
- IS: 13920-1993, "Ductile detailing of concrete structures subjected to seismic force" – Guidelines, B.I.S., New Delhi.

CEM512: Finite Element Analysis Lab

(Ver 1.0, Program Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	50
					POE	25	

Course Outcomes: after the end of this course students will able to

CO1 Use the modern tools to formulate the problem, and able to create geometry, descritize, apply boundary condition to solve problems of bars, truss, beams, plate to find stress with different loading conditions.

CO2 Demonstrate the deflection of beams subjected to point, uniformly distributed and varying loads further to use the available results to draw shear force and bending moment diagrams.

CO3 Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions.

Syllabus (Practical)

Study of a FEA package and modelling and stress analysis of

Units	Description	Hours
I	Bars of constant cross section area tapered cross section area and stepped bar.	02
II	Trusses – (Minimum 2 exercises of different types)	02
III	Beams – Simply supported, cantilever, beams with point load, UDL, beams with varying load etc., (Minimum 6 exercises different nature)	04
IV	Stress analysis of a rectangular plate with a circular hole	04

Text Book

- The Finite Element Method" Vol.I & II, O.C. Zienkiewicz & R.L. Taylor, Tata McGraw Hill
- "An introduction to the Finite Element Method", J. N. Reddy, Tata McGraw Hill Pub.

References

- "Concept and Application of Finite Element Analysis", R. D. Cook, John Wiley & sons.
- " Fundamentals of Finite Element Analysis", Hutton D.V, Tata McGraw Hill Pub.
- "Introduction to the Finite Element Method", C. S. Desai & J. F. Abel, CBS Publications
- "Programming in the Finite Element Method", C. S. Krishnamoorthy,,Tata McGraw Hill.
- "Introduction to the Finite Element in Engineering", T.R.Chandrupatla and Belegundu, Prentice Hall of India Pvt.Ltd.
- "Finite Element Procedures", Bathe K.J, PHI learning Pvt.Ltd.
- "Finite Element Method with application in Engineering", Y.M. Desai, T.I Eldho, Pearson, Delhi

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CSE514: Steel Structure Design Lab

(Ver 1.0, Program Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	50
					POE	25	

Course Description: This course covers the following topics: This course is designed to introduce the
behaviour and design of steel structural members according to the limit states design concept. The behaviour and design of tension members, compression members, laterally restrained and unrestrained beams, beam-columns and design of connections will be discussed. Students are expected to obtain basic knowledge about the design and failure mode of steel structural members after finished this course.

Course Outcomes: after the end of this course students will able to

CO1 application of analysis and design of steel structures

CO2	develop students with an understanding of the behavior and design of steel members and systems
CO3	prepare students for the effective use of the latest industry standard formulas, tables, design aids and computer software in the design of steel members

Syllabus (Practical)

Units	Description	Hours
I	A mini project and report on analysis and design of industrial steel structure using computer software in batches not more than 6 students.	04
II	Site visit and report at industrial steel structure (Conventional and Pre-Engineered Building)	02
III	Design and report on steel concrete composite column and beam.	04

Text book

- "Limit State Design of steel Structures", S.K. Duggal, McGraw Hill Education (India) Private Limited,

References

- "Design of steel structures, volume-II", Ramchandra, Scientific Publishers, Jodhpur, 9th Revised Edition, 2014.
- "Design of steel structures", N. Subramanian, Oxford University Press, USA, 1st Edition,
- "Structural analysis and Design of tall building" Taranath, Bangale S., McGraw Hill, 1988
- "Limit State Design of Structural Steel", M.R. Shiyekar, PHI Learning Pvt. Ltd., Second Edition, 2013.
- "Plastic Method of Structural Analysis", B.G. Neal, Chapman & Hall; 3rd edition, 1977
- Teaching Resource for Structural Steel Design –Vol.-III by IIT Madras, Anna University Chennai, SERC, Madras and Institute for Steel Development and Growth (INSDAG)

CSE516: Mini Project - II

(Ver 1.0, Program Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	50

Course Outcomes: after the end of this course students will able to

- **CO1** Acquired[4] knowledge within the chosen area of technology for project development
- **CO2** Justify[6] the technical aspects of the chosen project with a comprehensive
- **CO3** Reproduce[5], improve and refine technical aspects for engineering projects
- **CO4** Work[4] as an individual in development of technical projects
- **CO5** Communicate[5] and report effectively project related activities and findings

Syllabus

Mini project may be carried out in one or more form of following:

- Product preparations, working/non-working models, prototype development, fabrication of setups, laboratory experiment development, process modification/development, simulation, software development, integration of software and hardware, statistical data analysis, survey, creating awareness in society.
- The student is required to submit a report based on the work. The evaluation of the project shall be on continuous basis.

CSE507.1: Advanced Design of Concrete Structures

(Ver 1.0, Program Elective, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: The chapter addresses planning and design considerations for formwork. More specifically, the common design deficiencies, vertical and horizontal loads, safety factors for formwork accessories and shoring are discussed.

Course Outcomes: after the end of this course students will able to

- **CO1** Design of slender columns as per provisions of IS 456 – 2000.
- **CO2** Design of flat slab as per provisions of IS 456 – 2000.
- **CO3** Design of deep beams as per provisions of IS 456 – 2000.
- **CO4** Design of overhead service reservoir as per provisions of IS 456 – 2000.
- **CO5** Analysis of slab by using yield line theory
- **CO6** Design of beam column joints as per provisions of IS 456 – 2000.

Syllabus (Theory)

Units	Description	Hours
I	Design of Slender Columns: Concentrically loaded slender columns, eccentrically loaded slender columns, Slender columns subjected to axial and transverse loads, Structural behavior of columns in braced and unbraced frames, Codal procedure for design of slender columns.	06
II	Flat Slabs: Elements of flat slabs, Codal procedure for design of flat slabs, Behavior of flat slab in shear, one way and two-way shear, Equivalent Frame Method, Openings in flat slabs, Effect of pattern loading in flat slabs.	06
III	Deep Beams: General features, Parameter influencing design, Flexural bending and shear stresses in deep beams. Design provisions of IS-456, Checking for local failures, Strut and tie analysis of deep beams, Detailing of reinforcement in deep beams.	06
IV	Over Head Service Reservoir: Special design considerations, Design requirements of materials, membrane analysis and compatibility analysis of reservoir, complete design and drawing details of an overhead service reservoir.	06
V	Yield Line Analysis: Design of slabs of various shapes and having various support conditions using yield line analysis approach.	06
VI	Design of Beam Column Joints: Types of joints, Joints in multistoried buildings, Forces acting on joints, Design of joints for strength, Anchorage requirement in joints and detailing of reinforcement in joints.	06

Text Book

- "Reinforced concrete, limit state design", B.C. Punamia, Ashok K. Jain, Firewall Media, 2007.

References

- "Advanced reinforced concrete design" by P.C. Varghese- Prentice Hall of India ,2009.
- "Advanced reinforced concrete design" by N. Krishnaraju – CBS publishers and Distributers.
- "Plain and Reinforced concrete structures" Vol. I & Vol. II, Jain and Jaikrishna., Nem Chand and Brothers.
- "Advance RCC Design" S.S. Bhavikatti, New Age International Publishers, Second Edition
- IS 456-2000- Plain and Reinforced Concrete- Code of Practice
- SP:16 -1978- Design Aids to IS: 456:1978.

CSE508.2: Structural Design of Bridges

(Ver 1.0, Program Elective, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: The objectives of this course is to make students to learn planning, IRC specifications for road bridges and principles of Structural Design of bridges, To design and to detail the RCC, PSC and Plate Girder bridge superstructures. To design substructure and bearings for bridges.

Course Outcomes: after the end of this course students will able to

- **CO1** Appraise[4] choice of type, IRC Specifications and loads for road bridges.
- **CO2** Design short span and long span bridges.
- **CO3** Design Prestressed concrete bridges
- **CO4** Design Plate girder bridge for highway and railway.
- **CO5** Design bearings and substructure.

Syllabus (Theory)

Units	Description	Hours
I	Introduction: Classification, investigations and planning, choice of type, I.R.C. specifications for road bridges, standard live loads, other forces acting on bridges, general design considerations.	06
II	Short Span Bridges: Load distribution theories, analysis and design of slab culverts, box culvert, tee beam and slab bridges.	06
III	Long Span Girder Bridges: Design principles of continuous bridges, box girder bridges, balanced cantilever bridges.	06
IV	Design of Prestressed Bridges: Flexural and torsional parameters, Courbon's theory, Distribution co-efficient by exact analysis, Design of girder section, maximum and minimum prestressing forces, Eccentricity. Live load and dead load shear forces. Cable zone in girder. Check for stresses at various sections. Design of End block. Extradosed Bridge, Concept and Design	06

V	Design of Plate Girder Bridges: Design of welded plate girder bridges for highway and railway loading, wind effects, main section, splicing, curtailment, stiffeners.	06
VI	Bearings and Substructures: Different types of bearings. Design of bearings, Design of concrete piers and abutments, Types of bridge foundations.	06

Text Book

- "Design of Bridge Structures", Jagadeesh. T.R. and Jayaram. M.A., Prentice Hall of India Pvt. Ltd. 2004.

References

- "Bridge Engineering", Ponnuswamy S., Tata McGraw Hill, 2008.
- "Essentials of Bridge Engineering", Johnson Victor D., Oxford and IBH Publishing Co. New Delhi, 1990
- "Concrete Bridge Practice", Raina V.K, Tata McGraw Hill Publishing Company, New Delhi, 1991.
- IRC 21 – 1966 "Standard Specifications and Code Of Practice For Road Bridges"- Section III Cement Concrete (Plain and reinforced) The Indian Road Congress New Delhi
- IS 456 – 2000 "Indian Standard Plain and Reinforced Concrete Code of Practice"- (Fourth Revision) BIS New Delhi.
- IS 1343 – "Indian Standard Prestressed Concrete Code of Practice"- BIS New Delhi

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CSE507.3: Repair and Rehabilitation of Structures

(Ver 1.0, Program Elective, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: To impart knowledge about different types of determination of structures testing the structures for the deter ration of structures testing the structures for the diagnosis defects and different types of repairing methods.

Course Outcomes: after the end of this course students will able to

CO1 Analyze[4] distress in structures

CO2 Critisize[4] corrosion of reinforcement and remedial measure for it
CO3 Evaluate[6] and diagnosis damage of existing structure
CO4 Classify[4] different repair techniques in concrete structure
CO5 Summatize[6] different innovative techniques of strengthening of structures
CO6 Rate[6] need of structural health monitoring

Syllabus (Theory)

Units	Description	Hours
I	**Introduction:** Deterioration of Structures, Distress in Structures, Causes and Prevention. Mechanism of Damage, Types of Damage	06
II	**Corrosion of Steel Reinforcement:** Causes, Mechanism and Prevention. Damage of Structures due to Fire, Fire Rating of Structures, Phenomena of Desiccation	06
III	**Inspection and Testing:** Symptoms and Diagnosis of Distress, Damage assessment, NDT.	06
IV	**Repair of Structure:** Common Types of Repairs, Repair in Concrete Structures, Repairs in Under Water Structures, Guniting, Shotcreate, Underpinning.	06
V	**Strengthening of Structures:** Strengthening Methods, Retrofitting, Jacketing, Fiber wrapping, innovative retrofitting technics – base isolation, dampers etc.	06
VI	**Health Monitoring of Structures:** Need, Use of Sensors, Building Instrumentation.	06

Text Book

- Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.

References

- Concrete Technology by A.R. Santakumar, Oxford University press
- Defects and Deterioration in Buildingts, E F & N Spon, London
- Non-Destructive Evaluation of Concrete Structures by Bungey, Surrey University Press
- Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ranso, (1981)

CSE507.3: Structural Design of Bridges

(Ver 1.0, Program Elective, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: The objectives of this course is to make students to learn planning, IRC specifications for road bridges and principles of Structural Design of bridges, To design and to detail the RCC, PSC and Plate Girder bridge superstructures. To design substructure and bearings for bridges.

Course Outcomes: after the end of this course students will able to

- **CO1** Appraise[4] choice of type, IRC Specifications and loads for road bridges.
- **CO2** Design short span and long span bridges.
- **CO3** Design Prestressed concrete bridges
- **CO4** Design Plate girder bridge for highway and railway.
- **CO5** Design bearings and substructure.

Syllabus (Theory)

Units	Description	Hours
I	Introduction: Classification, investigations and planning, choice of type, I.R.C. specifications for road bridges, standard live loads, other forces acting on bridges, general design considerations.	06
II	Short Span Bridges: Load distribution theories, analysis and design of slab culverts, box culvert, tee beam and slab bridges.	06
III	Long Span Girder Bridges: Design principles of continuous bridges, box girder bridges, balanced cantilever bridges.	06
IV	Design of Prestressed Bridges: Flexural and torsional parameters, Courbon's theory, Distribution co-efficient by exact analysis, Design of girder section, maximum and minimum prestressing forces, Eccentricity. Live load and dead load shear forces. Cable zone in girder. Check for stresses at various sections. Design of End block. Extradosed Bridge, Concept and Design	06

V	Design of Plate Girder Bridges: Design of welded plate girder bridges for highway and railway loading, wind effects, main section, splicing, curtailment, stiffeners.	06
VI	Bearings and Substructures: Different types of bearings. Design of bearings, Design of concrete piers and abutments, Types of bridge foundations.	06

Text Book

- "Design of Bridge Structures", Jagadeesh. T.R. and Jayaram. M.A., Prentice Hall of India Pvt. Ltd. 2004.

References

- "Bridge Engineering", Ponnuswamy S., Tata McGraw Hill, 2008.
- "Essentials of Bridge Engineering", Johnson Victor D., Oxford and IBH Publishing Co. New Delhi, 1990
- "Concrete Bridge Practice", Raina V.K, Tata McGraw Hill Publishing Company, New Delhi, 1991.
- IRC 21 – 1966 "Standard Specifications and Code of Practice For Road Bridges"-Section III Cement Concrete (Plain and reinforced) The Indian Road Congress New Delhi
- IS 456 – 2000 "Indian Standard Plain and Reinforced Concrete Code of Practice"- (Fourth Revision) BIS New Delhi.
- IS 1343 – "Indian Standard Prestressed Concrete Code of Practice"- BIS New Delhi

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CSE508.1: Advanced Design of Steel Structures

(Ver 1.0, Program Elective, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: The course dealing with analysis and design of steel structures like portal frames, steel concrete composite structures, beam-column, beam column connection, and cold formed light gauge steel sections. It also comprises the plastic analysis of steel structure and Limit state design of building frame members.

Course Outcomes: after the end of this course students will able to

CO1 Design of hoarding Structures and castellated beams as per limit state method.

CO2 Design of microwave towers and tubular structures as per limit state method.
CO3 Design of transmission towers as per working stress method
CO4 Design of cold form light gauge section
CO5 Design of steel chimneys
CO6 Design of base plate of chimney

Syllabus (Theory)

Units	Description	Hours
I	a) Hoarding Structures: Analysis and design of hoarding structures under dead, live and wind load as per the latest IS:875 by limit state method. b) Castellated beams: Concept, fabrication of the castellated beam from rolled steel section, design of castellated beam for bending and shear as per latest code by limit state method.	06
II	a) Microwave Towers: Introduction, structural configuration, function, analysis and design. b) Tubular Structures: Design of tubular Trusses and scaffoldings using circular hollow, rectangular hollow sections as per code, detailing of joints.	06
III	Transmission Towers: Introduction, structural configuration, bracing systems, analysis and design as per code. Use working stress method	06
IV	Cold form light gauge section: Advantage, type of cross section, stiffened, multiple stiffened and un-stiffened element, flat-width ratio, effective design width, design of light gauge compression, tension and flexural members as per code.	06
V	Design of chimneys: Introduction, type, joints, lining, ladder, forces acting on chimney, design of thickness of steel plates for self-supporting chimney	06
VI	Design of base plate of chimney, design of anchor bolt, design of foundation and stability of steel chimneys	06

Text Book

- Ram Chandra, Design of steel Structures, Volume II, Standard Book House, New Delhi.
- Punmia and Jain, Comprehensive Design of steel structure, Laxmi Publication, New Delhi

References

- M Raghupathi, Design of steel structures, Tata McGraw Hill, New Delhi.
- S K Duggal, Limit state design of steel structures, Tata McGraw Hill Education.
- N Subramanian, Design of steel structures, Oxford University Press.
- IS: 800 - 2007, Code of Practice for General Construction in Steel, BIS, New Delhi.
- IS: 800 - 1984, Code of Practice for General Construction in Steel, BIS, New Delhi.

- IS: 801 - 1975, Code of Practice for use of cold formed light gauge steel structural members in general building construction, BIS, New Delhi.
- IS: 802 (Part I and II)-1978, Code of practice for use of structural steel in overhead transmission line towers, BIS, New Delhi.
- IS:806-1988, Code of practice for use of steel tubes in general building construction, BIS, New Delhi.
- IS: 811-1987, Specification for cold formed light gauge structural steel sections, BIS, New Delhi.
- IS: 875 (Part 1, 2 and 3) – 1987, Code of practice for design loads for buildings and structures, BIS, New Delhi.

CSE508.2: Structural Stability

(Ver 1.0, Program Elective, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: The objectives of this course are to make students to learn principles of stability of structures and to analyze the structural elements for stability.

Course Outcomes: after the end of this course students will able to

CO1 Understand the principles of strength and stability
CO2 Analyze stability of continues beam and frames
CO3 Understand the concepts of lateral buckling of beams.
CO4 Understand the inelastic stability of columns.
CO5 Analyze dynamic stability of structures.

Syllabus (Theory)

Units	Description	Hours
I	Fundamental concepts, elastic structural stability, structural instability, analytical methods for the stability analysis, equilibrium, imperfections and energy methods	06

II	Elastic buckling of columns, assumptions, critical load for various boundary conditions, columns with geometric imperfection, large deflection theory of columns, Southwell plot, Orthogonality of buckling modes, eccentrically loaded columns, numerical techniques – Finite difference and Finite element approach.	06
III	Elastic buckling of beam-column, differential equations of beam-column, beam column with concentrated point load, several point loads, continuous lateral load, single couple, uniformly distributed load, end couples.	06
IV	Elastic buckling of frames, triangular, partial, multistory portal and box frames with symmetric & anti symmetric buckling, stiffness method approaches, approximate method, buckling of open sections, torsional buckling.	06
V	Elastic buckling of thin plates, equilibrium approach, rectangular plate with axial load in one and two directions, various boundary conditions, Energy methods – Rayleigh Ritz and Gelerkin, large deformation theory of plates and effective width concept, post buckling behavior of plates.	06
VI	Structural Design for stability of Members, Lateral torsional buckling of beams, lateral torsional buckling of cantilever and S.S. beams, stability design of beam-column member.	06

Text Book

- Gambhir, M. L.: Stability Analysis and Design of Structures, Springer-Verlag (2004)

References

- Timoshenko S. P. and Gere J. M., Theory of Elastic Stability, Mc Graw Hill, Singapore
- George Gerard, Introduction to Structural Stability Theory, Mc Graw Hill, New York
- Iyenger N. G. R., Elastic Stability of Structural elements, Mc Millan, India
- Ashwini Kumar, Stability of Structures, Allied Publishers, New Delhi

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CSE508.3: Design of Foundations

(Ver 1.0, Program Elective, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: The design of foundation requires the consideration of many essential factors about soil data, geology of the site, land use patterns, ground conditions and the type of structure to be built. A detailed understanding of the field situation is also very important apart from theoretical knowledge of the subject.

Course Outcomes: after the end of this course students will able to

- **CO1** Summarize of soil structure interaction
- **CO2** Design of raft foundations as per codel provision of IS 2950 (Part-I)
- **CO3** Analysis and design machine foundation
- **CO4** Design of pile foundation and pile cap as per IS Code Provisions: IS 2911
- **CO5** Design of drilled shaft (Well) foundations

Syllabus (Theory)

Units	Description	Hours
I	Introduction and Soil Structure Interaction: a) Foundation objectives and their importance, Classification of foundations, Soil classification, Geotechnical design parameters, bearing capacity, Foundation settlements. b) Loads for design, Depth of foundation, and depth of soil exploration, parameters for design of foundation on various types of soil, Introduction to Soil Structure Interaction. c) Review of IS Code Provisions: IS 1892, IS 1904, IS 6403, IS 8009 (Part-I & II)	06
II	Design of Raft Foundations: a) Types of rafts, Relative Stiffness considering: Superstructure-Foundation-Soil system, Soil-Structure Interaction approach, raft on Clayey and Sandy soils. b) Review of IS Code Provisions: IS 2950 (Part-I). c) Design of Flat slab raft foundation (Rigid Method/Elastic Line Method)	06
III	Machine Foundation: a) Introduction, machine vibrations, vibration characteristics, design consideration for machine foundations. b) Review of IS Code Provisions: IS 2974 (Part-II, III & IV). c) Design of foundations for rotary machines / impact machine.	06
IV	Pile Foundation: a) Function and Classification of piles, Static point and skin resistance capacity of a Pile, Negative skin friction, Vertically and Laterally loaded piles, Pile settlements. b) Pile Cap, Pile group, Efficiency of piles in a group. c) Review of IS Code Provisions: IS 2911 (all related parts).	06
V	Design of Drilled Shaft (Caissons/Well) Foundations: a) Drilled Shafts (Caissons/Well) Foundations: Introduction, types and applications of drilled shafts, construction procedures – dry, wet and casing methods of construction. b) Soil-Structure interaction considerations, Design considerations under Axial and Lateral	06

	forces, ASD/LRFD method of design-General principles and steps.	
VI	Case Studies and Failures of Foundations: a) Review of Case Studies of – Shallow and Deep Foundations. b) Review of Failures of - Shallow and Deep Foundations.	06

Text Book

- Kurain N. P, Design of foundation systems Principles and Practice, Narosa Publishing house, New Delhi, 2005.

References

- Kurain N.P, Modern Foundations: Introduction to Advance Techniques: Tat aMcGraw Hill,1982
- Nayak N. V., Foundation Design Manual, Dhanpat Rai and Sons, Delhi.
- Shah H. J., Reinforced Concrete, Vol II, Charotar Publishing House.
- Winterkorn H.F. and Fang H.Y. Ed., Foundation Engineering Hand Book, Van-Nostrand Reynold, 1975
- Bowles J. E., Foundation Analysis and Design (4th Ed.), Mc. Graw –Hill, NY, 1996
- Poulose H. G. and Davis E. H., Pile foundation Analysis and Design, John-Wiley Sons, Neyork, 1980.
- Leonards G. Ed., Foundation Engineering, Mc. Graw-Hill, NY, 1962

CSE509.1: Structural Optimization

(Ver 1.0, Program Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: Analytical and numerical methods for structural optimization. Optimization problem formulation; optimization using calculus of variations; linear programming; nonlinear optimization; global optimization; generalized optimality criteria and dual methods; sensitivity analysis; multilevel and decomposition techniques; shape and topology optimization. Course in structural analysis, Finite element analysis of structures are required for this course

Course Outcomes: after the end of this course students will able to

CO1 Formulate[3] mathematical statement for design optimization problems

CO2 Solve[3] optimization problems using optimality criteria
CO3 Aapply[3] Linear Programming methods
CO4 Select[3] appropriate numerical techniques for optimization problems
CO5 Implement[4] or use evolutionary Algorithms for global optimization

Syllabus (Theory)

Units	Description	Hours
I	Introduction: Introduction of optimization, basic theory and elements of optimization, Terminology and definitions, Basic principles and procedure of optimization. Classical Methods of Optimization: Trial and error method, Monte-Carlo method, Lagrangian multiplier method, illustrative examples	06
II	Linear Programming: Introduction, terminology, formulation of LPP, graphical and algebraic methods of solving LPP, standard form and canonical form of linear programming, geometrical intepretation, illustrative examples.	06
III	Linear Programming: Simplex methods, Artificial variable techniques, solution of simultaneous equations, Dual formulations - illustrative examples. Network analysis: Modifications and improvements on CPM/PERT. Transportation and Assignment problem: Introduction, terminology, formulation and solution of mathematical models, illustrative examples.	06
IV	Non-Linear Programming: local and global optimum, problem formulation, Unconstrained and constrained methods of optimization-Kuhn Tucker conditions, Lagrangian Multiplier methods, graphical method, Univariate search method, Steepest Descent Methods, quadratic programming problem, Wolfs modified simplex method, illustrative examples.	06
V	Dynamic programming: Introduction, terminology, need and characteristics of dynamic programming, formulation, solution of LPP, applications, illustrative examples Decision theory: Introduction, types, decision trees. Simulation: Introduction, advantages, limitations, types, applications	06
VI	Structural Optimization: Optimum structural design of rectangular timber beam, reinforced concrete rectangular, T and L beams, concrete mix proportioning, reinforced concrete deep beams, planner trusses, Procedure of optimization for structural grid and slab.	06

Text Book

- Rao, S. S., "Engineering Optimization –Theory and Practice", fourth edition, John Willey & Sons, 2009.

References

- Vanderplaats, G.N., "Multidiscipline Design Optimization", 1st edition, Vanderplaats R&D, 2007.
- Rao, S. S., "Engineering Optimization –Theory and Practice", fourth edition, John Willey & Sons, 2009.
- Haftka, R.T. and Gurdal, Z., "Elements of Structural Optimization", Third edition, Kluwer Academic Publishers, 1992.
- Christensen, P. W. and Klarbing, A., "An Introduction to Structural Optimization", Springer Science and Media B.V., 2009.
- Fundamentals of Optimum Design in Engineering‖ S.S.Bhavikatti, New Age International Publishers.

CSE509.2: Structural Health Monitoring

(Ver 1.0, Department Elective, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: By continuously monitoring one or more response quantities causing these changes, it is possible to assess the condition of the structure for its structural integrity. Such a monitoring of the structure is generally known as Structural Health Monitoring. Health monitoring application has received great deal of attention all over the world due to its signi? can't impact on safety and longevity of the structure. The course will broadly cover the overview of SHM, its interrelationship with smart material and the application of various smart sensors in SHM

Course Outcomes: after the end of this course students will able to

CO1 Criticize[4] fundamentals of maintenance and repair strategies.
CO2 Diagnose[6] for serviceability and durability aspects of concrete
CO3 Propose[5] materials and techniques used for repair of structures.
CO4 Propose[5] the appropriate repair, strengthening, rehabilitation and retrofitting technique
CO5 Optimize[6] appropriate health monitoring technique and demolition technique.

Syllabus (Theory)

Units	Description	Hours
I	Introduction to Structural Health Monitoring Definition of structural health monitoring (SHM), Motivation for SHM, SHM as a way of making materials and structures smart, SHM and biomimetics, Process and pre-usage monitoring as a part of SHM, SHM as a part of system management, Passive and active SHM, NDE, SHM and NDECS, Variety and multidisciplinary: the most remarkable characters of SHM, Birth of the SHM Community.	06
II	Vibration-Based Techniques for SHM: Basic vibration concepts for SHM, Local and global methods, Damage diagnosis as an inverse problem, Model-based damage assessment, Mathematical description of structural systems with damage, General dynamic behavior, State space description of mechanical systems, Modeling of damaged structural elements, Linking experimental and analytical data, Modal Assurance Criterion (MAC) for mode pairing, Modal Scaling Factor (MSF), Co-ordinate Modal Assurance Criterion (COMAC), Damping, Expansion and reduction, Updating of the initial model.	06
III	Neural network approach to SHM: The basic idea of neural networks, Neural networks in damage detection, localization and quantification, Multi-layer Perceptron (MLP), A simulation example, Description of the structure, Application of damage indicator methods, Application of the modal force residual method and inverse eigen sensitivity method, Application of the kinetic and modal strain energy methods, Application of the Multi-Layer Perceptron neural network, Time-domain damage detection methods for linear systems, Parity equation method, Kalman filters, AR and ARX models.	06
IV	Fiber-Optic Sensors Classification of fiber-optic sensors, Intensity-based sensors, Phase modulated optical fiber sensors, or interferometers, Wavelength based sensors, or Fiber Bragg Gratings (FBG), The fiber Bragg grating as a strain and temperature sensor, Response of the FBG to uniaxial uniform strain fields, Sensitivity of the FBG to temperature, Response of the FBG to a non-uniform uniaxial strain field, Response of the FBG to transverse stresses, Photoelasticity in a plane stress state, Structures with embedded fiber Bragg gratings.	06
V	SHM with Piezoelectric Sensors The use of embedded sensors as acoustic emission (AE) detectors, Experimental results and conventional analysis of acoustic emission signals, Algorithms for damage localization, Algorithms for damage characterization, Available industrial AE systems, New concepts in acoustic emission, State-the-art and main trends in piezoelectric transducer-	06

	based acousto-ultrasonic SHM research, Lamb wave structure interrogation, Sensor technology.	
VI	SHM Using Electrical Resistance Composite damage, Electrical resistance of unloaded composite, Percolation concept, Anisotropic conduction properties in continuous fiber reinforced polymer, Influence of temperature, Composite strain and damage monitoring by electrical resistance, 0° unidirectional laminates, Multidirectional laminates, Randomly distributed fiber reinforced polymers, Damage localization.	06

Text Book

- Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes, Structural Health Monitoring, Wiley ISTE, 2006.

References

- Douglas E Adams, Health Monitoring of Structural Materials and Components-Methods with Applications, John Wiley and Sons, 2007.
- J.P. Ou, H.Li and Z.D. Duan, Structural Health Monitoring and Intelligent Infrastructure, Vol-1, Taylor and Francis Group, London, U.K, 2006.
- Victor Giurglutiu, Structural Health Monitoring with Wafer Active Sensors, Academic Press Inc, 2007.
- Smart Materials and Structures, Gandhi and Thompson
- Structural Health Monitoring: Current Status and Perspectives, Fu Ko Chang

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CSE509.3: Green Building Technology

(Ver 1.0, Department Elective, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: The Green Building Technology courses will highlight building construction methods that include: conservation techniques, environmental awareness in material reuse and energy efficient mechanical systems

Course Outcomes: after the end of this course students will able to

CO1 Understand the fundamentals of energy use and energy processes in building.

CO2 identify the energy requirement and its management.
CO3 Know the Sun-earth relationship vis-a-vis its effect on climate.
CO4 Be acquainted with the end-use energy requirements.
CO5 Be familiar with the audit procedures of energy.

Syllabus (Theory)

Units	Description	Hours
I	Overview of the significance of energy use and energy processes in building - Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.	06
II	Indoor environmental requirement and management - Thermal comfort - Ventilation and air quality – Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement.	06
III	Climate, solar radiation and their influences - Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of building.	06
IV	End-use, energy utilization and requirements - Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building. Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through	06
V	the glazed window and the wall - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer	06
VI	Energy management options - Energy audit and energy targeting - Technological options for energy management.	06

Text Book

- Sahni, Pardeep et.al. (eds.) 2002, Disaster Mitigation Experiences and Reflections, Prentice Hall of India, New Delhi.

References

- Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
- Carter, W. Nick, 1991: Disaster Management, Asian Development Bank, Manila.

CSE510.1: Disaster Management

(Ver 1.0, Department Elective, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: This course is intended to provide fundamental understanding of different aspects of Disaster Management. It will expose the students to the concept and functions of Disaster Management and to build competencies of Disaster Management professionals and development practitioners for effective supporting environment as put by the government in legislative manner. It would also provide basic knowledge, skills pertaining to Planning, Organizing and Decision-making process for Disaster Risk Reduction

Course Outcomes: after the end of this course students will able to

CO1 Understand the fundamentals of disasters and its impacts.
CO2 Understand the cyclones, local storms and floods.
CO3 procedures to prevent, mitigate and prepare community-based disaster risk reduction.
CO4 Know the inter-relationship between disasters and development.
CO5 Know the disaster risk management in India and case studies on reducing disaster risks.

Syllabus (Theory)

Units	Description	Hours
I	Introduction to Disasters: Concepts and definitions of Disaster, Hazard, Vulnerability, Resilience, Risks. Natural and Manmade disasters, impact of drought, review of past disasters and drought in India, its classification and characteristics. Classification of drought, causes, Impacts (including social, economic. political, environmental, health, psychosocial, etc.).	06
II	Disaster: Classifications, Causes, Impacts including social, economic, political, environmental, health, psychosocial etc. Differential Impacts - in terms of caste, class, gender, age, location, disability Global trends in disasters, urban disasters, pandemics, complex emergencies, climate change.	06

	Cyclones and Floods: Tropical cyclones & Local storms, Destruction by tropical cyclones and local storms, Cumulative atmospheric hazards/ disasters, Cold waves, Heat waves, Causes of floods, Rood hazards in India	
III	Approaches to Disaster Risk Reduction: Disaster cycle - its analysis, Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural sources, roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRis/ULBs), states, Centre, and other stake-holders.	06
IV	Inter-relationship between Disasters and Development: Factors affecting Vulnerabilities, differential impacts, impact of development projects such as darns, embankments, changes in Land-use etc. Climate change adaptation, Relevance of indigenous knowledge, appropriate technology and local resources.	06
V	Disaster Risk Management in India: Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, OM Act and Policy, other related policies, plans, programmes and legislation)	06
VI	Field Work and Case Studies: The field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the college is located.	06

Text Book

- Sahni, Pardeep et.al. (eds.) 2002, Disaster Mitigation Experiences and Reflections, Prentice Hall of India, New Delhi.

References

- Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
- Carter, W. Nick, 1991: Disaster Management, Asian Development Bank, Manila.

CSE510.2: Underwater Construction

(Ver 1.0, Program Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: This course deals with concepts of site preparation, drainage and shoring during excavation. It also teaches underwater construction activities. Pre-requisite for this course are basic of civil engineering, engineering mechanics, foundation engineering and soil exploration.

Course Outcomes: after the end of this course students will able to

- **CO1** Manage[5] problems in site preparation, drainage and shoring during excavation.
- **CO2** Implementation[5] of underwater construction
- **CO3** Apply[3] underwater tunnelling techniques
- **CO4** Design[5] of underwater foundation for structures

Syllabus (Theory)

Units	Description	Hours
I	Introduction: Site preparation, temporary roads, site drainage. Deep trench and deep basement excavations. Bulk excavation.	06
II	Coastal structures: Stability of slopes to open excavations. support of excavation by timbering and sheet piling.	06
III	Offshore Platforms: Retaining walls and sheet pile design, Requirements for shorting and underpinning. Methods of shoring of Underpinning.	06
IV	Dewatering and Groundwater Control for Soft Ground Tunneling: Tunneling in touch, mediumtough and soft rocks. Tunneling by borls shield tunneling.	06
V	Piping Systems: Culverts and conduits.	06
VI	Deep water foundations: Design of piles, pile load tests. Foundation design for dynamic conditions	06

Text Book

- Ben C. Gerwick Jr., “Construction of Marine and Offshore Structures”, 3rd ed. CRC Press, 2007.

References

- Ben C. Gerwick Jr., "Construction of Marine and Offshore Structures", 3rd ed. CRC Press, 2007.
- Patrick Powers. J., "Construction Dewatering: New Methods and Applications", John Wiley and Sons, 1992.

CSE510.3: Environmental Impact Assessment and Management

(Ver 1.0, Department Elective, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Description: This course deals with concepts of site preparation, drainage and shoring during excavation. It also teaches underwater construction activities. Pre-requisite for this course are basic of civil engineering, engineering mechanics, foundation engineering and soil exploration.

Course Outcomes: after the end of this course students will able to

CO1 Identify[5] methods for prediction of impacts.
CO2 Identify[5] methodology and prepare EIA reports.
CO3 Identify[5] the environmental attributes for EIA study.
CO4 Formulate[6] environmental management plans.

Syllabus (Theory)

Units	Description	Hours
I	Introduction: The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects	06

	requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements	
II	Identifying the Key Issues: Key Elements of an Initial Project Description and Scoping, Project Location(s), Land Use Impacts, Consideration of Alternatives, Process selection: Construction Phase, Input Requirements, Wastes and Emissions, Air Emissions, Liquid Effluents, Solid Wastes, Risks to Environment and Human, Health, Socio-Economic Impacts, Ecological Impacts, Global Environmental Issues	06
III	EIA Methodologies: Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods, Environmental index using factor analysis, Cost/benefit analysis, Predictive or Simulation methods. Rapid assessment of Pollution sources method, predictive models for impact assessment, Applications for RS and GIS.	06
IV	Reviewing the EIA Report: Scope, Baseline Conditions, Site and Process alternatives, Public hearing. Construction Stage Impacts, Project Resource Requirements and Related Impacts, Prediction of Environmental Media Quality, Socio-economic Impacts, Ecological Impacts, Occupational Health Impact, Major Hazard/ Risk Assessment, Impact on Transport System, Integrated Impact Assessment.	06
V	Review of EMP and Monitoring: Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, what should be monitored? Monitoring Methods, who should monitor? Pre-Appraisal and Appraisal.	06
VI	Case Studies: Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Tannery industry.	06

Text Book

- David P. Lawrence, Environmental Impact Assessment: Practical Solutions to Recurrent Problems, John Wiley & Sons, 2003.

References

- Canter, L.W., Environmental Impact Assessment, McGraw Hill Pub. Co., 1997.
- Hosetti, B. B., Kumar Eds, A., Environmental Impact Assessment and Management, Daya Publishing House, 1998.

- UNESCO, Methodological Guidelines for the Integrated Environmental Evaluation of Water Resources Development, UNESCO/UNEP, Paris, 1987.
- Anjaneyulu. Y., and Manickam. V., Environmental Imapact Assessment Methodologies, B.S. Publications, Hyderabad, 2007.
- Wathern. P., Environmental Impact Assessment- Theory and Practice, Routledge Publishers, London, 2004.

CEM601: Dissertation Phase - I

(Ver 1.0, Project Work, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	-	4	Practical	FEP	100	40

Syllabus

A student is expected to carry out intensive literature survey/ identification of a major issue or problem in case of industry projects with observations and discussions in the area of interest specific to the domain in consultation with the dissertation supervisor and industry co- supervisor. The objectives and scope of the dissertation will be expected at a higher level.

A student is required to submit the dissertation synopsis duly signed by supervisor and co-supervisor to the M. Tech Co- coordinator of the department who schedules the synopsis presentation seminar in the DPC (Departmental Program Committee).

The dissertation synopsis seminar presentation comprises of the following details:

- Dissertation titles
- General introduction to the area of the topic
- Relevance of the dissertation work
- Literature review/ prior work done in the area
- Dissertation objectives and scope
- Expected outcomes
- Methodology
- Phases of work and representation on a Gantt chart with deadlines
- Resources required to complete the work
- Commitment from the student (Ethical conduct)
- References

Based on the report and the presentation, the DPC will give approval to the dissertation/ give suggestions/ suggest changes/modifications, additional scope, etc. specific to make dissertation to come to the expected level of PG requirement. The student will incorporate the suggestions and resubmit the same for approval.

The final copy of the synopsis with approval seal will be issued to the student, supervisor and the co- supervisor of the company which becomes the guiding document for the dissertation.

CEM603: Dissertation Phase - II

(Ver 1.0, Project Work, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	-	4	Practical	FEP	50	40
					POE	50	

Syllabus

Followed by approval of the synopsis, this phase aims at completing at least 40 % of the dissertation work specified in the synopsis. Phase II evaluation consists of a progress review based on the efforts put in by the student to carry out the work and results obtained thereof to seek suggestions and improvements and to ascertain that the student is going in the right direction.

This phase consists of both the In- semester evaluation by the supervisor and DPC and the end semester evaluation (consisting of presentation followed by demonstration) by a panel of examiners appointed by the COE of the university based on the panel of experts approved by BOS submitted to the COE.

Followed by approval of the synopsis, this phase aims at completing at least 40 % of the dissertation work specified in the synopsis. Phase II evaluation consists of a progress review based on the efforts put in by the student to carry out the work and results obtained thereof to seek suggestions and improvements and to ascertain that the student is going in the right direction.

This phase consists of both the In- semester evaluation by the supervisor and DPC and the end semester evaluation (consisting of presentation followed by demonstration) by a panel of examiners appointed by the COE of the university based on the panel of experts approved by BOS submitted to the COE.

CEM602: Dissertation Phase - III

(Ver 1.0, Project Work, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	-	9	Practical	FEP	100	40

Syllabus

This stage marks the final progress review which indicates the completion of all the defined phases of the dissertation satisfactorily on the periodic progress reviews by supervisor and co- supervisor. A student by this time has used an opportunity to present his dissertation work in a reputed international/national conference to receive the feedbacks/ comments on the work and any new dimension to be incorporated to make the work novel and worthy of publishing in peer reviewed journals and should also prepare a journal paper based on the complete work of dissertation with results, discussions and conclusions.

A student is required to prepare the draft dissertation report as per the format of the university and with approval of supervisor and co- supervisor submit the same to the PG program coordinator of department.

The Program coordinator will schedule the presentation of student (Pre-submission) before the DPGC members once the student has completed all the academic requirements for the prescribed program.

1. Submission of Draft Dissertation Report
2. Completion of internship
3. Completion of the online/self-study.
4. Earning 100% credits of Sem I to III
5. Proof of presentation of the work in the International Conference (Certificate publication and draft paper in a template for an identified journal/uploading of same in peer reviewed journal)

Based on the recommendation of DPC, the dissertation is processed further. Viva-Voce examination is to be scheduled preferably with the same external expert appointed for the Dissertation Phase II by COE.

The successful completion of the Viva- voce, the panel of examiners recommends the candidate as successfully completed and submits the evaluation in the sealed envelope.

CEM604: Dissertation Phase - IV

(Ver 1.0, Project Work, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	-	9	Practical	FEP	50	40
					POE	50	

Syllabus

If the DPC committee is of the opinion that a student is required to work further to achieve the stated objectives and incorporate some additional work, an extension based on the work is given to the student to complete the work and the student is required to re-submit the dissertation and a presentation is to be given to DPC. The DPC will take a final decision on whether to schedule the final exam or give additional extension of the work.

It is mandatory on the part of the student to

1. Participate and present a paper in a reputed national/ international conference organized by the premium institutions/ professional bodies. It is recommended to participate and publish in conferences whose proceedings are published by IEEE, Elsevier Springer, Materials Today or any other reputed conferences.

2. A paper for a peer reviewed journal is to be prepared as per the journal format and uploaded to the journal website. It is desirable that at least the paper will be selected in initial review regarding Scope and it enters the second phase of editor

3. If the work of a student is novel and patentable in this case, a student need not have to bring his research findings in public domain through publication but he can file the patent. Student should be able to get provisional registration of patent with patent office.

4. In case of NDA with company when student is pursuing his dissertation, publication may not be possible in public domain. These cases are to be treated as special cases. A rubric is developed for evaluation.

The evaluation of the dissertation work of a student shall be carried out in four phases: First and third phase being evaluated for ISE by Department Post Graduate Committee (DPC) while second and fourth phase by DPGC for ISE and by a panel of examiners for ESE. Except for phase I evaluation i.e. evaluation based on synopsis submission seminar, a student shall be evaluated for all other phases for his/her understanding, the work done and his/her presentation followed by demonstration.

A panel of examiners for ESE shall consist of Chairman (who shall be one of the DPC members and shall monitor the process as per norms), an Internal Examiner (who shall be the Guide) and an External Examiner (who shall be a subject expert from outside the institute).
