

Syllabus for 2022-23 Batch PG (CSE)

Semester: I	
Course Title: OPTIMIZATION TECHNIQUES IN STRUCTURAL ENGINEERING	
Course Code: 22CSE11	CIE + Assignment + Group Activity + Seminar + SEE
Credits: 03	Marks
Course: BSC	= 30 + 10 + 5 + 5 + 50 = 100
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To make students learn principles of optimization.
2	To implement the optimization concepts for the structural engineering problems.
3	To evaluate different methods of optimization.

UNIT – I**Introduction:**

Introduction to optimization, engineering applications of optimization, Formulation of structural optimization problems as programming problems.

Optimization Techniques:

Classical optimization techniques, single variable optimization, multivariable optimization with no constraints, unconstrained minimization techniques and algorithms constrained optimization solutions by penalty function techniques, Lagrange multipliers techniques and feasibility techniques.

8 Hrs**UNIT – II****Linear Programming:**

Linear programming, standard form of linear programming, geometry of linear programming problems, solution of a system of linear simultaneous equations, pivotal production of general systems of equations, simplex algorithms, revised simpler methods, duality in linear programming.

8 Hrs**UNIT – III****Non-linear programming:**

Non-linear programming, one dimensional minimization methods, elimination methods, Fibonacci method, golden section method, interpolation methods, quadratic and cubic methods, Unconstrained optimization methods, direct search methods, random search methods, descent methods.

8 Hrs**UNIT – IV****Constrained optimization:**

Techniques such as direct methods, the complex methods, cutting plane method, exterior penalty function methods for structural engineering problems. Formulation and solution of structural optimization problems by different techniques.

8 Hrs**UNIT – V****Geometric programming:**

Geometric programming, conversion of NLP as a sequence of LP/ Geometric programming.

Dynamic programming:

Dynamic programming conversion of NLP as a sequence of LP/ Dynamic programming.

7 Hrs**Course Outcomes:** The students will be able to

1	Understand the principles of optimization and its techniques.
2	Summarize the Linear, Non-linear and Geometric Programming,
3	Ability to apply the knowledge of different programming models for structural optimisation.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:

1	Singiresu S. Rao,(2010), “Engineering Optimization (Theory and Practice)” 3rd Edition, New Age International (P) Ltd.
2	Rao S.S.,(1983), “Engineering Optimization-Theory and Applications”, New Age International Publishers
3	Bhavikatti S.S.- “Structural optimization using sequential linear programming”- Vikas publishing house
4	Richard Bronson, “Operation Research”- Schaum’s Outline Series

Reference Books:

1	Jack R. Benjamin & C. Allin Cornell., (2014), “Probability, Statistics and Decision for Engineers”, McGrawHill.
2	Spunt, “Optimum Structural Design”- Prentice Hall
3	Kirsch U., (1981) “Optimum Structural Design”, McGraw Hill

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓		✓			
CO2		✓		✓		
CO3	✓			✓		✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: I	
Course Title: ADVANCED DESIGN OF RCC STRUCTURES	
Course Code: 22CSE12	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 04 Course: IPCC	
Hours: 52 Hrs. (L:T:P:S:4:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To learn principles of Structural Design.
2	To design different types of structures and to detail the structures.
3	To evaluate performance of the structures.

UNIT – I

Yield line method of analysis of slabs. Design of flat Slabs. Lab Experiment No-1 : Simple design of Flat Slab using Excel Spread sheet Lab Experiments 2: Simple design of Flat Slab using Excel Spreadsheet, contd.	12 Hrs
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UNIT – II

Design of grid floors, Design of Chimneys. Lab Experiments 3: Simple Design of grid floors using Excel Spread sheet Lab Experiments 4: Simple Design of grid floors using Excel Spread sheets contd.	10 Hrs
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UNIT – III

Design of continuous beams with redistribution of moments. Design of circular beams. Lab Experiments 5: Simple Design of Continuous beam using Excel Spread sheet Lab Experiments 6: Simple Design of Continuous beam using Excel Spread sheet contd.	10 Hrs
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UNIT – IV

Design of silos and bunkers. Lab Experiments 7: Simple design of RC Silos using Excel Spread sheet Lab Experiments 8: Simple design of RC bunkers using Excel Spread sheet	10 Hrs
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UNIT – V

Design of portal frames. Art of detailing earthquake resistant structures. Lab Experiment 9: Concrete mix design using Excel spread sheet Lab Experiment 10: Concrete mix design using Excel spread sheet contd.	10 Hrs
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Course Outcomes: The students will be able to

1	Achieve Knowledge of design and development of problem solving skills.
2	Summarize the principles of Structural Design and detailing.
3	Understands the structural performance.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:

1	P.C. Varghese, "Advanced Reinforced Concrete Design", Prentice-Hall of India, New Delhi, 2005.
2	Dr. B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, "Comprehensive RCC Design"
3	A Park and Paulay, "Reinforced and Prestressed Concrete"

Reference Books:

1	Pillai and Menon "Reinforced Concrete Design" McGraw Hill.
2	Bungey and Mosley "Reinforced concrete. Palgrave – Macmillan
3	Lin TY and Burns N H, "Reinforced Concrete Design".
4	Kong KF and Evans T H "Design of Prestressed Concrete Structures".

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓		✓		✓	✓
CO2		✓				✓
CO3		✓		✓		✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: I	
Course Title: MECHANICS OF DEFORMABLE BODIES	
Course Code: 22CSE13	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 04 Course: PCC	
Hours: 52 Hrs. (L:T:P:S:4:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To make students to learn principles of Analysis of Stress and Strain.
2	To predict the stress- strain behaviour of continuum.
3	To evaluate the stress and strain parameters and their interrelations of the continuum.

UNIT – I**Theory of Elasticity:**

Introduction: Definition of stress and strain and strain at a point, components of stress and strain at a point of Cartesian and polar co-ordinates. Constitutive relations, equilibrium equations, compatibility equations and boundary conditions in 2-D and 3-D cases.

12 Hrs**UNIT – II**

Transformation of stress and strain at a point, Principal stresses and principal strains, invariants of stress and strain, hydrostatic and deviatoric stress, spherical and deviatoric strains, max. Shear strain.

10 Hrs**UNIT – III**

Plane stress and plane strain: Airy's stress function approach to 2-D problems of elasticity, simple problems of bending of beams. Solution of axi-symmetric problems, stress concentration due to the presence of a circular hole in plates.

10 Hrs**UNIT – IV**

Elementary problems of elasticity in three dimensions, stretching of a prismatic bar by its own weight, twist of circular shafts, torsion of non-circular sections, membrane analogy, Propagation of waves in solid media. Applications of finite difference equations in elasticity.

10 Hrs**UNIT – V****Theory of Plasticity**

Stress – strain diagram in simple tension, perfectly elastic, Rigid – Perfectly plastic, Linear work – hardening, Elastic Perfectly plastic, Elastic Linear work hardening materials, Failure theories, yield conditions, stress – space representation of yield criteria through Westergard stress space, Tresca and Von-Mises criteria of yielding.

10 Hrs**Course Outcomes:** The students will be able to

1	Apply the basic theory of elasticity in two and three dimensional state of stress.
2	Analyze the behavior of solids of different shapes/forms, under different loads and boundary conditions.
3	Evaluate the stresses, strains, and establish governing equations in two and three dimensional problems.
4	Apply the plasticity theory, failure theories and their significance in the design of members.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:

1	S P Timoshenko and J N Goodier, “Theory of Elasticity”, McGraw-Hill International Edition, 1970
2	S Valliappan, “Continuum Mechanics - Fundamentals”, Oxford & IBH Pub. Co. Ltd., 1981
3	L S Srinath, “Advanced Mechanics of Solids”, Tata - McGraw-Hill Pub., New Delhi, 2003.
4	P.G. Seetharamu and L Govindaraju “Applied Elasticity Interline Publishing 2005.

Reference Books:

1	G. W. Housner and T. Vreeland, Jr., “The Analysis of Stress and Deformation”, California Institute of Tech.CA, 2012.
2	Abdel-Rahman Ragab and Salah Eldinin Bayoumi, “Engineering Solid Mechanics: Fundamentals and Applications”, CRC Press, 1998.
3	A. C. Ugural and Saul K.Fenster, “Advanced Strength and Applied Elasticity”, PrenticeHall, 2003.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓					✓
CO2	✓					
CO3	✓	✓				
CO4	✓					✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: I	
Course Title: STRUCTURAL DYNAMICS	
Course Code: 22CSE14	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: PCC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To learn principles of Structural Dynamics.
2	To implement these principles through different methods and to apply the same for free and forced vibration of structures.
3	To evaluate the dynamic characteristics of the structures.

UNIT – I**Introduction:**

Introduction to Dynamic problems in Civil Engineering, Concept of degrees of freedom, D'Alembert's principle, principle of virtual displacement and energy, principles Dynamics of Single-degree-of-freedom systems: Mathematical models of Single-degree-of-freedom systems system, Free vibration response of damped and undamped systems. Methods of evaluation of damping.

8 Hrs**UNIT – II**

Response of Single-degree-of-freedom systems to harmonic loading (rotation unbalance, reciprocating unbalance) including support motion, vibration isolation, transmissibility, Numerical methods applied to Single-degree-of-freedom systems - Duhamel integral, principle of vibration-measuring instruments – seismometer and accelerometer.

8 Hrs**UNIT – III****Dynamics of Multi-degree freedom systems:**

Mathematical models of multi-degree-of-freedom systems, Shear building concept, free vibration of undamped multi-degree-of-freedom systems - Natural frequencies and mode shapes – orthogonality property of modes.

8 Hrs**UNIT – IV**

Response of Shear buildings for harmonic loading without damping using normal mode approach. Response of Shear buildings for forced vibration for harmonic loading with damping using normal mode approach, condition of damping uncoupling.

8 Hrs**UNIT – V****Approximate methods:**

Rayleigh's method Dunkarley's method, Stodola's method. Dynamics of Continuous systems: Free longitudinal vibration of bars, flexural vibration of beams with different end conditions, Stiffness matrix, mass matrix (lumped and consistent); equations of motion for the discretized beam in matrix form.

7 Hrs**Course Outcomes:** The students will be able to

1	Analyse multi-storey frames and draw mode shapes of vibrations.
2	Develop the equation of motion of undamped and under damped multi degree of freedom systems subjected to free and forced vibration.
3	Achieve Knowledge of design and development of problem solving skills.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.

- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:

1	Structural dynamics: Vibrations and systems, 1 st edition, madhujit mukophadyay, publisher: ANE Books ISBN: 9788180520907,8180520900, 2008.
2	Structural dynamics: Theory and computation, Mario Paz, 2 nd edition, CBS publisher, 2004.
3	Dynamics of structure. R.W.clough and J.Penzien, 2 nd revised edition, McGraw-Hill education 1993.
4	Thompson “Dynamics of Structures”.

Reference Books:

1	Theory of Vibration with applications, William Thomson, 4 th edition, CRC Press, 1996
2	Structural Dynamics- Anil Chopra: PHI Publishers.
3	Timoshenko, S., “Vibration Problems in Engineering”, VanNostrand Co.,

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓		✓			✓
CO2	✓		✓			✓
CO3	✓		✓		✓	✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: I	
Course Title: COMPUTATIONAL STRUCTURAL MECHANICS	
Course Code: 22CSE15	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: PCC	
Hours: 39 Hrs. (L:T:P:S:2:0:0:2)	SEE Duration: 3 Hrs.

Course Learning Objectives:	
1	To make students to learn principles of Structural Analysis,
2	To implement these principles through different methods and to analyze various types of structures.
3	To evaluate the force and displacement parameters of the structures by Flexibility and Stiffness matrix methods.

UNIT – I	
FUNDAMENTAL CONCEPTS: Static and Kinematic indeterminacy, Concepts of stiffness and flexibility. Energy concepts. Principle of minimum potential energy and minimum complementary energy. Development of element flexibility and element stiffness matrices for truss, beam and grid elements. Geometric & materials non linearity.	8 Hrs
UNIT – II	
ANALYSIS USING FLEXIBILITY METHOD: Force-transformation matrix using Flexibility method, Development of global flexibility matrix for continuous beams, plane trusses and rigid plane frames(having not more than six co-ordinates– 6x6 flexibility matrix) Analysis of continuous beams and rigid plane frames by flexibility method (having not more than 3 coordinates– 3x3 flexibility matrix).	8 Hrs
UNIT – III	
ANALYSIS USING STIFFNESS METHOD: Displacement-transformation matrix using Stiffness Method, Development of global stiffness matrix for continuous beams, plane trusses and rigid plane frames (having not more than six co-ordinates – 6x6 stiffness matrix) Analysis of continuous beams, plane trusses and rigid plane frames by stiffness method(having not more than 3 coordinates– 3x3 stiffness matrix).	8 Hrs
UNIT – IV	
EFFECTS OF TEMPERATURE CHANGE AND LACK OF FIT: Related numerical problems by flexibility and stiffness method as in Chapters 2 and 3.	8 Hrs
UNIT – V	
SOLUTION TECHNIQUES: Solution techniques including numerical problems for simultaneous equation, Gauss elimination and Cholesky method. Bandwidth consideration. Newton-Raphson method and Modified Newton Method.	7 Hrs

Course Outcomes: The students will be able to	
1	Apply the concepts of flexibility and stiffness matrices.
2	Apply knowledge of local and global coordinate system to develop displacement transformation matrices.
3	Solve Civil Engineering problems with respect to various storage schemes.

Question paper pattern:	
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub - questions) from each unit. • Each full question will have sub - question covering all the topics under a unit. • The students will have to answer five full questions, selecting one full question from each unit. 	

Text Books:	
1	Weaver W and Gere J H, “Matrix Analysis of Framed Structures”, CBS publications, New Delhi.
2	Rajasekaran S, “Computational Structural Mechanics”, PHI, New Delhi.
3	Madhujit Mukhopadhyay and Abdul Hamid Sheikh, “Matrix and Finite Element Analysis of Structures”, Ane Books Pvt. Ltd.

Reference Books:	
1	H C Martin, “Introduction to Matrix Methods in Structural Analysis”, International textbook company, McGraw Hill.
2	A K Jain, “Advanced Structural Analysis”, Nemchand Publications, Roorkee.
3	Manikaselvam, “Elements of Matrix Analysis and Stability of Structures”, Khanna Publishers, NewDelhi.

CO-PO Mapping						
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓					✓
CO2	✓					
CO3	✓	✓				

Syllabus for 2022-23 Batch PG (CSE)**Semester: I****Course Title: RESEARCH METHODOLOGY AND IPR**

Course Code: 22RM16	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: MCC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To make students learn the research methodology and the technique of defining a research problem
2	To understand the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
3	To discuss the research designs, sampling designs, measurement and scaling techniques and also different methods of data collections.
4	To parametric tests of hypotheses and various forms of the intellectual property

UNIT – I

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.	8 Hrs
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UNIT – II

Reviewing the literature: Place of the literature review in research, bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed. Research Design: Meaning of Research Design, Need for Research Design, features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.	8 Hrs
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UNIT – III

Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.	8 Hrs
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UNIT – IV

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests.	8 Hrs
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UNIT – V

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.	7 Hrs
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Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999, The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder	
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Course Outcomes: The students will be able to	
1	Discuss research methodology and the technique of defining a research problem
2	Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
3	Explain various research designs, sampling designs, measurement and scaling techniques, data collection. Impact in the changing global business environment and leading International Instruments concerning IPR. Tests of hypotheses, Chi-square test, art of interpretation and writing research reports
4	Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR.

Reference Books:	
1	Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International, 4 th Edition, 2018.
2	Research Methodology a step-by-step guide for beginners. Ranjit Kumar, SAGE Publications, 3 rd Edition, 2011. (For the topic Reviewing the literature under module 2),
3	Study Material, (For the topic Intellectual Property under module 5), Professional Programme Intellectual
4	Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013

CO-PO Mapping						
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓		✓			✓
CO2	✓	✓				
CO3	✓		✓	✓	✓	
CO4	✓			✓	✓	

Syllabus for 2022-23 Batch PG (CSE)

Semester: I	
Course Title: STRUCTURAL ENGINEERING LABORATORY	
Course Code: 22CSEL17	CIE + Record + SEE Marks = 20 + 30 + 50 = 100
Credits: 02 Course: PCCL	
Hours: 26 Hrs. (L:T:P:S:2:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To make students to learn principles of design of experiments.
2	To investigate the performance of structural elements.
3	To evaluate the different testing methods and equipment's.

UNIT – I

Testing of beams for deflection, flexure and shear	7 Hrs
UNIT – II	
Experiments on Concrete, including Mix design	7 Hrs
UNIT – III	
Experiments on vibration of multi storey frame models for Natural frequency and modes.	6 Hrs
UNIT – IV	
Use of Nondestructive testing (NDT) equipments – Rebound hammer, Ultra sonic pulse velocity meter and Profometer.	6 Hrs

Course Outcomes: The students will be able to

1	Achieve Knowledge of design and development of experimenting skills.
3	Design and develop analytical skills.
4	Summarize the testing methods and equipments.

References:

IS:10262-2019 for mix design of concrete.
Other relevant codebooks like IS: 456-2000, IS: 516-1959
Swayam – NPTEL <https://onlinecourses.nptel.ac.in>

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	✓				
CO2	✓	✓	✓			
CO3	✓	✓				✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: II	
Course Title: ADVANCED DESIGN OF STEEL STRUCTURES	
Course Code: 22CSE21	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: PCC	
Hours: 39 Hrs. (L:T:P:S:2:0:0:2)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To learn the background to the design provisions for hot-rolled and cold-formed steel structures, including the main differences between them.
2	To proficient in applying the provisions for design of columns, beams, beam-columns.
3	To design structural sections for adequate fire resistance.

UNIT – I**LATERALLY UNRESTRAINED BEAMS:**

Lateral Buckling of Beams, Factors affecting lateral stability, IS800 code provisions, Design Approach. Lateral buckling strength of Cantilever beams, continuous beams, beams with continuous and discrete lateral restraints, Mono- symmetric and non- uniform beams – Design Examples. Concepts of -Shear Center, Warping, Uniform and Non-Uniform torsion.

8Hrs**UNIT – II****BEAM - COLUMNS IN FRAMES:**

Behaviour of Short and Long Beam - Columns, Effects of Slenderness Ratio and Axial Force on Modes of Failure, Biaxial bending, Strength of Beam Columns, Sway and Non-Sway Frames, Strength and Stability of rigid jointed frames, Effective Length of Columns-, Methods in IS 800 – Examples.

8Hrs**UNIT – III****STEEL BEAMS WITH WEB OPENINGS:**

Shape of the web openings, practical guide lines, and Force distribution and failure patterns, Analysis of beams with perforated thin and thick webs, Design of laterally restrained castellated beams for given sectional properties, Vierendeel girders (design for given analysis results).

8Hrs**UNIT – IV****COLD FORMED STEEL SECTIONS:**

Techniques and properties, Advantages, Typical profiles, Stiffened and unstiffened elements, Local buckling effects, effective section properties, IS 801& 811 code provisions- numerical examples, beam design, column design.

8Hrs**UNIT – V****FIRE RESISTANCE:**

Fire resistance level, Period of Structural Adequacy, Properties of steel with temperature, Limiting Steel temperature, Protected and unprotected members, Methods of fire protection, Fire resistance ratings. - Numerical Examples.

7Hrs**Course Outcomes:** The students will be able to

1	Define the design and development of problem solving skills.
2	Design the roof truss, steel bridges and towers.
3	Design of various steel structural elements.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:

1	Design of steel structures – William T. Segui, Cengage Learning, India-2007. 5. Steel Structures Vol - 1 and 2- J.F. Baker
2	Design of Steel Structures - Arya and Ajaman - Nem Chand & Bros. Roorkee.
3	Bureau of Indian Standards, IS: 800, IS: 875
4	Steel tables.

Reference Books:

1	K.S. Sai Ram, Design of Steel Structures, Pearson Publishers.
2	Dr. Ramachandra & Virendra Gehlot, Design of Steel Structures 1&2, SCIENTIFIC (INDIA).Publishers.
3	N. Subramanian, Design of Steel Structures (Limit state Design), Oxford Publishers.
4	Dr.Anand s. Arya & Dr. J.L.Ajmani, Design of Steel Structures, printed by N.C Jain, Roorkee press, Roorkee.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	✓				
CO2	✓	✓	✓			
CO3	✓					✓

Text Books:

1	Soil Mechanics and Foundation Engineering, Punmia B C, Laxmi Publications Co., New Delhi.
2	Basic and Applied Soil Mechanics - Gopal Ranjan and Rao A.S.R. (2000), New Age International (P) Ltd., New Delhi.
3	Geotechnical Engineering - Braja, M. Das (2002), Fifth Edition, Thomson Business Information India (P) Ltd., India
4	Principles of Soil Mechanics and Foundation Engineering- Murthy V.N.S. (1996), 4th Edition, UBS Publishers and Distributors, New Delhi.

Reference Books:

1	Bowles J E, Foundation analysis and design, McGraw- Hill Publications
2	Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering, Tata McGraw Hill Publications
3	T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley & Sons.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓			✓		
CO2			✓			
CO3		✓			✓	✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: II	
Course Title: FINITE ELEMENT METHOD OF ANALYSIS	
Course Code: 22CSE22	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 04 Course: IPCC	
Hours: 52 Hrs. (L:T:P:S:3:0:2:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To provide the fundamental concepts of the theory of the finite element method
2	To develop proficiency in the application of the finite element method (modeling, analysis, and interpretation of results) to realistic engineering problems through the use of softwares
3	To analyze the structure by force / flexibility approach based on direct approach and energy based methods.

UNIT – I

<p>Basic concepts of elasticity, Kinematic and Static variables for various types of structural problems, approximate methods of structural analysis–Rayleigh–Ritz method, Finite difference method, Finite element method. Variation method and minimization of Energy approach of element formulation, Principles of finite element method, advantages and disadvantages, Finite element procedure, Finite elements used for one, two and three dimensional problems, C0, C1 and C2 type elements, Element aspect ratio, Mesh refinement vs. higher order elements, Numbering of nodes to minimize bandwidth.</p> <p>Experiment 1: Analysis of a beam with different support conditions subjected to different loading conditions by 2-Dimensional and 3-Dimensional finite element analysis using any commercially available FEA packages.</p> <p>Experiment 2: Analysis of a beam with different support conditions subjected to different loading conditions by 2-Dimensional and 3-Dimensional finite element analysis using any commercially available FEA packages continued,.</p>	12 Hrs
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UNIT – II

<p>Nodal displacement parameters, Convergence criterion, Compatibility requirements, Geometric invariance, Shape function, Polynomial form of displacement function, Generalized and Natural coordinates, Lagrangian interpolation function, shape functions for one, two & three dimensional elements.</p> <p>Experiment 3: Analysis of a simple truss by mesh optimization and by considering different truss elements using any commercially available FEA packages and comparing the obtained results with the exact solution.</p> <p>Experiment 4: Analysis and Design of Simple doglegged/ open well/ spiral staircase using any commercially available FEA packages</p>	10 Hrs
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UNIT – III

<p>Isoparametric elements, Internal nodes and higher order elements, Serendipity and Lagrangian family of Finite Elements, Sub-parametric and Super- parametric elements, Condensation of internal nodes, Jacobian transformation Matrix, Development of strain-displacement matrix and stiffness matrix, consistent load vector, numerical integration.</p> <p>Experiment 5: Analysis and Design of Simple overhead RCC water tanks using any commercially available FEA packages</p> <p>Experiment 6: Soil-structure Interaction analysis of a building frame considering conventional, discrete (Example: Winkler's soil model) and continuum soil models subjected to seismic loading using any commercially available FEA packages.</p>	10 Hrs
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UNIT – IV

<p>Application of Finite Element Method for the analysis of one & two dimensional problems: Analysis of plane trusses and beams, Application to plane stress/strain, Axisymmetric problems using CST and Quadrilateral Elements.</p>	10 Hrs
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Experiment 7: Soil-structure Interaction analysis of a building frame considering conventional, discrete (Example: Winkler’s soil model) and continuum soil models subjected to seismic loading using any commercially available FEA packages continued,. Experiment 8: Soil-structure Interaction analysis of a building frame considering conventional, discrete (Example: Winkler’s soil model) and continuum soil models subjected to seismic loading using any commercially available FEA packages continued,.	
UNIT – V	
Application to Plates and Shells, Non-linearity: material, geometric and combined non- linearity, Techniques for Non- linear Analysis. Experiment 9: Soil-structure Interaction analysis of a building frame considering conventional, discrete (Example: Winkler’s soil model) and continuum soil models subjected to seismic loading using any commercially available FEA packages continued,. Experiment 10: Computation of fire resisting capacity parameters of steel beams using Excel spread sheet/ MatLab programming soft-computing techniques.	10 Hrs

Course Outcomes: The students will be able to	
1	Identify the numerical techniques for solving engineering problems using FEM.
2	FEM based software’s help to create different structural models, and to change the elements and geometry of the system and structural analysis outputs are obtained in post processing stage.
3	Obtain results like deflections, stresses, strains, and other parameters.

Question paper pattern:
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub - questions) from each unit. • Each full question will have sub - question covering all the topics under a unit. • The students will have to answer five full questions, selecting one full question from each unit.

Text Books:	
1	Finite Element Analysis – Theory and Programming - Krishnamurthy. C.S – Tata McGraw Hill Co. Ltd., New Delhi. 2000.
2	Introduction to Finite Elements in Engineering- Chadrupatha, Tirupathi R and Ashoka D University Press, India 2003.
3	Finite Element Methods in Engineering- Butterworth and Heinemann 2001.
4	Cook R D, Malkan D S & Plesta M.E, “Concepts and Application of Finite Element Analysis” - 3 rd Edition, John Wiley and Sons Inc., 1989.

Reference Books:	
1	Finite element analysis in engineering design- Rajasekharan. S. – Wheeler Publishers.
2	A First Course on Finite Element Method – Daryl L Logan, Cengage Learning
3	The Finite Element Method- Zienkeiwicz. O.C. – Tata McGraw Hill Co. Ltd., New Delhi.
4	Finite Element Analysis- S.S. Bhavikatti, - New Age International Publishers, New Delhi.

CO-PO Mapping						
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓		✓			✓
CO2		✓	✓			✓
CO3	✓	✓	✓			

Syllabus for 2022-23 Batch PG (CSE)

Semester: II	
Course Title: SPECIAL CONCRETE	
Course Code: 22CSE231	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: PEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To learn principles of Concrete mix design.
2	To differentiate between different types of concrete.
3	To characterize the High Performance concrete.

UNIT – I

Components of modern concrete and developments in the process and constituent materials : Role of constituents, Development in cements and cement replacement materials, pozzolona, fly ash, silica fume, rice husk ash, recycled aggregates, chemical admixtures. Mix proportioning of Concrete: Principles and methods.	8 Hrs
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UNIT – II

Light Weight concrete: Introduction, classification, properties, strength and durability, mix proportioning and problems. High density concrete: Radiation shielding ability of concrete, materials for high density concrete, mix proportioning, properties in fresh and hardened state, placement methods.	8 Hrs
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UNIT – III

Ferro cement: Ferrocement materials, mechanical properties, cracking of ferrocement, strength and behaviour in tension, compression and flexure, Design of ferrocement in tension, ferrocement constructions, durability, and applications.	8 Hrs
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UNIT – IV

Fibre reinforced concrete: Fibre materials, mix proportioning, distribution and orientation, interfacial bond, properties in fresh state, strength and behavior in tension, compression and flexure of steel fibre reinforced concrete, mechanical properties, crack arrest and toughening mechanism, applications.	8 Hrs
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UNIT – V

High Performance concrete: Constituents, mix proportioning, properties in fresh and hardened states, applications and limitations. Ready Mixed Concrete, Self-Compacting Concrete, Reactive powder concrete, and bacterial concrete (Self-healing Concrete).	7 Hrs
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Course Outcomes: The students will be able to

1	Achieve Knowledge of design and development of problem solving skills.
2	Understand the principles of Concrete mix design.
3	Summarize the different types of concrete and its materials used.

Question paper pattern:

<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub - questions) from each unit. • Each full question will have sub - question covering all the topics under a unit. • The students will have to answer five full questions, selecting one full question from each unit.
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Text Books:

1	Neville A.M, “Properties of Concrete” Pearson Education Asia, 2000
2	P. Kumar Mehta, Paul J.N.Monterio, CONCRETE, “Microstructure, Properties and Materials”- Tata McGraw Hill.
3	A.R.Santhakumar, (2007) “Concrete Technology”-Oxford University Press, New Delhi, 2007
4	M.S. Shetty “Concrete Technology”
5	IS: 10262-2009, IS: 456- 2000

Reference Books:

1	Gambhir “Concrete Technology” TMH.
2	Rudnai.G. “Light Weight concrete”- Akademiai kiado, Budapest, 1963.
3	Rixom.R. and Mailvaganam.N., “Chemical admixtures in concrete”- E and FN, Spon London 1999
4	Aitcin P.C. “High performance concrete”-E and FN, Spon London 1998

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓		✓		✓	✓
CO2		✓	✓		✓	
CO3			✓	✓		✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: II	
Course Title: EARTH AND EARTH RETAINING STRUCTURES	
Course Code: 22CSE232	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: PEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	Broadly familiar with the importance of geotechnical engineering problems related field.
2	Understand the types of lateral earth pressure and its use in the design of retaining structures.
3	Check the stability of earthen slopes, retaining walls, sheet piles and braced cuts.
4	Estimation of seepage quantity through earthen dams and sheet piles.

UNIT – I**STABILITY OF EARTH SLOPES:**

Types of slopes, causes and type of failure of slopes. Factor of safety, Stability analysis of Infinite slopes by limiting equilibrium condition, Stability analysis of finite slopes by Swedish slip circle method, Method of slices, Fellenius method, Taylor's stability number. Stability of slopes under steady seepage, sudden drawdown and during construction.

8 Hrs**UNIT – II****SEEPAGE ANALYSIS:**

Laplace equation, Flow nets – characteristics and applications, Flow nets for sheet piles and below dam. Phreatic line – A. Casagrande's method – with and without filter, Flow through dams, Design of dam filters.

8 Hrs**UNIT – III****LATERAL EARTH PRESSURE:**

Types of earth pressure (Active, Passive and at-rest earth pressure). Rankine's and Coulomb's Earth pressure theories – Assumptions and limitations. Rankine's theory of applications (Dry, moist, submerged, partially submerged, uniform surcharge, layered cohesionless, cohesive and cohesive – friction backfill).

8 Hrs**UNIT – IV****RETAINING WALLS:**

Types of retaining walls, Failure of retaining walls by sliding, overturning and bearing. Stability and principles of the design of retaining walls – Gravity retaining walls, cantilever retaining walls, counterfort retaining walls, modes of failure of retaining walls, drainage of the backfill.

8 Hrs**UNIT – V****BULK HEADS:**

Cantilever sheet pile walls and Anchored cantilever sheet pile walls in cohesion less soils and in clay.

BRACED CUTS:

Lateral earth pressure on sheeting and Design of various components of bracings.

7 Hrs**Course Outcomes:** The students will be able to

1	Estimate the factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures.
2	Estimate the quantity of seepage through earth retaining structures.
3	Analyse and design the various components and check the safety of retaining wall, sheet pile and braced cut.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:

1	Soil Mechanics and Foundation Engineering, Punmia B C, Laxmi Publications Co., New Delhi.
2	Basic and Applied Soil Mechanics - Gopal Ranjan and Rao A.S.R. (2000), New Age International (P) Ltd., New Delhi.
3	Geotechnical Engineering - Braja, M. Das (2002), Fifth Edition, Thomson Business Information India (P) Ltd., India
4	Principles of Soil Mechanics and Foundation Engineering- Murthy V.N.S. (1996), 4th Edition, UBS Publishers and Distributors, New Delhi.

Reference Books:

1	Bowles J E, Foundation analysis and design, McGraw- Hill Publications
2	Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering, Tata McGraw Hill Publications
3	T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley & Sons.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓			✓		
CO2			✓			
CO3		✓			✓	✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: II	
Course Title: MASONRY STRUCTURES	
Course Code: 22CSE233	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: PEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To know different terminologies related to masonry design and construction, codes used for design.
2	To understand guidelines governing for masonry design is studied
3	To understand properties of masonry units, strength and factors affecting strength.
4	To gain knowledge and understand design criteria of various types of wall subjected to different load system.

UNIT – I

Introduction, Masonry units, materials and types: History of masonry Characteristics of Brick, stone, clay block, concrete block, stabilized mud block masonry units – strength, modulus of elasticity and water absorption. Masonry materials – Classification and properties of mortars, selection of mortars.	8 Hrs
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UNIT – II

Strength of Masonry in Compression: Behaviour of Masonry under compression, strength and elastic properties, influence of masonry unit and mortar characteristics, effect of masonry unit height on compressive strength, prediction of strength of masonry in Indian context, Failure theories of masonry under compression. Effects of slenderness and eccentricity, effect of rate of absorption, effect of curing, effect of ageing, workmanship on compressive strength.	8 Hrs
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UNIT – III

Flexural and shear bond, flexural strength and shear strength: Bond between masonry unit and mortar, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength, shear strength of masonry, test procedures for evaluating flexural and shear strength.	8 Hrs
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UNIT – IV

Design of load bearing masonry buildings: Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses, Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels; Wall carrying axial load, eccentric load with different eccentricity ratios, wall with openings, freestanding wall; Design of load bearing masonry for buildings up to 3 to 8 storeys using BIS codal provisions.	8 Hrs
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UNIT – V

Earthquake resistant masonry buildings: Behaviour of masonry during earthquakes, concepts and design procedure for earthquake resistant masonry, BIS codal provisions. Masonry arches, domes and vaults: Components and classification of masonry arches, domes and vaults, historical buildings, construction procedure.	7 Hrs
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Course Outcomes:

1	Define different masonry units, mortars and factors influencing masonry strength.
2	Understand the concept of structural masonry, failure theories, strength under compression and behaviour of masonry during earthquake.
3	Apply codal provision for design of load bearing masonry building.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:

1	Dayaratnam P, “Brick and Reinforced Brick Structures”, Scientific International Pvt. Ltd.
2	M. L. Gambhir, “Building and Construction Materials”, McGraw Hill education Pvt. Ltd.
3	Brick and Reinforced Brick Structures- Dayaratnam P: Oxford & IBH, 1987.
4	Alternative Building Materials Technology -Jagadish K.S., 2008, New Age International.

Reference Books:

1	Structural Masonry - Henry, A.W: Macmillan Education Ltd., 1990.
2	Design of Masonry Structures- Sinha B.P, Davies S.R: E & FN spon 1997
3	IS 1905–1987 Code of practice for structural use of un-reinforced masonry- BIS, New Delhi.
4	SP20(S&T)–1991, “Hand book on masonry design and construction (1st revision) BIS, New Delhi.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓			✓		
CO2			✓			✓
CO3	✓			✓	✓	

Syllabus for 2022-23 Batch PG (CSE)

Semester: II	
Course Title: DESIGN OF PLATES AND SHELLS	
Course Code: 22CSE234	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: PEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To learn different methods of analysis and design of plates and shells.
2	To critically detail the plates, folded plates and shells.
3	To evaluate the performance of spatial structures.

UNIT – I

Introduction to plate theory, Small deflection of laterally loaded thin rectangular plates for pure bending. Navier's and Levy's solution for various lateral loading and boundary conditions (No derivation), Numerical examples. Derivation of fourth order differential equation, relationship between moment and curvature and deflection.	8Hrs
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UNIT – II

Energy methods for rectangular and circular plates with simply supported and clamped edges subjected to symmetric loadings, Raleigh-Ritz. Method.	8Hrs
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UNIT – III

Introduction to curved surfaces and classification of shells, Membrane theory of spherical shells, cylindrical shells, hyperbolic paraboloids, elliptic paraboloid and conoids Approximate bending theory for shells and folded plates.	8Hrs
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UNIT – IV

Axially symmetric bending of shells of revolution, Closed cylindrical shells, water tanks, spherical shells and Geckler's approximation. Bending theory of doubly curved shallow shells, Derivation of governing differential equation of shallow shell of double curvature. DKJ, Schorer, Blasov's theories.	8Hrs
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UNIT – V

Design and detailing of folded plates with numerical examples Design and Detailing of simple shell problems – spherical domes, conical domes, water tanks, barrel vaults and hyperbolic paraboloid roofs.	7Hrs
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Course Outcomes: The students will be able to

1	Achieve Knowledge of design and development of problem solving skills.
2	Learn the concepts of energy principle of Plates.
3	Understand the principles of Analysis and Design of Plates and Shells.

Question paper pattern:

<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub - questions) from each unit. • Each full question will have sub - question covering all the topics under a unit. • The students will have to answer five full questions, selecting one full question from each unit.
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Text Books:

1	Timosheko, S. and Woinowsky-Krieger, W., "Theory of Plates and Shells" 2nd Edition, McGraw-Hill Co., New York, 1959
2	Ramaswamy G.S. – "Design and Constructions of Concrete Shell Roofs" – CBS Publishers and Distributors – New Delhi – 1986.

3	Ugural, A. C. “Stresses in Plates and Shells”, 2nd edition, McGraw-Hill, 1999.
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Reference Books:

1	R. Szilard, “Theory and analysis of plates - classical and numerical methods”, Prentice Hall, 1994.
2	Chatterjee.B.K. – “Theory and Design of Concrete Shell”, – Chapman & Hall, Newyork-third edition, 1988.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	✓				
CO2						✓
CO3	✓	✓	✓			

Syllabus for 2022-23 Batch PG (CSE)

Semester: II	
Course Title: ADVANCED DESIGN OF PRE-STRESSED CONCRETE STRUCTURES	
Course Code: 22CSE235	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: PEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:	
1	To understand the behaviour of pre-stressed elements.
2	To analyse and design of pre-stressed concrete elements.

UNIT – I	
LOSSES OF PRESTRESS : Loss of prestress in pre-tensioned and post-tensioned members due to various causes like elastic shortening of concrete, shrinkage of concrete, creep of concrete, relaxation of steel, slip in anchorage, bending of member and frictional loss – Analysis of sections for flexure.	8 Hrs
UNIT – II	
DESIGN OF SECTION FOR FLEXURE: Allowable stresses, Elastic design of simple beams having rectangular and I-section for flexure, kern lines, cable profile and cable layout. Design of Sections for Shear: Shear and Principal stresses, Improving shear resistance by different prestressing techniques- horizontal, sloping and vertical prestressing, Analysis of rectangular and I-beam, Design of shear reinforcement, Indian code provisions..	8 Hrs
UNIT – III	
DEFLECTIONS OF PRESTRESSED CONCRETE BEAMS: Short term deflections of uncracked members, Prediction of long-term deflections, load–deflection curve for a PSC beam, IS code requirements for maximum deflections.	7 Hrs
UNIT – IV	
TRANSFER OF PRESTRESS IN PRETENSIONED MEMBERS : Transmission of prestressing force by bond, Transmission length, Flexural bond stresses, IS code provisions, Anchorage zone stresses in post tensioned members, stress distribution in End block, Anchorage zone reinforcements.	8 Hrs
UNIT – V	
STATICALLY INDETERMINATE STRUCTURES: Advantages and disadvantages of continuous PSC beams, Primary and secondary moments, P and C lines, Linear transformation, concordant and non-concordant cable profiles, Analysis of continuous beams.	8 Hrs

Course Outcomes: The students will be able to	
1	Achieve Knowledge of design and development of problem solving skills.
2	Analyse, Design and detail PSC elements.
3	Understand the concept of Pre stressed and Post tensioned concrete.

Question paper pattern:	
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub - questions) from each unit. • Each full question will have sub - question covering all the topics under a unit. • The students will have to answer five full questions, selecting one full question from each unit. 	

Text Books:

1	Design of Prestressed concrete structures - Lin T.Y. and H. Burns - John Wiley & Sons, 1982.
2	Prestressed Concrete - N. Krishna Raju - Tata McGraw Hill, 3rd edition, 1995.
3	Prestressed Concrete Structures- P. Dayaratnam - Oxford & IBH, 5th Edition, 1991.
4	S. Ramamrutham, "Prestressed concrete", Dhanpat Rai & Sons, Delhi.
5	IS: 1343-2012.

Reference Books:

1	G.S. Pandit and S.P. Gupta, Prestressed Concrete - CBS Publishers, 1993.
2	Praveen Nagarjun, Prestressed Concrete Design, Pearson Publishers.
3	Dr.S.N.Sinha & Dr.S.K.Roy, Fundamentals of Prestressed Concrete, S.Chand Publishers.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	✓				
CO2	✓	✓	✓			
CO3	✓					✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: II	
Course Title: DESIGN OF TALL STRUCTURES	
Course Code: 22CSE241	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: PEC	
Hours: 39 Hrs. (L:T:P:S:4:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To make students to learn principles of stability of tall buildings,
2	To design the tall buildings for earthquake and wind resistance.
3	To evaluate the performance of tall structures for strength and stability

UNIT – I

Design Criteria: Design philosophy, loading, sequential loading, and materials–high performance concrete, fiber reinforced concrete, light weight concrete, design mixes. Loading and Movement, Gravity loading, Dead and live load, methods of live load reduction, Impact, Gravity loading, Construction loads	8 Hrs
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UNIT – II

Wind loading: Static and dynamic approach, Analytical and wind tunnel experimentation method. Earthquake loading: Equivalent lateral force, modal analysis, combinations of loading, working stress design, Limit state design, Plastic design.	8 Hrs
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UNIT – III

Behavior of Various Structural Systems: Factors affecting growth, Height and structural form; High rise behavior, Rigid frames, braced frames, in-filled frames, shear walls, coupled shear walls, wall-frames, tubular, cores, Outrigger-braced and hybrid mega system.	8 Hrs
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UNIT – IV

Analysis and Design: Modeling for approximate analysis, accurate analysis and reduction techniques, analysis of building as total structural system considering over all integrity and major sub system interaction, analysis for member forces; drift and twist, computerized general three dimensional analyses.	8 Hrs
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UNIT – V

Stability of Tall Buildings: Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first order and P-Delta analysis, Transnational, Torsional instability, out of plum effects, stiffness of member instability, effect of foundation rotation. Structural elements: sectional shapes, properties and resisting capacities, design, deflection, cracking, prestressing, shear flow. Design for differential movement, creep and shrinkage effects, temperature effects and fire.	7 Hrs
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Course Outcomes: The students will be able to

1	Understand the design criteria and philosophy for Tall buildings.
2	Analyze the tall structures subjected to different types of dynamic loadings
3	Analyze the behavior of various structural systems with different boundary conditions.
4	Understand the stability of tall buildings using various theories.

Question paper pattern:

• The question paper will have ten full questions carrying equal marks.

- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books

1	Taranath B.S., “Analysis& Design of Tall Building”, McGraw-Hill Book Co, 1988.
2	Bryan S.S, and Alexcoull, “Tall Building Structures, Analysis and Design”, John Wiley and Sons, Inc., 1991.

Reference Books:

1	T.Y Lin & D.S totes Burry, “Structural concepts and system for Architects and Engineers”
2	Lynn S. Beedle, “Advances in Tall Buildings”
3	Dr.Y.P.Gupta – Editor, “Proceedings National Seminar on High Rise Structures Design and Construction practices for middle level cities”-New Age International Limited.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	✓				✓
CO2	✓		✓			✓
CO3	✓		✓			
CO4	✓		✓			✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: I	
Course Title: RELIABILITY ANALYSIS OF STRUCTURES	
Course Code: 22CSE242	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 100
Credits: 03 Course: PEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:	
1	To learn principles of reliability.
2	To implement the Probability Concepts for the Reliability Analysis.
3	To evaluate different methods of reliability analysis.

UNIT – I	
Preliminary Data Analysis: Graphical representation- Histogram, frequency polygon, Measures of central tendency- grouped and ungrouped data, measures of dispersion and measures of asymmetry. Curve fitting and Correlation: Fitting a straight line, curve of the form $y = ab^x$, and parabola, Coefficient of correlation	8 Hrs
UNIT – II	
Probability Concepts: Random events-Sample space and events, Venn diagram and event space, Measures of probability- interpretation, probability axioms, addition rule, multiplication rule, conditional probability, probability tree diagram, statistical independence, total probability theorem and Baye's theorem.	8 Hrs
UNIT – III	
Random variables: Probability mass function, probability density function, Mathematical expectation, Chebyshev's theorem. Probability distributions: Discrete distributions- Binomial and poison distributions, Continuous distributions- Normal, Log normal distributions.	8 Hrs
UNIT – IV	
Reliability Analysis: Measures of reliability-factor of safety, safety margin, reliability index, performance function and limiting state. Reliability Methods-First Order Second Moment Method (FOSM), Point Estimate Method (PEM), and Advanced First Order Second Moment Method (Hasofer-Lind's method)	8 Hrs
UNIT – V	
System reliability: Influence of correlation coefficient, redundant and non-redundant systems-series, parallel and combined systems, Uncertainty in reliability assessments- Confidence limits, Bayesian revision of reliability. Simulation Techniques: Monte Carlo simulation- Statistical experiments, sample size and accuracy, Generation of random numbers- random numbers with standard uniform distribution, continuous random variables, discrete random variables.	7 Hrs

Course Outcomes: The students will be able to	
1	Achieve Knowledge of design and development of problem solving skills.
2	Understand the principles of reliability.
3	Summarize the Probability distributions.

Question paper pattern:	
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. 	

- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:

1	Ranganathan, R. (1999). “Structural Reliability Analysis and design”- Jaico publishing house, Mumbai, India.
2	Ang, A. H. S., and Tang, W. H. (1984). “Probability concepts in engineering planning and design”- Volume –I, John Wiley and sons, Inc, New York.
3	Ang, A. H. S., and Tang, W. H. (1984). “Probability concepts in engineering planning and design”- Volume –II, John Wiley and sons, Inc, New York.
4	Milton, E. Harr (1987). “Reliability based design in civil engineering”- McGraw Hill book Co.

Reference Books:

1	Nathabndu, T., Kottogoda, and Renzo Rosso (1998). Statistics, “Probability and reliability for Civil and Environmental Engineers”- Mc Graw Hill international edition, Singapore.
2	Achintya Haldar and Sankaran Mahadevan (2000). “Probability, Reliability and Statistical methods in Engineering design”- John Wiley and Sons. Inc.
3	Thoft-christensen, P., and Baker, M., J., (1982), “Structural reliability theory and its applications”- Springer-Verlag, Berlin, NewYork.
4	Thoft-christensen, P., and Murotsu, Y. (1986). “Application of structural systems reliability theory”- Springer-Verlag, Berlin, NewYork
5	Srinath, “Reliability analysis of structures”.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1			✓			
CO2	✓			✓		
CO3		✓			✓	

Syllabus for 2022-23 Batch PG (CSE)

Semester: II	
Course Title: STABILITY OF STRUCTURES	
Course Code: 22CSE243	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 100
Credits: 03 Course: PEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To learn principles of stability of structures.
2	To analyse the structural elements for stability.
3	To evaluate the use of strain energy in plate bending and stability.

UNIT – I

Beam – column differential equation. Beam column subjected to (i) lateral concentrated load, (ii) several concentrated loads, (iii) continuous lateral load. Application of trigonometric series, Euler's formulation using fourth order differential equation for pinned – pinned, fixed – fixed, fixed – free and fixed – pinned column.	8 Hrs
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UNIT – II

Buckling of frames and continuous beams. Elastic Energy method, Approximate calculation of critical loads for a cantilever. Exact critical load for hinged – hinged column using energy approach. Buckling of bar on elastic foundation. Buckling of cantilever column under distributed loads. Determination of critical loads by successive approximation. Bars with varying cross section. Effect of shear force on critical load. Column subjected to non – conservative follower and pulsating forces	8 Hrs
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UNIT – III

Stability analysis by finite element approach. Deviation of shape function for a two noded Bernoulli – Euler beam element (lateral and translation of) – element stiffness and element geometric stiffness matrices – assembled stiffness and geometric stiffness matrices for discretised column with different boundary condition – calculation of critical loads for a discretised (two elements) column (both ends built in). Buckling of pin jointed frames (maximum of two active dof) – symmetrical single bay portal frame.	8 Hrs
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UNIT – IV

Lateral buckling of beams. Differential equation – pure bending – cantilever beam with tip load – simply supported beam of I section subjected to central concentrated load. Pure Torsion of thin – walled bars of open cross section. Non – uniform Torsion of thin – walled bars of open cross section.	8 Hrs
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UNIT – V

Expression for strain energy in plate bending with in plate forces (linear and non – linear). Buckling of simply supported rectangular plate Uniaxial load and biaxial load. Buckling of uniformly compressed rectangular plate simply supported along two opposite sides perpendicular to the direction of compression and having various edge condition along the other two sides.	7 Hrs
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Course Outcomes: The students will be able to

1	Achieve Knowledge of design and development of problem solving skills.
2	Appraise the Stability analysis by finite element approach.
3	Understand the concepts of Lateral buckling of beams.

Question paper pattern:

<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks.

- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:

1	Stephen P.Timoshenko, James M Gere, “Theory of Elastic Stability”-2nd Edition, McGraw – Hill, New Delhi.
2	Robert D Cook et.al, “Concepts and Applications of Finite Element Analysis”-3rd Edition, John Wiley and Sons, NewYork.
3	S.Rajashekar, “Computations and Structural Mechanics”-Prentice – Hall, India.
4	Ray W Clough and J Penzien, “Dynamics of Structures” - 2nd Edition, McGraw Hill, New Delhi

Reference Books:

1	H.Zeiglar, “Principles of Structural Stability”-Blaisdall Publications.
2	Manica Selvam “Stability Analysis of Structures”.
3	Chajes “Stability of Structures”.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1		✓	✓			
CO2	✓			✓		
CO3			✓		✓	

Syllabus for 2022-23 Batch PG (CSE)

Semester: II	
Course Title: COMPOSITES AND SMART MATERIALS	
Course Code: 22CSE244	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: PEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To make students to learn principles of Composite materials.
2	To characterize smart materials.
3	To identify and understand the actuators and sensors.

UNIT – I

Introduction: Introduction to Composite materials, classifications and applications. Anisotropic elasticity – unidirectional and anisotropic lamina, thermo–mechanical properties, micro-mechanical analysis, characterization tests.	8 Hrs
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UNIT – II

Classical composite lamination theory, cross and angle – ply lamina, symmetric, anti-symmetric and general symmetric laminates, mechanical coupling. Analysis of simple laminated structural elements ply-stress and strain, lamina failure theories First ply failure, vibration and buckling analysis. Sandwich structure face and core materials, secondary failure modes environmental effects, manufacturing of composites.	8 Hrs
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UNIT – III

Introduction to smart materials and structures – piezoelectric materials – coupled electromechanical constitutive relations – depoling and coercive field – field – strain relation – hysteresis – creep – strain rate effects – manufacturing.	8 Hrs
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UNIT – IV

Actuators and sensors: single and dual actuators – pure extension, pure bending – bending extension relations – uniform strain beam model – symmetric induced strain actuators – bond shearing force – Bernoulli Euler (BE) beam model – embedded actuators.	8 Hrs
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UNIT – V

Asymmetric induced strain actuators in uniform strain and Euler – Bernoulli models. Uniform strain model – energy principle formulation – BE model – single and dual surface bonded actuators – Extension – bending and torsion model. Introductions to control systems: Open loop and close loop transfer functions – stability criteria – deflection control of beam like structures – using piezoelectric sensors and actuators – shape memory alloys.	7 Hrs
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Course Outcomes:

1	Classify Composite materials and smart materials with its applications in structural elements.
2	Understand the behaviour of Actuators and sensors.
3	Apply the knowledge of control systems in structural elements.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:

1	Mechanics of Composite Materials and Structures by M. Mukhopadhyaya- Universities Press 2009
2	Robert M.Jones, “Mechanical of Composite Materials”- McGraw Hill Publishing Co.
3	Bhagwan D Agarvalm and Lawrence J Brutman, “Analysis and Performance of Fiber Composites”- John Willy and Sons.

Reference Books:

1	Crawley, E and de Luis, J., “Use of Piezoelectric actuators as elements of intelligent structures”- AIAA Journal, Vol.25, No.10, Oct 1987, PP 1373-1385
2	Crawley, E and Anderson, E., “Detailed models of Piezoceramic actuation of beams” - Proc. of the 30th AIAA/ASME/ASME/ASCE/AHS/ASC – Structural dynamics and material conference, AIAA, Washington DC, 1989

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓		✓			
CO2		✓	✓			
CO3	✓			✓	✓	✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: II	
Course Title: REPAIR AND REHABILITATION OF STRUCTURES	
Course Code: 22CSE245	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: PEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To make students to investigate the cause of deterioration of concrete structures.
2	To identify different repair and rehabilitation of structures.
3	To evaluate the performance of the materials for repair.

UNIT – I

General: Introduction, Cause of deterioration of concrete structures, Diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping, core drilling and other instrumental methods Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking.	8 Hrs
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UNIT – II

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection.	8 Hrs
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UNIT – III

Maintenance and Repair Strategies: Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects. Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.	8 Hrs
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UNIT – IV

Materials for Repair: Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, Sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete. Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.	8 Hrs
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UNIT – V

Examples of Repair to Structures: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure, engineered demolition techniques for dilapidated structures case studies	7 Hrs
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Course Outcomes: The students will be able to

1	Identify the causes of failure and analyse failures in concrete structures.
2	Evaluate causes for failures in deteriorated concrete structures.
3	Develop simple and comprehensive solutions to rehabilitate deteriorated structures.

Question paper pattern:

<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub - questions) from each unit. • Each full question will have sub - question covering all the topics under a unit. • The students will have to answer five full questions, selecting one full question from each unit.
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Text Books:

1	Johnson, S.M., 1965. Deterioration, maintenance, and repair of structures.
2	Campbell-Allen, D. and Roper, H., 1991. Concrete structures: materials, maintenance and repair.
3	Allen, R.T.L., Edwards, S.C. and Shaw, D.N. eds., 1992. Repair of concrete structures. CRC Press. Blakie and Sons
4	Raiker R.N., “Learning for failure from Deficiencies in Design, Construction and Service”- R&D Center (SDCPL)

Reference Books:

1	Rehabilitation of Concrete Structures, B Vedivelli, 2013, Standard publishers and distributors, ISBN: 978-8180141102.
2	Distress and Repair of Concrete Structures, Norb Dellate Failure, 2009, I Edition, Woodhead Publishing Series in Civil and Structural Engineering, Woodhead Publishing.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	-	✓	-	-	-
CO2	-	✓	-	✓	-	-
CO3	-	-	-	✓	✓	✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: II	
Course Title: MINI PROJECT WITH SEMINAR	
Course Code: 22CSEM25	CIE + Seminar = 100 Marks
Credits: 03 Course: MPS	
Hours: 39 Hrs. (L:T:P:S:0:4:0:2)	SEE Duration: -

Course Learning Objectives:

1	To enhance the self-learning capacity of students.
2	Enable them to make a comprehensive approach to new and upcoming areas of technology.
3	Also to impart training to students to face audience and present their ideas and thus creating in them self-esteem and courage.

Individual students are required to choose a topic on their field of interest in Structural Engineering domain preferably from outside the regular curriculum, conduct mini project and give seminar for about 45 minutes before a committee consisting of at least three faculty members (preferably specialized in Structural Engineering) shall assess the presentation of the seminar and award marks to the students based on merits of topic of presentation. Each student shall submit two reports in a specified format design by the department. One copy shall be returned to the student after certifying by the chairman of the assessing committee and remaining one will be kept in the departmental library. Internal continuous assessment marks are awarded based on the relevance topic, presentation skill, quality of the report write up and participation and Simulations.

Reading Materials:

1	Journal Publication.
2	Conference / Seminar Proceedings.
3	Handbooks / Research Digests / Codebooks

Course Outcomes: The students will be able to

1	Identify appropriate topic in relevant domain.
2	Analyze literature on various research papers of specified topic and prepare comprehension.
3	Design and develop presentation on a given technical topic.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	✓				✓
CO2		✓	✓			
CO3				✓	✓	✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: II	
Course Title: COMPUTATIONAL STRUCTURAL LABORATORY	
Course Code: 22CSEL26	CIE + SEE Marks = 50 + 50
Credits: 02 Course: PCCL	
Hours: 26 Hrs. (L:T:P:S:0:0:2:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To make students to learn the software's for structural analysis and design.
2	To investigate the performance of structures for static and dynamic forces.

UNIT – I

Static and Dynamic analysis of Building structure using software (ETABS / STAADPRO / ANSYS /NISA).	7 Hrs
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UNIT – II

Design of RCC and Steel structure using software (ETABS /STAADPRO).	7 Hrs
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UNIT – III

Analysis of folded plates and shells using software.	6 Hrs
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UNIT – IV

Preparation of EXCEL sheets for structural design.	6 Hrs
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Course Outcomes: The students will be able to

1	Analyze the static and Dynamic behavior of RC and Steel Buildings
2	Apply the concepts of FEM to analyze the structural components using standard software package.

Reference Books:

1	Damodar Maity, "Computer Analysis of Framed Structures", I K International Publishing House Pvt Ltd.
2	Sharma, T.S., "Design of RCC Buildings using Staad Pro V8i with Indian Examples – Static & Dynamics method", Educreation Publishing, 2017
3	Gaurav Verma, "ETABS 2016 Black Book", 1stEdition, 2018 ISBN 978-1988722290.
4	Relevant Software Manual.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	✓	✓			✓
CO2	✓					

Syllabus for 2022-23 Batch PG (CSE)**Semester: III****Course Title: EARTHQUAKE RESISTANT STRUCTURES**

Course Code: 22CSE31	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 04 Course: PCC	
Hours: 52 Hrs. (L:T:P:S:4:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To learn principles of engineering seismology.
2	To design the reinforced concrete buildings for earthquake resistance.
3	To evaluate the seismic response of the structures.

UNIT – I

Introduction to engineering seismology, Geological and tectonic features of India, Origin and propagation of seismic waves, characteristics of earthquake and its quantification – Magnitude and Intensity scales, seismic instruments. Earthquake Hazards in India, Earthquake Risk Evaluation and Mitigation. Structural behavior under gravity and seismic loads, Lateral load resisting structural systems, Requirements of efficient earthquake resistant structural system, damping devices, base isolation systems.	12 Hrs
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UNIT – II

The Response history and strong motion characteristics. Response Spectrum – elastic and inelastic response spectra, tripartite (D-V-A) response spectrum, use of response spectrum in earthquake resistant design. Computation of seismic forces in multi- storied buildings – using procedures (Equivalent lateral force and dynamic analysis) as per IS-1893.	10 Hrs
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UNIT – III

Structural Configuration for earthquake resistant design, Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings. Design provisions for these in IS-1893. Effect of infill masonry walls on frames, modeling concepts of infill masonry walls. Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, Slenderness concept of masonry walls, concepts for earthquake resistant masonry buildings – Codal provisions.	10 Hrs
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UNIT – IV

Design of Reinforced concrete buildings for earthquake resistance-Load combinations, Ductility and energy absorption in buildings. Confinement of concrete for ductility, design of columns and beams for ductility, ductile detailing provisions as per IS-1893. Structural behavior, design and ductile detailing of shear walls.	10 Hrs
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UNIT – V

Seismic response control concepts – Seismic demand, seismic capacity, Overview of linear and nonlinear procedures of seismic analysis. Performance Based Seismic Engineering methodology, Seismic evaluation and retrofitting of structures.	10 Hrs
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Course Outcomes: The students will be able to

1	Understand the principles of engineering seismology, response spectrum, ductility and seismic analysis
2	Understand the structural response of reinforced concrete buildings under seismic loads.
3	Summarize the Seismic evaluation and retrofitting of structures.

Question paper pattern:

<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub - questions) from each unit. • Each full question will have sub - question covering all the topics under a unit. • The students will have to answer five full questions, selecting one full question from each unit.
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Text Books:

1	Anil K. Chopra, Dynamics of Structures – Theory and Application to Earthquake Engineering- 2nd ed. – Pearson Education.
2	Vinod Hosur, Earthquake Resistant Design of Building Structures, WILEY (India)
3	Duggal, Earthquake Resistant Design of Structures, Oxford University Press
4	IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS-13828: 1993

Reference Books:

1	T Paulay and M J N Priestley, Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley and Sons
2	Minoru Wakabayashi, Design of Earthquake Resistant Buildings, McGraw Hill Pub.
3	Pankaj Agarwal, Earthquake resistant design of structures – Manish Shrikande - PHI India

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1			✓	✓		✓
CO2	✓	✓		✓		✓
CO3		✓	✓		✓	✓

Syllabus for 2022-23 Batch PG (CSE)**Semester: III****Course Title: STRUCTURAL HEALTH MONITORING**

Course Code: 22CSE321	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: PEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	Understand the concept of structural health monitoring
2	Learn the importance and significance of structural health monitoring
3	Learn about various techniques used in structural health monitoring.
4	Explore about the recent advancements in structural health monitoring

UNIT – 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..	8 Hrs
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UNIT – 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, Modal Scaling Factor (MSF), Co-ordinate Modal Assurance Criterion (COMAC), Damping, Expansion and reduction, Updating of the initial model, Damage localization and quantification, Change of the flexibility matrix, Change of the stiffness matrix, Strain-energy-based indicator methods and curvature modes, MECE error localization technique, Static displacement method, Inverse eigen sensitivity method, Modal force residual method, Kinetic and strain energy- based sensitivity methods, Forced vibrations and frequency response functions, Solution of the equation system, Regularization, Parameter subset selection, Other solution methods, Variances of the parameters, Neural network approach to SHM, The basic idea of neural networks, 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, Damage identification in non-linear systems, Extended Kalman filter, Localization of damage using filter banks.	8 Hrs
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UNIT – III

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, Orientation of the optical fiber optic with respect to the reinforcement fibers, Ingress/egress from the laminate, Fiber Bragg gratings as damage sensors for composites, Measurement of strain and stress variations, Measurement of spectral perturbations associated with internal stress release resulting from damage spread, Examples of applications in aeronautics and civil engineering, Stiffened panels with embedded fiber Bragg gratings, Concrete beam repair.	8 Hrs
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UNIT – IV

SHM with Piezoelectric Sensors The use of embedded sensors as acoustic emission (AE)	8 Hrs
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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-based acousto-ultrasonic SHM research, Lamb wave structure interrogation, Sensor technology, Tested structures (mainly metallic or composite parts), Acousto-ultrasonic signal and data reduction methods, The full implementation of SHM of localized damage with guided waves in composite materials, Available industrial acousto-ultrasonic systems with piezoelectric sensors, Electromechanical impedance, E/M impedance for defect detection in metallic and composite parts, The piezoelectric implant method applied to the evaluation and monitoring of viscoelastic properties.	
UNIT – V	
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. Low Frequency Electromagnetic Techniques Theoretical considerations on electromagnetic theory, Maxwell's equations, Dipole radiation, Surface impedance, Diffraction by a circular aperture, Eddy currents, Polarization of dielectrics, Applications to the NDE/NDT domain, Dielectric materials, Conductive materials, Hybrid method, Signal processing, Time-frequency transforms, The continuous wavelet transform, The discrete wavelet transform, Multiresolution, Denoising, Application to the SHM domain, General principles, Magnetic method, Electric method, Hybrid method.	7 Hrs

Course Outcomes: The students will be able to	
1	Learn the fundamentals of structural health monitoring.
2	Study the various vibration-based techniques for structural health monitoring.
3	Study the structural health monitoring process using electrical resistance, electromagnetic techniques, fiber-optic and Piezoelectric sensors.

Question paper pattern:	
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub - questions) from each unit. • Each full question will have sub - question covering all the topics under a unit. • The students will have to answer five full questions, selecting one full question from each unit. 	

Text Books:	
1	Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes, Structural Health Monitoring, WileyISTE, 2006.
2	Douglas E Adams, Health Monitoring of Structural Materials and Components-Methods with Applications, John Wiley and Sons, 2007.
3	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.

Reference Books:	
1	Victor Giurgutiu, Structural Health Monitoring with Wafer Active Sensors, Academic Press Inc, 2007.
2	Smart Materials and Structures, Gandhi and Thompson
3	Structural Health Monitoring: Current Status and Perspectives, Fu Ko Chang

CO-PO Mapping						
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1			✓	✓		✓
CO2	✓	✓		✓		✓
CO3		✓	✓		✓	✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: III	
Course Title: THEORY OF PLASTICITY AND FRACTURE MECHANICS	
Course Code: 22CSE322	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: PEC	
Hours: 39Hrs (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs

Course Learning Objectives:

1	To compute the stress intensity factor, strain energy release rate, and the stress and strain fields around a crack tip for linear and nonlinear materials
2	Know experimental methods to determine the fracture toughness
3	Use the design principle of materials and structures using fracture mechanics approaches

UNIT – I**Plasticity**

General concept, yield criteria, flow rules for perfectly plastic and strain hardening materials-simple applications, Theories of failure. Plasticity models for concrete

8 Hrs**UNIT – II****Linear Elastic Fracture mechanics**

Basic modes of fracture, Griffith theory of brittle fracture, Irwin's modifications for elastic-plastic materials, theories of linear elastic fracture mechanics, stress intensity factors, fracture toughness testing.

8 Hrs**UNIT – III****Elasto-plastic fracture mechanics**

Crack-tip plasticity and in metals. Mixed mode problems and evaluation of critical fracture parameters.

8 Hrs**UNIT – IV****Fatigue damage theories**

Fatigue test, endurance limit, fatigue fracture under combined loading, fatigue controlling factors, cumulative fatigue damage concepts.

8 Hrs**UNIT – V****Fracture of Concrete**

Review of concrete behaviour in tension and compression, Basic frame works for modelling of quasi-brittle materials, discrete crack concept/Smearred crack concept. FE Concepts and applications.

7 Hrs**Course Outcomes:** The students will be able to

1	Explain and apply yield criteria & flow
2	Design structures using fracture mechanics approaches
3	Apply principles of fracture mechanics
4	Solve problems related to plastic fracture mechanics

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books

1	Prashant Kumar, "Elements of Fracture Mechanics", Tata McGraw Hill, NewDelhi, India, 2009.
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Reference Books:

1	Valliappan S. "Continuum Mechanics Fundamentals" (1982), Oxford IBH, N D. New Delhi.
2	Broek, D., "Elementary Engineering Fracture Mechanics", 4th edition, MartinusNijhoff (1987).
3	Venkataraman and Patel "Structural Mechanics with introduction to Elasticity and Plasticity" – Mcgraw Hill, 1990.
4	Simha K.R.Y., "Fracture Mechanics for Modern Engineering Design", Universities Press (India) Limited, 2001.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓					
CO2	✓	✓				✓
CO3	✓	✓				✓
CO4	✓	✓				✓

Syllabus for 2022-23 Batch PG (CSE)**Semester: III****Course Title: DESIGN CONCEPTS OF SUBSTRUCTURES**

Course Code: 22CSE323	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 100
Credits: 03 Course: PEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	Understand the stratification of soil mass and soil investigation.
2	Interpret the soil condition at a given location and suggest the suitable foundation.
3	Summarize the various methods of soil investigation and foundations for Civil Engineering applications.

UNIT – I**Subsurface Exploration:**

Definition, Objectives and Planning of exploration program, Significant depth, Methods of exploration: Test pits, Borings (Auger, Wash, Rotary and Percussion borings), Stabilization of bore holes, Types of samples (undisturbed, disturbed, representative and non-representative samples, Types of Samplers (Standard split spoon sampler, Shell by tubes, Thin walled samplers, Piston sampler), Design features affecting sample disturbance (area ratio, Recovery ratio, inside and outside clearances), Estimation of depth of ground water table (Hvorslev's method), Geophysical methods (Seismic refraction and electrical resistivity methods), Typical bore log. Number and depth of borings for various Civil engineering structures, Soil exploration report.

8 Hrs**UNIT – II****Bearing capacity of Shallow Foundations:**

Modes of shear failure, Terzaghi's and IS: 6403 and 1981 method, Shallow foundation in sand, clay and C- Φ soils, Effect of water table and footing eccentricity, Allowable bearing capacity for Field plate load test and SPT.

8 Hrs**UNIT – III****Proportioning of Shallow Foundations:**

Proportion of shallow foundation for equal settlement, Computation of design loads, design of combined footings (rectangular and trapezoidal), Types of rafts, bearing capacity and settlements of raft foundation, Rigid methods, coefficient of subgrade reaction.

8 Hrs**UNIT – IV****Pile Foundations:**

Types of piles, Load Transfer mechanism, Static formulae, Dynamic formulae, Pile load Test, SPT and SCPT. Pile groups in clay: Efficiency, Bearing capacity and settlement, Negative skin friction.

8 Hrs**UNIT – V****Drilled Piers and Caissons:**

Construction of drilled pier, Construction of open caisson, Pneumatic caisson and floating caisson.

Well foundations:

Different shapes of wells, Grip length, Forces acting on the well foundation, Terzaghi's analysis, Individual components of well, Sinking of wells, Measures for rectification of tilts and shifts.

7 Hrs**Course Outcomes:** The students will be able to

1	Understand the soil behaviour under different subsoil conditions and methods of soil investigation.
2	Interpret the investigated soil data and design suitable foundation system.
3	Analyse the subsoil conditions at a given location and evaluate bearing capacity.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub - questions) from each unit.

- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:

1	Soil Mechanics and Foundation Engineering, Punmia B C, Laxmi Publications Co., New Delhi.
2	Basic and Applied Soil Mechanics - Gopal Ranjan and Rao A.S.R. (2000), New Age International (P) Ltd., New Delhi.
3	Geotechnical Engineering - Braja, M. Das (2002), Fifth Edition, Thomson Business Information India (P) Ltd., India
4	Principles of Soil Mechanics and Foundation Engineering- Murthy V.N.S. (1996), 4th Edition, UBS Publishers and Distributors, New Delhi.

Reference Books:

1	Bowles J E, Foundation analysis and design, McGraw- Hill Publications
2	Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering, Tata McGraw Hill Publications
3	T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley & Sons.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1		✓				
CO2	✓			✓		
CO3		✓				

Syllabus for 2022-23 Batch PG (CSE)**Semester: III****Course Title: DESIGN OF CONCRETE BRIDGE STRUCTURES**

Course Code: 22CSE324	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: PEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To learn principles of Bridge Design,
2	To design different types of structures and to detail the structures.
3	To evaluate performance of the Bridge structures.

UNIT – I**INTRODUCTION:**

Historical Developments, Site Selection for Bridges, Classification of Bridges Forces on Bridges. Bridge substructures: Abutments, piers and wing walls Balanced Cantilever Bridge: Introduction and proportioning of components, Design of simply supported portion and design of cantilever portion, design of articulation, ROB (Road Over Bridges), RUB (Road Under Bridges) and Box Pre-Stressing.

8 Hrs**UNIT – II****BOX CULVERT:**

Different Loading Cases IRC Class AA Tracked, Wheeled and Class A Loading, working out the worst combination of loading, Moment Distribution, Calculation of BM & SF, Structural Design of Slab Culvert, with Reinforcement Details.

8 Hrs**UNIT – III****T BEAM BRIDGE SLAB DESIGN:**

Proportioning of Components Analysis of interior Slab & Cantilever Slab Using IRC Class AA Tracked, Wheeled Class A Loading, Structural Design of Slab, with Reinforcement Detail. T Beam Bridge Cross Girder Design: Analysis of Cross Girder for Dead Load & Live Load Using IRC Class AA Tracked, Wheeled Class A Loading A Loads, Structural Design of Beam, with Reinforcement Detail.

8 Hrs**UNIT – IV****T BEAM BRIDGE MAIN GIRDER DESIGN:**

Analysis of Main Girder for Dead Load & Live Load Using IRC Class AA Tracked, Wheeled Class A Loading Using COURBON'S Method, Analysis of Main Girder Using HENDRY-JAEGER and MORICE- LITTLE Method for IRC Class AA Tracked vehicle only, BM & SF for different loads, Structural Design of Main Girder With Reinforcement Details.

8 Hrs**UNIT – V****PSC BRIDGES:**

Introduction to Pre and Post Tensioning, Proportioning of Components, Analysis and Structural Design of Slab, Analysis of Main Girder using COURBON's Method for IRC Class AA tracked vehicle, Calculation of pre-stressing force, cable profile and calculation of stresses, Design of End block and detailing of main girder.

7 Hrs**Course Outcomes:** The students will be able to

1	Achieve Knowledge of design and development of problem solving skills.
2	Learn the Bridge substructures and superstructures
3	Summarize the principles of design and detailing of bridges.
4	Analyse and Design different types of Bridges.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:

1	“Essentials of Bridge Engineering”- D Johnson Victor, Oxford & IBH Publishing Co New Delhi
2	“Design of Bridges”- N Krishna Raju, Oxford & IBH Publishing Co New Delhi
3	“Principles and Practice of Bridge Engineering”- S P Bindra Dhanpat Rai & Sons New Delhi
4	IRC 6 – 1966 “Standard Specifications And Code Of Practice For Road Bridges”- Section II Loads and Stresses, The Indian Road Congress New Delhi
5	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
6	IS 456 – 2000 “Indian Standard Plain and Reinforced Concrete Code of Practice”- (Fourth Revision) BIS New Delhi
7	IS 1343 – “Indian Standard Prestressed Concrete Code of Practice”- BIS New Delhi

Reference Books:

1	Raina V.K., “Concrete Bridge Practice”- Tata McGraw Hill
2	Bakht B & Jaeggar, “Bridge Analysis Simplified”- McGraw Hill
3	Ponnuswamy. S, “Bridge Engineering”- Tata McGraw Hill.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	✓				
CO2	✓					✓
CO3	✓					
CO4	✓	✓	✓			

Syllabus for 2022-23 Batch PG (CSE)

Semester: III	
Course Title: INDUSTRIAL STRUCTURES	
Course Code: 22CSE325	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: PEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To make students to learn principles of Design of industrial building,
2	To design different components of industrial structures and to detail the structures.
3	To evaluate the performance of the Pre-engineered buildings

UNIT – I

Analysis of industrial building for Gravity and Wind load. Analysis and design of framing components namely, girders, trusses, gable frames	8 Hrs
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UNIT – II

Analysis and design of gantry column (stepped column / column with bracket), purlins, girts, bracings including all connections.	8 Hrs
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UNIT – III

Analysis of transmission line towers for wind load and design of towers including all connections.	8 Hrs
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UNIT – IV

Forms of light gauge sections, Effective width computation of unstiffened, stiffened, multiple stiffened compression elements of cold formed light gauge sections. Concept of local buckling of thin elements. Limiting width to thickness ratio. Post buckling strength.	8 Hrs
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UNIT – V

Concept of Pre- engineered buildings, Design of compression and tension members of cold formed light gauge sections, Design of flexural members (Laterally restrained / laterally unrestrained).	7 Hrs
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Course Outcomes: The students will be able to

1	Acquire knowledge of design of industrial structure and development of problem solving skills.
2	Understand the industrial building and its components
3	Design and develop analytical skills in Structural Design and detailing
4	Understand the concept of Pre- engineered buildings.

Question paper pattern:

<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub - questions) from each unit. • Each full question will have sub - question covering all the topics under a unit. • The students will have to answer five full questions, selecting one full question from each unit.
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Text Books:

1	Bureau of Indian Standards, IS800-2007, IS875-1987, IS-801-1975. Steel Tables, SP 6(1) – 1984
2	N Subramanian- “Design of Steel Structure” oxford University Press
3	B.C. Punmia, A.K. Jain “Design of Steel Structures”, Laxmi Publications, New Delhi.

Reference Books:

1	Ramchandra and Virendra Gehlot “ Design of Steel Structures “ Vol 1 and Vol.2, Scientific Publishers, Jodhpur
2	Duggal “Limit State Design of Steel Structures” TMH

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	✓				
CO2	✓					✓
CO3	✓					
CO4	✓	✓	✓			

Syllabus for 2022-23 Batch PG (CSE)

Semester: III	
Course Title: COMPOSITE MATERIALS	
Course Code: 22CSE331	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: OEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To make students to learn principles of Composite materials.
2	To characterize smart materials.
3	To identify and understand the actuators and sensors.

UNIT – I

Introduction: Introduction to Composite materials, classifications and applications. Anisotropic elasticity – unidirectional and anisotropic lamina, thermo–mechanical properties, micro-mechanical analysis, characterization tests.	8 Hrs
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UNIT – II

Classical composite lamination theory, cross and angle – play lamina, symmetric, anti-symmetric and general symmetric laminates, mechanical coupling. Analysis of simple laminated structural elements ply-stress and strain, lamina failure theories First fly failure, vibration and buckling analysis. Sandwich structure face and core materials, secondary failure modes environmental effects, manufacturing of composites.	8 Hrs
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UNIT – III

Introduction to smart materials and structures – piezoelectric materials – coupled electromechanical constitutive relations – depoling and coercive field – field – strain relation – hysteresis – creep – strain rate effects – manufacturing.	8 Hrs
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UNIT – IV

Actuators and sensors: single and dual actuators – pure extension, pure bending – bending extension relations – uniform strain beam model – symmetric induced strain actuators – bond shearing force – Bernoulli Euler (BE) beam model – embedded actuators.	8 Hrs
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UNIT – V

Asymmetric induced strain actuators in uniform strain and Euler – Bernoulli models. Uniform strain model – energy principle formulation – BE model – single and dual surface bonded actuators – Extension – bending and torsion model. Introductions to control systems: Open loop and close loop transfer functions – stability criteria – deflection control of beam like structures – using piezoelectric sensors and actuators – shape memory alloys.	7 Hrs
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Course Outcomes:

1	Classify Composite materials and smart materials with its applications in structural elements.
2	Understand the behaviour of Actuators and sensors.
3	Apply the knowledge of control systems in structural elements.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:

1	Mechanics of Composite Materials and Structures by M. Mukhopadhyaya- Universities Press 2009
2	Robert M.Jones, “Mechanical of Composite Materials”- McGraw Hill Publishing Co.
3	Bhagwan D Agarvalm and Lawrence J Brutman, “Analysis and Performance of Fiber Composites”- John Willy and Sons.

Reference Books:

1	Crawley, E and de Luis, J., “Use of Piezoelectric actuators as elements of intelligent structures”- AIAA Journal, Vol.25, No.10, Oct 1987, PP 1373-1385
2	Crawley, E and Anderson, E., “Detailed models of Piezoceramic actuation of beams” - Proc. of the 30th AIAA/ASME/ASME/ASCE/AHS/ASC – Structural dynamics and material conference, AIAA, Washington DC, 1989

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓		✓			
CO2		✓	✓			
CO3	✓			✓	✓	✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: III	
Course Title: CONCRETE TECHNOLOGY	
Course Code: 22CSE332	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: OEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	The objective of the course is to provide students to obtain an in-depth knowledge of a wide variety of advanced topics in concrete technology and practice.
2	Understand Cement and concrete production technology, testing methods and performance requirements.
3	Learn about the significance of different materials in concrete

UNIT – I

Cement, Chemical composition, hydration of cement, Types of cement, manufacture of OPC by wet and dry, process (flow charts only) Testing of cement - Field testing, Fineness by sieve test and Blaine's air permeability test, Normal consistency, testing time, soundness, Compression strength of cement and grades of cement, Quality of mixing water.	8 Hrs
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UNIT – II

Fine aggregate - grading, analysis, Specify gravity, bulking, moisture content, deleterious materials. Coarse aggregate – Importance of size, shape and texture. Grading of aggregates - Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests.	8 Hrs
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UNIT – III

Workability - factors affecting workability, Measurement of workability - slump, flow tests, Compaction factor and vee-bee consistometer tests, Segregation and bleeding, Process of manufactures of concrete : Batching, Mixing, Transporting, Placing, Compaction, Curing. Chemical admixtures - plasticizers, accelerators, retarders and air entraining agents, Mineral admixtures - Fly ash, Silica fumes, rice husk ash and GGBS.	8 Hrs
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UNIT – IV

Factors affecting strength, w/c ratio, gel/space ratio, maturity concept, Effect of aggregate properties, relation between compressive strength, and tensile strength, bond strength, modulus of rupture, Accelerated curing, aggregate - cement bond strength, Testing of hardened concrete - compressive strength, split tensile strength, Flexural strength, factors influencing strength test results.	7 Hrs
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UNIT – V

Elasticity - Relation between modulus of elasticity and Strength, factors affecting modulus of elasticity, Poisson , Ratio, Shrinkage - plastic shrinkage and drying shrinkage, Factors affecting shrinkage, Creep - Measurement of creep, factors affecting creep, effect of creep, Durability - definition, significance, permeability, Sulphate attack, Chloride attack, carbonation, freezing and thawing – remedial measures. Concept of Concrete Mix design, variables in proportioning , exposure conditions, Procedure of mix design as per IS 10262-2009, Numerical examples of Mix Design	8 Hrs
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Course Outcomes:

1	Understand the significance of concrete materials.
2	Categorize the properties for assessment of concrete.
3	Design a concrete mix based on requirement.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

- There will be two full questions (with a maximum of four sub – questions) from each unit.
- Each full question will have sub – question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:

- | | |
|---|--|
| 1 | “Concrete Technology” – Theory and Practice, M.S.Shetty, S.Chand and Company, New Delhi, 2002. |
| 2 | “Concrete Technology” – M.L.Gambhir, TATA McGRAW HILL, New Delhi. |
| 3 | “Properties of Concrete”Neville, A.M. : , ELBS, London |

Reference Books:

- | | |
|---|---|
| 1 | “Concrete Technology” – A.R.Santakumar. Oxford University Press (2007)“ |
| 2 | “Concrete Mix Design” – N.Krishna Raju, Sehgal – publishers. |
| 3 | "Recommended guidelines for concrete mix design" - IS:10262,BIS Publication |

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓		✓			
CO2		✓	✓			
CO3	✓			✓	✓	✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: III	
Course Title: REPAIR AND RESTORATION OF STRUCTURES	
Course Code: 22CSE333	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: OEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	To make students to investigate the cause of deterioration of concrete structures.
2	To identify different repair and rehabilitation of structures.
3	To evaluate the performance of the materials for repair.

UNIT – I

General: Introduction, Cause of deterioration of concrete structures, Diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping, core drilling and other instrumental methods Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking.	8 Hrs
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UNIT – II

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection.	8 Hrs
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UNIT – III

Maintenance and Repair Strategies: Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects. Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.	8 Hrs
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UNIT – IV

Materials for Repair: Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, Sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete. Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.	8 Hrs
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UNIT – V

Examples of Repair to Structures: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure, engineered demolition techniques for dilapidated structures case studies	7 Hrs
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Course Outcomes: The students will be able to

1	Identify the causes of failure and analyse failures in concrete structures.
2	Evaluate causes for failures in deteriorated concrete structures.
3	Develop simple and comprehensive solutions to rehabilitate deteriorated structures.

Question paper pattern:

<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub - questions) from each unit. • Each full question will have sub - question covering all the topics under a unit. • The students will have to answer five full questions, selecting one full question from each unit.
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Text Books:

1	Johnson, S.M., 1965. Deterioration, maintenance, and repair of structures.
2	Campbell-Allen, D. and Roper, H., 1991. Concrete structures: materials, maintenance and repair.
3	Allen, R.T.L., Edwards, S.C. and Shaw, D.N. eds., 1992. Repair of concrete structures. CRC Press. Blakie and Sons
4	Raiker R.N., “Learning for failure from Deficiencies in Design, Construction and Service”- R&D Center (SDCPL)

Reference Books:

1	Rehabilitation of Concrete Structures, B Vedivelli, 2013, Standard publishers and distributors, ISBN: 978-8180141102.
2	Distress and Repair of Concrete Structures, Norb Dellate Failure, 2009, I Edition, Woodhead Publishing Series in Civil and Structural Engineering, Woodhead Publishing.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	-	✓	-	-	-
CO2	-	✓	-	✓	-	-
CO3	-	-	-	✓	✓	✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: III	
Course Title: BASIC CONSTRUCTION MATERIALS	
Course Code: 22CSE334	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: OEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	The course intends to provide basic information on the structure and properties of construction materials
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UNIT – I

Introduction and usage of Stone / Brick / Mortar in construction	8 Hrs
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UNIT – II

Introduction and usage of Cement and Concrete in construction	8 Hrs
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UNIT – III

Introduction and usage of Steel / Aluminium / Copper in construction	8 Hrs
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UNIT – IV

Introduction and usage of Composite materials / FRP / Polymers and Plastics in construction	8 Hrs
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UNIT – V

Introduction and usage of Wood / Glass in construction	7 Hrs
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Course Outcomes: The students will be able to

1	Understand the applications of stone, brick and mortar
2	Understand the role and importance of cement and concrete
3	Differentiate the significance of various building materials.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:

1	S. K. Duggal, “Building Materials”, (Fourth Edition)New Age International (P) Limited, 2016 National Building Code(NBC) of India
2	P C Vergese, “Building Materials”, PHI Learning Pvt.Ltd
3	Building Materials and Components, CBRI, 1990,India

Reference Books:

1	Jagadish. K.S, “Alternative Building Materials Technology”, New Age International,2007.
2	M. S. Shetty, “Concrete Technology”, S. Chand & Co. New Delhi.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	-	✓	-	-	-
CO2	-	✓	-	✓	-	-
CO3	-	-	-	✓	✓	✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: III	
Course Title: STRENGTH OF MATERIALS	
Course Code: 22CSE335	CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100
Credits: 03 Course: OEC	
Hours: 39 Hrs. (L:T:P:S:3:0:0:0)	SEE Duration: 3 Hrs.

Course Learning Objectives:

1	Learn to compute simple stress and strain in a material
2	Compute shear force, bending moment, deflection, bending stress and shear stress in a beams.
3	Compute torsion of circular shafts

UNIT – I

Simple Stress and Strain: Introduction, Properties of Materials, Stress, Strain, Hook's law, Stress – Strain Diagram for structural steel and non ferrous materials, Volumetric strain, expression for volumetric strain, Elastic Constants: Relationship among elastic constants, Total elongation of tapering bars of circular and rectangular cross sections. Elongation due to self weight.	8 Hrs
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UNIT – II

Bending moment and shear force in beams: Introduction, Shearing force and Bending moment in beam, Sign convention, Relationship between loading, shear force and bending moment, Shear force and bending moment equations, SFD and BMD with salient values for cantilever beams, simply supported beams and overhanging beams considering gravity loads(point, udl and uvl) and Couple.	8 Hrs
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UNIT – III

Bending stress, shear stress in beams: Introduction – Bending stress in beam, Assumptions in pure bending theory, Derivation of Pure bending equation, Modulus of rupture, section modulus, Flexural rigidity, Expression for horizontal shear stress in beam, Shear stress diagram for rectangular, I and T section (Flitched beams not included).	8 Hrs
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UNIT – IV

Deflection of beams: Introduction – Definitions of slope, deflection, Elastic curve-derivation of differential equation of flexure, Sign convention Slope and deflection for standard loading classes using Macaulay's method for prismatic beams and overhanging beams subjected to point loads, UDL and Couple.	8 Hrs
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UNIT – V

Torsion of circular shafts: Introduction – Pure torsion-torsion equation of circular shafts, Strength and stiffness, Torsional rigidity and polar modulus, Power transmitted by shaft of solid and hollow circular sections.	7 Hrs
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Course Outcomes: The students will be able to

1	Understand the concept of simple stress and strain behaviour of different materials.
2	Compute shear force, bending moment and deflection of a beam.
3	Analyze beams for bending stress & shear stress and torsion for circular shaft.

Question paper pattern:

<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub - questions) from each unit. • Each full question will have sub - question covering all the topics under a unit. • The students will have to answer five full questions, selecting one full question from each unit.
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Text Books:

1	Strength of Materials, Subramanyam, Oxford University Press, Edition 2008
2	Mechanics of Materials, B.C Punmia Ashok Jain, Arun Jain, Lakshmi Publications, New Delhi
3	Strength of Materials, Basavarajaiah and Mahadevappa Universities Press (2009).

Reference Books:

1	Strength of Materials, Singer Harper and Row Publications.
2	Elements of Strength of Materials, Timoshenko and Young Affiliated East-West Press.
3	Mechanics of Materials, James M. Gere, Barry J. Goodno (India Edition), Cengage Learning.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	-	✓	-	-	-
CO2	-	✓	-	✓	-	-
CO3	-	-	-	✓	✓	✓

Syllabus for 2022-23 Batch PG (CSE)**Semester: III****Course Title: Project Work Phase – I(Presentation of Synopsis)**

Course Code: 22CSEP34

Credits: 03

Course: PROJ

Hours: 39 Hrs. (L:T:P:S:0:0:6:0)

CIE = 100 Marks

Course Learning Objectives:

1	To improve the professional competency and research aptitude by touching the specific areas which otherwise not covered by theory or laboratory classes.
2	The project work aims to develop the work practice in students to apply theoretical and practical tools / techniques to solve real life problems related to industry/field and current research.

The project work can be analysis and design projects of innovative nature or experimental investigation or numerical simulations or a combination of these. Appropriate software developments with sufficient literature contributions can also be taken up. Each student will be allotted with a faculty as guide. In specific cases student may consult with an external guide with the prior consents of internal guide and head of the department. In this semester, students are expected to finalize appropriate topic of research, complete the required literature survey and objectives of their intended research.

Note:

Phase – I evaluation on the basis of students progress.

Reading Materials

1	Journal Publication.
2	Conference / Seminar Proceedings.
3	Handbooks / Research Digests / Codebooks.

Course Outcomes: The students will be able to

1	Identify and chose appropriate topic of relevance.
2	Critically evaluate literature in chosen area of research & Establish Scope of work.
3	Define Research Problem Statement.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓		✓		✓	✓
CO2		✓	✓	✓		✓
CO3	✓	✓		✓		✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: III	
Course Title: SOCIETAL PROJECT	
Course Code: 22CSES35	CIE = 100 Marks
Credits: 03 Course: SP	
Hours: 39 Hrs. (L:T:P:S:0:0:6:0)	

Course Learning Objectives:

1	To improve the professional competency and research aptitude by touching the specific areas which otherwise not covered by theory or laboratory classes.
2	The project work aims to develop the work practice in students to apply theoretical and practical tools / techniques to solve real life problems related to industry/field and current research.

Students in consultation with the internal guide as well as with external guide (much preferable) shall involve in applying technology to workout/proposing viable solutions for societal problems. CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session. Those, who have not pursued /completed the Societal Project, shall be declared as fail in the course and have to complete the same during subsequent semester/s after satisfying the Societal Project requirements. There is no SEE for this course.

Reading Materials

1	Journal Publication.
2	Conference / Seminar Proceedings.
3	Handbooks / Research Digests / Codebooks.

Course Outcomes: The students will be able to

1	Identify and chose appropriate topic of relevance.
2	Critically evaluate literature in chosen area of research & Establish Scope of work.
3	Define Research Problem Statement.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓		✓		✓	✓
CO2		✓	✓	✓		✓
CO3	✓	✓		✓		✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: III	
Course Title: INTERNSHIP	
Course Code: 22CSEI36	CIE + SEE Marks = 50 + 50
Credits:06 Course: INT	
Hours: 52Hrs (L:T:P:S:0:0:16:0)	SEE Duration: 3 Hrs

Course Learning Objectives:

1	Ability to expose to a particular job and a profession or industry.
2	Explore career alternatives prior to graduation.
3	Develop business skills in communication, technology and team work.

The students are informed to select a suitable company to carry out Internship in their respective field of specialization.

The student shall make a midterm presentation of the activities undertaken during the internship course to the panel comprising Internship Guide, a senior faculty from the department and Head of the Department.

The Department shall facilitate and monitor the student internship program.

***The internship report of each student shall be submitted to the Institute.**

Note:

6 Weeks internship to be completed during the intervening vacation of II & III Semester

Course Outcomes: The students will be able to

1	Develop work culture in groups.
2	Identify and demonstrate work habits for success in real field.
3	Develop network of the various contacts to exhibit work efficiency through presentations, reports, group discussions to the public.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓		✓	✓	✓	✓
CO2			✓		✓	
CO3				✓	✓	✓

Syllabus for 2022-23 Batch PG (CSE)

Semester: IV	
Course Title: EVALUATION OF PROJECT PHASE 2	
Course Code: 22CSEP41	CIE + SEE Marks = 100 + 100 Marks
Credits: 18 Course: PROJ	
Hours: 52 Hrs. (L:T:P:S:0:0:8:0)	SEE Duration: 3 Hrs

Course Learning Objectives:

1	To improve the professional competency and research aptitude by touching the specific areas which otherwise not covered by theory or laboratory classes.
2	The project work aims to develop the work practice in students to apply theoretical and practical tools / techniques to solve real life problems related to industry/field and current research.

Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall continue to work of Project Work phase -1 to complete the Project work. Each student / batch of students shall prepare project document, and present a seminar. CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session. SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.

Reading Materials

1	Journal Publication.
2	Conference / Seminar Proceedings.
3	Handbooks / Research Digests / Codebooks.

Course Outcomes: The students will be able to

1	Critically evaluate literature in chosen area of research & work in accordance to the Scope.
2	Conduct experiments/ design exclusively.
3	Arrive at conclusion and define future scope for work.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓		✓		✓	✓
CO2		✓	✓	✓		✓
CO3	✓	✓		✓		✓