**Dr. Ambedkar Institute of Technology, Bengaluru 56**
**(An autonomous Institute, affiliated to VTU, Belgaum)**
**Department of Civil Engineering –**
**MTech Structural Engineering**
**Syllabus for I Semester M Tech (2017-18)**

| Sub Title : COMPUTATIONAL STRUCTURAL MECHANICS | | |
|---|---|---|
| Sub Code : CSE11 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objective of this course is

19. To make students to learn principles of Structural Analysis.
20. To implement these principles through different methods and to analyse various types of structures.
21. To evaluate the force and displacement parameters of the structures by Flexibility and Stiffness matrix methods.

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Fundamental concepts:**<br>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. | 12 |
| 2 | **Analysis using Flexibility method:**<br>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)<br>Analysis of continuous beams, plane trusses and rigid plane frames by flexibility method (having not more than 3 coordinates – 3x3 flexibility matrix) | 10 |
| 3 | **Analysis using Stiffness Method:**<br>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)<br>Analysis of continuous beams, plane trusses and rigid plane frames by stiffness method (having not more than 3 coordinates – 3x3 stiffness matrix) | 10 |
| 4 | **Effects of temperature change and lack of fit:** | 10 |

| | | |
|---|---|---|
| | Related numerical problems by flexibility and stiffness method as in Chapters 2 and 3. | |
| **5** | **Solution techniques:**<br>Solution techniques including numerical problems for simultaneous equation, Gauss elimination and Cholesky method. Bandwidth consideration. | **10** |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of analysis, design and development of problem solving skills.

CO2: Understand the principles of Structural Analysis

CO3: Design and develop analytical skills and Summarize the Solution techniques

CO4: Understand the concepts of structural behaviour.

| **REFERENCES:** | |
|---|---|
| 1 | S.Rajasekaran, "**Computational Structural Mechanics**", PHI, New Dehi 2001 |
| 2 | F.W.Beaufait et al., "**Computer methods of Structural Analysis**", Prentice Hall, 1970 |
| 3 | W.Weaver and J.H.Gere, "**Matrix Analysis of Framed Structures**", Van Nastran, 1980 |
| 4 | H.Karde Stuncer, "**Elementary Matrix Analysis of Structures**", McGraw Hill 1974 |
| 5 | A.K.Jain "**Advanced Structural Analysis with Computer Application**" Nemchand and Brothers, Roorkee, India |
| 6 | M.F.Rubinstein "**Matrix Computer Methods of Structural Analysis**" Prentice – Hall |
| 7 | Damodhar Maithy "Computational Analysis of Framed Structures" |
| 8 | Martin "Matrix Method of Structural Anlysis" |

| **CO'S** | **Mapping with PO'S** |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3 |
| CO3 | PO1, PO2 |
| CO4 | PO3, PO4, PO6 |

**Syllabus for I Semester M Tech (2017-18)**

| Sub Title : ADVANCED DESIGN OF RCC STRUCTURES | | |
|---|---|---|
| Sub Code : CSE12 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objective of this course is

1. To make students 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 No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | Yield line method of design of slabs. Design of flat Slabs. | 12 |
| 2 | Design of grid floors, Design of Chimneys. | 10 |
| 3 | Design of continuous beams with redistribution of moments | 10 |
| 4 | Design of silos and bunkers. | 10 |
| 5 | Art of detailing earthquake resistant structures. Expansion and contraction joints. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of Structural Design.
CO3: Design and develop analytical skills.
CO4: Summarize the principles of Structural Design and detailing.
CO5: Understands the structural performance.

**REFERENCE BOOKS:**


'17. A Park and Paulay, **"Reinforced Reinforced and Prestressed Concrete"**

18. Lin TY and Burns N H, "**Reinforced Concrete Design**".

19. Kong KF and Evans T H "**Design of Prestressed Concrete Structures**

20. P.C.Varghese, "**Advanced Reinforced Concrete Design**",

Prentice-Hall of India, New Delhi, 2005.

21. Dr.B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, **"Comprehensive RCC Design"**

**22.** Bungey and Mosley **"Reinforced concrete. Palgrave – Macmillan**

**23.** **Pillai and Menon "Reinforced Concrete Design"** McGraw Hill.

24. N. Krishnaraju "Advanced Reinforced Concrete".


| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO2, PO3, PO6 |
| CO3 | PO1, PO3 |
| CO4 | PO3, PO4 |

**Syllabus for I Semester M Tech (2017-18)**

| Sub Title : MECHANICS OF DEFORMABLE BODIES | | |
|---|---|---|
| **Sub Code : CSE13** | **No of Credits:4, : 4:0:0** | **No of lecture hours/week : 04** |
| **Exam Duration : 3 hours** | **CIE+ SEE= 50 + 50 = 100** | **Total Number of contact hours : 52** |

**Course Objectives:** The objective of this course is

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 inter relations of the continuum.

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Theory of Elasticity:** Introduction: Definition of stress and strain and strain at a point, components of stress and strain at appoint of Cartesian and polar co-ordinates. Constitutive relations, equilibrium equations, compatibility equations and boundary conditions in 2-D and 3-D cases. | 12 |
| 2 | Transformation of stress and strain at a point, Principal stresses and principal strains, invariants of stress and strain, hydrostatic and deviatric stress, spherical and deviatoric strains, max. shear strain. | 10 |
| 3 | 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 |
| 4 | Elementary problems of elasticity in three dimensions, stretching of a prismatical 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 |
| 5 | **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 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of stress-strain behaviour of continuum.
CO3: Design and develop analytical skills.
CO4: Describe the continuum in 2 and 3- dimensions.
CO5: Understand the concepts of elasticity and plasticity.

**REFERENCES:**


| | |
|---|---|
| 1 | Timoshenko & Goodier, "**Theory of Elasticity**", McGraw Hill |
| 2 | Srinath L.S., **Advanced Mechanics of Solids**, 10th print, Tata McGraw Hill, Publishing company, New Delhi, 1994 |
| 3 | Sadhu Singh, "**Theory of Elasticity**", Khanna Publishers |
| 4 | Verma P.D.S, "**Theory of Elasticity**", Vikas Publishing Pvt. Ltd |
| 5 | Chenn W.P and Hendry D.J, "**Plasticity for Structural Engineers**", Springer Verlag |
| 6 | Valliappan C, "**Continuum Mechanics Fundamentals**", Oxford IBH Publishing Co. Ltd. |
| 7 | Sadhu Singh, "**Applied Stress Analysis**", Khanna Publishers |
| 8 | Xi Lu, "**Theory of Elasticity**", John Wiley |
| 9 | T.G. Seetharam and L Govindaraju "Applied Elasticity Interline Publishing, 2005 |


| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO2, PO3, PO5 |
| CO3 | PO1, PO3 |
| CO4 | PO1, PO2 |

**Syllabus for I Semester M Tech (2017-18)**

| Sub Title : STRUCTURAL DYNAMICS | | |
|---|---|---|
| **Sub Code : CSE14** | **No of Credits: 4, : 4:0:0** | **No of lecture hours/week : 04** |
| **Exam Duration : 3 hours** | **CIE+ SEE= 50 + 50 = 100** | **Total Number of contact hours : 52** |

**Course Objectives:** The objective of this course is

7. To make students to learn principles of Structural Dynamics.
8. To implement these principles through different methods and to apply the same for free and forced vibration of structures.
9. To evaluate the dynamic characteristics of the structures.

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Introduction:**<br>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. | 12 |
| 2 | Response of Single-degree-of-freedom systems to harmonic loading (rotation unbalance, reciprocating unbalance) including support motion, vibration isolation, transmissibility, Numerical methods applied to a Single-degree-of-Freedom systems-Duhamel integral, principle of vibration-measuring instruments – seismometer and accelerometer. | 10 |
| 3 | **Dynamics of Multi-degree freedom systems:**<br>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. | 10 |
| 4 | 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. | 10 |
| 5 | **Approximate methods:**<br>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 discretised beam in matrix form. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of Structural Dynamics.
CO3: Design and develop analytical skills.
CO4: Summarize the Solution techniques for dynamics of Multi-degree freedom systems.
CO5: Understand the concepts of damping in structures.

**REFERENCE BOOKS:**


21. Mario Paz, "**Structural dynamics – Theory and Computation**", CBS Publishers
22. Biggs, "**Structural Dynamics**", McGraw Hill
23. R.W. Clough & J. Penzien, "**Dynamics of Structures**", McGraw Hill
24. Anil K. Chopra, "**Dynamics of Structures**", Prentice Hall of India
25. Timoshenko, S., "**Vibration Problems in Engineering**", VanNostrand Co.,
26. Mukyopadhyaya, "**Vibration and Structural Dynamics**", Oxford &IBH
27. William Thompson, "**Theory of Vibration with Applications**"
28. William Seto, "**Mechanical Vibrations**", McGraw Hill Pub., (Schaum Series)"
29. Vinod Hosur, "**Earthquake Resistant Design of Building Structures**", WILEY (India)
30. Thompson "**Dynamics of Structures**",


| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3, PO6 |
| CO3 | PO1, PO3 |
| CO4 | PO1, PO2 |
| CO5 | PO1 |

**Syllabus for I Semester M Tech (2017-18)**

| Sub Title : Advanced Design of Pre-stressed Concrete Structures | | |
|---|---|---|
| **Sub Code : CSE151** | **No of Credits: 4, : 4:0:0** | **No of lecture hours/week : 04** |
| **Exam Duration : 3 hours** | **CIE+ SEE= 50 + 50 = 100** | **Total Number of contact hours : 52** |

| **Course Objectives:** The objective of this course is |
|---|
| **7.** Design pre-stressed elements |
| **8.** Understand the behavior of pre-stressed elements |
| **9.** Understand the behavior of pre-stressed sections |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **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. | **12** |
| 2 | **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.<br>**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. | **10** |
| 3 | **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. | **10** |
| 4 | **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. | **10** |
| 5 | **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. | **10** |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.

CO2: Analyze, Design and detail PSC elements.

CO3: Design and develop analytical skills.

CO4: Understand the concept of prestressed and post tensioned concrete.

| **REFERENCES:** | |
|---|---|
| 1 | Krishna Raju, "Prestressed concrete", Tata Mc Graw Hill Book – Co., New Delhi |
| 2 | T.Y. Lin and Burn, "Design of prestress concrete structures", John Wiley, New York |
| 3 | S. Ramamrutham "Prestressed concrete", Dhanpat Rai & Sons, Delhi |

| **CO'S** | **Mapping with PO'S** |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO2, PO3 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |

**Syllabus for I Semester M Tech (2017-18)**

| Sub Title : SPECIAL CONCRETE | | |
|---|---|---|
| **Sub Code : CSE152** | **No of Credits:4, : 4:0:0** | **No of lecture hours/week : 04** |
| **Exam Duration : 3 hours** | **CIE+ SEE= 50 + 50 = 100** | **Total Number of contact hours : 52** |

| **Course Objectives:** The objective of this course is |
|---|
| 22. To make students to learn principles of Concrete mix design.<br>23. To differentiate between different types of concrete.<br>24. To characterize the High Performance concrete. |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Components of modern concrete and developments in the process and constituent materials** :<br>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. | 12 |
| 2 | **Light Weight concrete:**<br>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 | 10 |
| 3 | **Ferro cement:**<br>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. | 10 |
| 4 | **Fibre reinforced concrete:**<br>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. | 10 |
| 5 | **High Performance concrete:**<br>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). | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.

CO2: Understand the principles of Concrete mix design.

CO3: Summarize the Light Weight concrete, Fibre reinforced concrete and High Performance concrete.

CO4: Understand the concepts of high Performance concrete.

| **REFERENCES:** | |
|---|---|
| 1 | Neville A.M, "**Properties of Concrete"** Pearson Education Asis, 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 | Gambhir "Concrete Technology" TMH |
| 5 | Short A and Kinniburgh.W, "**Light Weight Concrete"**- Asia Publishing House, 1963 |
| 6 | Aitcin P.C. **"High performance concrete"**-E and FN, Spon London 1998 |
| 7 | Rixom.R. and Mailvaganam.N., "**Chemical admixtures in concrete"**- E and FN, Spon London 1999 |
| 8 | Rudnai. G, "**Light Wiehgt concrete"**- Akademiaikiado, Budapest, 1963 |
| 9 | M.S. Shetty "Concrete Technology" |
| 10 | http://qcin.org/CAS//RMCPC/, IS: 10262-2009, IS: 456- 2000 |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO4 |
| CO2 | PO1, PO4, PO6 |
| CO3 | PO1, PO3 |
| CO4 | PO1, PO3 |

**Syllabus for I Semester M Tech (2017-18)**

| Sub Title : DESIGN OF PRECAST AND COMPOSITE STRUCTURES | | |
|---|---|---|
| **Sub Code : CSE153** | **No of Credits:4, : 4:0:0** | **No of lecture hours/week : 04** |
| **Exam Duration : 3 hours** | **CIE+ SEE= 50 + 50 = 100** | **Total Number of contact hours : 52** |

| **Course Objectives:** This course will enable students to |
|---|
| 25. Select or design precast elements suitable for project specific requirements.<br>26. Design precast systems to ensure integrity and safety of the structure and to avoid progressive collapse.<br>27. Design composite floors and beam elements. |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Concepts, components, Structural Systems and Design of precast concrete floors**<br>Need Andtypes of precast construction, Modular coordination, Precast elements- Floor, Beams, Columns and walls. Structural Systems and connections.<br>**Design of precast Concrete Floors:** Theoretical and Design Examples of Hollow core slabs. Precast Concrete Planks, floor with composite toppings with and without props. | 12 |
| 2 | **Design of precast reinforced and prestressed Concrete beams:** Theoretical and Design Examples of ITB, Full section precast, Semi Precast, propped and unpropped conditions. Design of RC Nibs | 10 |
| 3 | **Design of precast concrete columns and walls** Design of braced and unbraced columns with corbels subjected to pattern and full loading. Design of Corbels Design of RC walls subjected to Vertical, Horizontal loads and moments, Design of vertical ties and horizontal joints. | 10 |
| 4 | **Design of Precast Connections and Structural Integrity**<br>Beam bearing, Beam half Joint, Steel Inserts, Socket Connection, Structural integrity, Avoidance of progressive collapse, Design of Structural Ties. | 10 |
| 5 | **Design of Steel Concrete Composite Floors and Beams Composite Floors:** Profiled Sheeting with concrete topping, Design method, Bending and Shear Resistance of Composite Slabs, Serviceability Criteria, Design Example.<br>**Composite Beams:** Elastic Behaviour, Ultimate Load behavior of Composite beams, Stresses and deflection in service and vibration, Design Example of Simply Supported beams. | 10 |

**Course Outcomes: On completion of the course, students are able to**

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of Precast and Composite Structures.
CO3: Design and develop analytical skills.
CO4: Understand the concept of precast construction

| REFERENCES: | |
|---|---|
| 1 | Hass A.M. – Precast Concrete – Design and applications Applied Science, 1983 |
| 2 | David Sheppard – "Plant cast, Precast and Prestressed concrete – McGraw Hill; 1989 |
| 3 | NBC – 2005 ( Part I to Part VII) BIS Publications, New Delhi, IS 15916-2011, IS 11447, IS 6061 – I and III |
| 4 | R.P.Johnson: Composite Structure of Steel and Concrete (Volume 1), Blackwell Scientific Publication (Second Edition), U.K., 1994 |
| 5 | IS: 11384-1985, Code of Practice for Composite Construction in Structural Steel and Concrete |
| 6 | INSDAG Teaching Resource Chapter 21 to 27: www.steel-insdag.org |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3, PO6 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |

**Syllabus for I Semester M Tech (2017-18)**

| Sub Title : RELIABILITY ANALYSIS OF STRUCTURES | | |
|---|---|---|
| Sub Code : CSE154 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** This course will enable students to

7. To make students to learn principles of reliability.
8. To implement the Probability Concepts for the Reliability Analysis.
9. To evaluate different methods of reliability analysis.

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **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 $y = ab$, and parabola, Coefficient of correlation | 12 |
| 2 | **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. | 10 |
| 3 | **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. | 10 |
| 4 | **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). | 10 |
| 5 | **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 | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of reliability.
CO3: Design and develop analytical skills.
CO4: Summarize the Probability distributions.
CO5: Understands the concept of System reliability

| **REFERENCES:** | |
|---|---|
| 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 |
| 5 | Nathabdndu, T., Kottegoda, and Renzo Rosso (1998). Statistics, "Probability and reliability for Civil and Environmental Engineers"- Mc Graw Hill international edition, Singapore |
| 6 | Achintya Haldar and Sankaran Mahadevan (2000). "Probability, Reliability and Statistical methods in Engineering design"- John Wiley and Sons. Inc. |
| 7 | Thoft-christensen, P., and Baker, M., J., (1982), "Structural reliability theory and its applications"- Springer-Verlag, Berlin, NewYork |
| 8 | Thoft-christensen, P., and Murotsu, Y. (1986). "Application of structural systems reliability theory"- Springer-Verlag, Berlin, NewYork |
| 9 | Srinath, "Reliability analysis of structures" |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO2, PO3, PO6 |
| CO3 | PO1,PO3, |
| CO4 | PO1, PO2, PO5 |
| CO5 | PO1 |

**Syllabus for I Semester M Tech (2017-18)**

| Sub Title : STRUCTURAL ENGINEERING LAB-1 | | |
|---|---|---|
| Sub Code : CSE16 | No of Credits:2, : 0:0:2 | No of lecture hours/week : 03 |
| Exam Duration : 3 hours | CIE+ SEE= 25 + 50 = 75 | Total Number of contact hours : 39 |

**Course Objectives:** The objectives of this course is

7. To make students to learn principles of design of experiments,
8. To investigate the performance of structural elements.
9. To evaluate the different testing methods and equipments.

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | Testing of beams for deflection, flexure and shear | 12 |
| 2 | Experiments on Concrete, including Mix design | 9 |
| 3 | Experiments on vibration of multi storey frame models for Natural frequency and modes. | 9 |
| 4 | Use of Non destructive testing (NDT) equipments – Rebound hammer, Ultra sonic pulse velocity meter and Profometer | 9 |

**References**: NPTL.Com, IISc, Code Books. IS: 456-2000, IS: 10262-2009

**Course Outcomes: On completion of the course, students are able to**

CO1: Achieve Knowledge of design and development of experimenting skills.
CO2: Understand the principles of design of experiments
CO3: Design and develop analytical skills.
CO4: Summarize the testing methods and equipments.

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO2, PO3, PO4 |
| CO2 | PO3, PO6 |
| CO3 | PO1, PO2, PO3 |
| CO4 | PO5 |

**Syllabus for I Semester M Tech (2017-18)**

| Sub Title : Mini Project Work | | |
|---|---|---|
| **Sub Code : CSE18** | **No of Credits:2, : 0:0:2** | **No of lecture hours/week : 04** |
| **Project Viva-Voce : 3 hours** | **CIE+ SEE= 25 + 50 = 75** | **Total Number of contact hours : 52** |

**Course Objectives**: The objectives of this course is

7. To make students to learn principles of Structural Analysis,
8. To analyse various types of structures.
9. To evaluate the force and displacement parameters of the structures.

| Syllabus | Reamrks |
|---|---|
| 29. Analysis and Design of Multi-storied frames,<br>30. Analysis and Design of Residential Building frames,<br>31. Smart Buildings and Construction<br>32. Analysis and Design of RCC / PSC / Steel Bridges,<br>33. Analysis and Design of Chimneys,<br>34. Analysis and Design of Tall Structures,<br>35. Analysis and Design of Suspension Bridges.<br>36. Analysis and Design of Silos and Bunkers.<br>37. Analysis and Design of raft / Pile foundation.<br>38. Analysis and Design of flat slab Structures.<br>39. Experimental investigation on engineering materials.<br>40. Experimental investigation on Special concrete.<br>41. Design of form work for high rise buildings.<br>42. Any other projects related to Structural Engineering in consultation with the Project Guide. | Students are advised to take any one of the topic |

**Course Outcomes: On completion of the course, students are able to**

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of Structural Analysis and concepts of structural behaviour.
CO3: Design and develop analytical skills and Summarize the Solution techniques.
CO4: Understand the material behaviour and Learn the Presentation skills.

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO2, PO3, PO6 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |

**Department of Civil Engineering – MTech Structural Engineering**
**Syllabus for II Semester M Tech (2017-18)**

| Sub Title : DESIGN OF PLATES AND SHELLS | | |
|---|---|---|
| **Sub Code : CSE21** | **No of Credits:4, : 4:0:0** | **No of lecture hours/week : 04** |
| **Exam Duration : 3 hours** | **CIE+ SEE= 50 + 50 = 100** | **Total Number of contact hours : 52** |

**Course Objectives:** The objectives of this course is to make students to learn:

7. Different methods of analysis and design of plates and shells.
8. To critically detail the plates, folded plates and shells.
9. To evaluate the performance of spatial structures.

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | 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. | 12 |
| 2 | Energy methods for rectangular and circular plates with clamped edges subjected to Symmetric loadings | 10 |
| 3 | Introduction to Curved surfaces and classification of shells, Membrane theory of spherical shells, cylindrical shells, hyperbolic paraboloids, elliptic paraboloid and conoids | 10 |
| 4 | 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. | 10 |
| 5 | Design and detailing of folded plates with numerical examples Design and Detailing of simple shell problems – spherical domes, water tanks, barrel vaults and hyperbolic paraboloid roofs | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of Analysis and Design.
CO3: Design and develop analytical skills.
CO4: Summarize the performance of shells Understand the concepts of energy principle.

| REFERENCES: | |
|---|---|
| 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 |
| 4 | R. Szilard, **"Theory and analysis of plates - classical and numerical methods"**, Prentice Hall,1994 |
| 5 | Chatterjee.B.K. – **"Theory and Design of Concrete Shell"**, – Chapman & Hall, Newyork-third edition, 1988 |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1,PO2, PO3, PO6 |
| CO3 | PO1,PO2, PO3 |
| CO4 | PO1 |

**Syllabus for II Semester M Tech (2017-18)**

| Sub Title : EARTHQUAKE RESISTANT STRUCTURES | | |
|---|---|---|
| Sub Code : CSE22 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

| **Course Objectives:** The objectives of this course is: |
|---|
| 7. To make students to learn principles of engineering seismology. |
| 8. To design the reinforced concrete buildings for earthquake resistance. |
| 9. To evaluate the seismic response of the structures. |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | 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 devises, base isolation systems. | 12 |
| 2 | 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- storeyed buildings – using procedures (Equivalent lateral force and dynamic analysis) as per IS-1893. | 10 |
| 3 | 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 |
| 4 | 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 |
| 5 | 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 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.

CO2: Understand the principles of engineering seismology.

CO3: Design and develop analytical skills.

CO4: Summarize the Seismic evaluation and retrofitting of structures.

CO5: Understand the concepts of earthquake resistance of reinforced concrete buildings

**REFERENCES:**


| | |
|---|---|
| 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 | Pankaj Agarwal, **Earthquake Resistant Design of Structures – Manish Shrikande - PHI India** |
| 5 | **IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS - 13828: 1993** |
| 6 | Minoru Wakabayashi, **Design of Earthquake Resistant Buildings, McGraw Hill Pub.** |
| 7 | T Paulay and M J N Priestley, **Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley and Sons** |


| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3, PO5 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |
| CO5 | PO1 |

**Syllabus for II Semester M Tech (2017-18)**

| Sub Title : FINITE ELEMENT METHOD OF ANALYSIS | | |
|---|---|---|
| **Sub Code : CSE23** | **No of Credits:4, : 4:0:0** | **No of lecture hours/week : 04** |
| **Exam Duration : 3 hours** | **CIE+ SEE= 50 + 50 = 100** | **Total Number of contact hours : 52** |

**Course Objectives:** The objectives of this course is:

7. To make students to learn principles of Analysis of Stress and Strain.
8. To apply the Finite Element Method for the analysis of one and two dimensional problems.
9. To evaluate the stress and strain parameters and their inter relations of the continuum.

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | Basic concepts of elasticity – Kinematic and Static variables for various types of structural problems – approximate method 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 & disadvantages – Finite element procedure. Finite elements used for one, two & three dimensional problems – Element aspect ratio – mesh refinement vs. higher order elements – Numbering of nodes to minimize band width. | 12 |
| 2 | 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. | 10 |
| 3 | 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 | 10 |
| 4 | Application of Finite Element Method for the analysis of one & two dimensional problems - Analysis of simple beams and plane trusses – Application to plane stress / strain / axisymmetric problems using CST & Quadrilateral Elements | 10 |
| 5 | Application to Plates & Shells- Choice of displacement function (C , C and C type) – Techniques for Non – linear Analysis | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of stress-strain behaviour of continuum.
CO3: Design and develop analytical skills.
CO4: Describe the state of stress in a continuum.
CO5: Understand the concepts of elasticity and plasticity.

**REFERENCES:**


| | |
|---|---|
| 1 | Krishnamoorthy C S, "**Finite Element Analysis**"- Tata McGraw Hill |
| 2 | Desai C and Abel J F, "**Introduction to the Finite Element Method**"- East West Press Pvt. Ltd., 1972 |
| 3 | Bathe K J, "**Finite Element Procedures in Engineering Analysis**"- Prentice Hall |
| 4 | Rajasekaran. S, "**Finite Element Analysis in Engineering Design**"-Wheeler N Publishing |
| 5 | Cook R D. Malkan D S & Plesta M.E, "**Concepts and Application of Finite Element Analysis**" - 3rd Edition, John Wiley and Sons Inc., 1989 |
| 6 | Shames I H and Dym C J, **"Energy and Finite Element Methods in Structural Mechanics"** – McGraw Hill, New York. |


| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO2, PO4 |
| CO2 | PO1, PO5 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |
| CO5 | PO1 |

**Syllabus for II Semester M Tech (2017-18)**

| Sub Title : DESIGN CONCEPTS OF SUBSTRUCTURES | | |
|---|---|---|
| Sub Code : CSE24 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objectives of this course is:

7. To make students to learn principles of subsoil exploration.
8. To design the sub structures.
9. To evaluate the soil shear strength parameters.

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | Introduction, Site investigation, In-situ testing of soils, Subsoil exploration, classification of foundations systems. General requirement of foundations, Selection of foundations, Computations of Loads, Design concepts. | 12 |
| 2 | Concept of soil shear strength parameters, Settlement analysis of footings, Shallow foundations in clay, Shallow foundation in sand & C-Φ soils, Footings on layered soils and sloping ground, Design for Eccentric or Moment Loads | 10 |
| 3 | Types of rafts, bearing capacity & settlements of raft foundation, Rigid methods, Flexible methods, soil-structure interaction, different methods of modeling the soil. Combined footings (rectangular & trapezoidal), strap footings & wall footings, Raft – super structure interaction effects & general concepts of structural design, Basement slabs. | 10 |
| 4 | Deep Foundations: Load Transfer in Deep Foundations, Types of Deep Foundations, Ultimate bearing capacity of different types of piles in different soil conditions, Laterally loaded piles, tension piles & batter piles, Pile groups: Bearing capacity, settlement, uplift capacity, load distribution between piles, Proportioning and design concepts of piles. | 10 |
| 5 | Types of caissons, Analysis of well foundations, Design principles, Well construction and sinking. Foundations for tower structures: Introduction, Forces on tower foundations, Selection of foundation type, Stability and design considerations, Ring foundations – general concepts. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of subsoil exploration.
CO3: Design and develop analytical skills.
CO4: Identify and evaluate the soil shear strength parameters.
CO5: Understand the concepts of Settlement analysis.

| REFERENCES: | |
|---|---|
| 1 | Swami Saran – **"Analysis & Design of Substructures"**- Oxford & IBH Pub. Co. Pvt. Ltd. , 1998 |
| 2 | Nainan P Kurian – **"Design of Foundation Systems"**- Narosa Publishing House, 1992 |
| 3 | R.B. Peck, W.E. Hanson & T.H. Thornburn – **"Foundation Engineering"-** Wiley Eastern Ltd.,Second Edition, 1984 |
| 4 | J.E. Bowles – **"Foundation Analysis and Design"**- McGraw-Hill Int. Editions, Fifth Ed., 1996 |
| 5 | W.C. Teng – **"Foundation Design"-** Prentice Hall of India Pvt. Ltd., 1983 |
| 6 | Bureau of Indian Standards:IS-1498, IS-1892, IS-1904, IS-6403, IS-8009, IS-2950, IS-11089, IS-11233, IS-2911 and all other relevant codes |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO2, PO3, PO5 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |
| CO5 | PO1 |

**Syllabus for II Semester M Tech (2017-18)**

| Sub Title : DESIGN OF TALL STRUCTURES | | |
|---|---|---|
| Sub Code : CSE251 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objectives of this course is:

7. To make students to learn principles of stability of tall buildings.
8. To design the tall buildings for earthquake and wind resistance.
9. To evaluate the performance of tall structures for strength and stability.

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Design Criteria:** Design philosophy, loading, sequential loading, and materials–high performance concrete, fiber reinforced concrete, lightweight concrete, design mixes. Loading and Movement: Gravity loading: Dead and live load, methods of live load reduction, Impact, Gravity loading, Construction loads. | 12 |
| 2 | **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. | 10 |
| 3 | **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, Futigger – braced and hybrid mega system. | 10 |
| 4 | **Analysis and Design:** Modeling for approximate analysis, accurate analysis and reduction techniques, analysis of building as total structural system considering overall integrity and major subsystem interaction, analysis for member forces; drift and twist, computerized general three dimensional analyses. | 10 |
| 5 | **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 in stability, effect of foundation rotation. Structural elements: sectional shapes, properties and resisting capacities, design, deflection, cracking, pre-stressing, shear flow. Design for differential movement, creep and shrinkage effects, temperature effects and fire. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of strength and stability.
CO3: Design and develop analytical skills.
CO4: Summarize the behavior of various structural systems.
CO5: Understand the concepts of P-Delta analysis.


| REFERENCES: | |
|---|---|
| 1 | Taranath B.S, **"Structural Analysis and Design of Tall Buildings"**- McGraw Hill |
| 2 | Wilf gang Schuller, **"High rise building structures"**- John Wiley |
| 3 | Bryan Stafford Smith & Alexcoull, **"Tall building structures Analysis and Design"**-John Wiley |
| 4 | T.Y Lin & D.Stotes Burry, **"Structural concepts and system for Architects and Engineers"-** John Wiley |
| 5 | Lynn S.Beedle, **"Advances in Tall Buildings"**- CBS Publishers and Distributors |
| 6 | 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'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3, PO5 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |
| CO5 | PO1 |

| Sub Title : REPAIR AND REHABILITATION OF STRUCTURES | | |
|---|---|---|
| Sub Code : CSE252 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

| **Course Objectives:** The objectives of this course is: |
|---|
| 7. To make students to investigate the cause of deterioration of concrete structures.<br>8. To strategise different repair and rehabilitation of structures.<br>9. To evaluate the performance of the materials for repair. |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **General:**<br>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. | 12 |
| 2 | **Influence on Serviceability and Durability**:<br>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. | 10 |
| 3 | **Maintenance and Repair Strategies:**<br>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. | 10 |
| 4 | **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.<br>**Techniques for Repair**: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning. | 10 |
| 5 | **Examples of Repair to Structures:**<br>Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure, engineered demolition techniques for dilapidated structures - case studies. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the cause of deterioration of concrete structures.
CO3: Design and develop analytical skills.
CO4: Summarize the principles of repair and rehabilitation of structures.
CO5: Understand the concept of Serviceability and Durability.

**REFERENCES:**


| | |
|---|---|
| 1 | Sidney, M. Johnson **"Deterioration, Maintenance and Repair of Structures"**. |
| 2 | Denison Campbell, Allen & Harold Roper, **"Concrete Structures – Materials, Maintenance and Repair"-** Longman cientific and Technical |
| 3 | R.T.Allen and S.C. Edwards, **"Repair of Concrete Structures"**-Blakie and Sons |
| 4 | Raiker R.N., **"Learning for failure from Deficiencies in Design, Construction and Service"**- R&D Center (SDCPL) |


| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO2, PO5 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |
| CO5 | PO1 |

Syllabus for II Semester M Tech (2017-18)

| Sub Title : STABILITY ANALYSIS OF STRUCTURES | | |
|---|---|---|
| Sub Code : CSE253 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objectives of this course is:

7. To make students to learn principles of stability of structures.
8. To analyse the structural elements for stability.
9. To evaluate the use of strain energy in plate bending and stability.

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Beam – Column**<br>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 pined – pined, fixed – fixed, fixed – free and fixed – pinned column. | 12 |
| 2 | **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.<br>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. | 10 |
| 3 | **Stability analysis by finite element approach**<br>Deviation of shape function for a two nodded Bernoulli – Euler beam element (lateral and translation of) –element stiffness and element geometric stiffness matrices – assembled stiffness and geometric stiffness matrices for discretized 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. | 10 |
| 4 | **Lateral buckling of beams**<br>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. | 10 |
| 5 | **Expression for strain energy in plate bending with in plate forces (linear and non– linear).**<br>**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. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of strength and stability.
CO3: Design and develop analytical skills.
CO4: Appraise the Stability analysis by finite element approach.
CO5: Understand the concepts of Lateral buckling of beams.

| REFERENCES: | |
|---|---|
| 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 |
| 5 | H.Zeiglar, **"Principles of Structural Stability"**-Blaisdall Publications |
| 6 | Manica Selvam "Stability Analysis of Structures" |
| 7 | Chajes "Stability of Structures" |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3, PO4 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |
| CO5 | PO2 |

**Syllabus for II Semester M Tech (2017-18)**

| Sub Title : ADVANCED DESIGN OF STEEL STRUCTURES | | |
|---|---|---|
| Sub Code : CSE254 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objectives of this course is:

7. Understand the background to the design provisions for hot-rolled and cold-formed steel structures, including the main differences between them.
8. Proficiency in applying the provisions for design of columns, beams, beam-columns
9. Design structural sections for adequate fire resistance

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **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. | 12 |
| 2 | **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 | 10 |
| 3 | **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) | 10 |
| 4 | **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. | 10 |
| 5 | **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. | 10 |

**Syllabus for II Semester M Tech (2017-18)**

| Sub Title : STRUCTURAL ENGINEERING LAB-2 | | |
|---|---|---|
| Sub Code : CSEL26 | No of Credits: 2, : 0:0:2 | No of lecture hours/week : 03 |
| Exam Duration : 3 hours | CIE+ SEE= 25 + 50 = 75 | Total Number of contact hours : 39 |

**Course Objectives:** The objectives of this course is:

5. To make students to learn the soft wares for structural analysis and design.
6. To investigate the performance of structures for static and dynamic forces

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | Static and Dynamic analysis of Building structure using software (ETABS / STAAD Pro. / ANSYS /NISA) | 12 |
| 2 | Design of RCC and Steel structure using software (ETABS / STAAD Pro.) | 9 |
| 3 | Analysis of folded plates and shells using software. | 9 |
| 4 | Preparation of EXCEL sheets for structural design | 9 |

**REFERENCES:**

- ANSYS Manual
- STAAD PRO. Manual

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of programming skills.
CO2: Understand the principles of structural analysis and design.
CO3: Design and develop analytical skills.

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO2, PO3, PO4 |
| CO2 | PO3, PO6 |
| CO3 | PO1, PO2, PO3 |
| CO4 | PO1, PO3 |

**Syllabus for II Semester M Tech (2017-18)**

| Sub Title : STRUCTURAL ENGINEERING LAB-2 | | |
|---|---|---|
| **Sub Code : CSEL26** | **No of Credits: 2, : 0:0:2** | **No of lecture hours/week : 03** |
| **Exam Duration : 3 hours** | **CIE+ SEE= 25 + 50 = 75** | **Total Number of contact hours : 39** |

**Course Objectives:** The objectives of this course is:

5. To make students to learn the soft wares for structural analysis and design.
6. To investigate the performance of structures for static and dynamic forces

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | Static and Dynamic analysis of Building structure using software (ETABS / STAAD Pro. / ANSYS /NISA) | 12 |
| 2 | Design of RCC and Steel structure using software (ETABS / STAAD Pro.) | 9 |
| 3 | Analysis of folded plates and shells using software. | 9 |
| 4 | Preparation of EXCEL sheets for structural design | 9 |

**REFERENCES:**

- ANSYS Manual
- STAAD PRO. Manual

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of programming skills.
CO2: Understand the principles of structural analysis and design.
CO3: Design and develop analytical skills.

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO2, PO3, PO4 |
| CO2 | PO3, PO6 |
| CO3 | PO1, PO2, PO3 |
| CO4 | PO1, PO3 |

**Department of Civil Engineering - Structural Engineering**

**Syllabus for II Semester M Tech (2017-18)**

| Sub Title : RESEARCH METHODOLOGY | | |
|---|---|---|
| **Sub Code : CSE27/RM27** | **No of Credits: 2, : 2:0:0** | **No of lecture hours/week : 02** |
| **Exam Duration : 3 hours** | **CIE+ SEE= 50 + 50 = 100** | **Total Number of contact hours : 26** |

| **Course Objectives:** The objectives of this course is: |
|---|
| 9. Have a basic understanding of the underlying principles of quantitative and qualitative research |
| 10. Identify the overall process of designing a research study from its inception to its report. |
| 11. Choose the most appropriate research method to address a particular research question |
| 12. Gain a overview of a range of quantitative and qualitative approaches to data analysis |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Unit – I, Overview of Research**<br>Research and its types, identifying and defining research problem and introduction to different research designs. Essential constituents of Literature Review. Basic principles of experimental design, Primary data and Secondary Data, methods of primary data collection, classification of secondary data, designing questionnaires and schedules. | 8 |
| 2 | **Unit – II, Sampling Methods**<br>Probability sampling: simple random sampling, systematic sampling, stratified sampling, cluster sampling and multistage sampling. Non-probability sampling: convenience sampling, judgment sampling, quota sampling. Sampling distributions | 6 |
| 3 | **Unit – III, Processing and analysis of Data**<br>Statistical measures and their significance: Central tendencies, variation, skewness, Kurtosis, time series analysis, correlation and regression, Testing of Hypotheses: Parametric (t and Chi Square). | 6 |
| 4 | **Unit-IV,**<br>**Essential of Report writing and Ethical issues**:<br>Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Ethical issues related to Research, Plagiarism and self-Plagiarism, Publishing. | 6 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Describe a range of quantitative and qualitative research designs and identify the advantages and disadvantages associated with these designs.

CO2: Choose appropriate quantitative or qualitative method to collect data.

CO3: Analyze and test the given data using appropriate methods.

CO4: Design an appropriate mixed-method research study to answer a research question.

| **REFERENCES:** | |
|---|---|
| 1 | Krishnaswami, K.N., Sivakumar, A. I. and Mathirajan, M., Management Research Methodology, Pearson Education: New Delhi. |
| 2 | Kothari C.R., Research Methodology Methods and techniques by, New Age International Publishers, 2nd edition |
| 3 | Levin, R.I. and Rubin, D.S., Statistics for Management, 7th Edition, Pearson Education: New Delhi. |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4, PO5 |
| CO2 | PO4, PO5 |
| CO3 | PO1, PO2, PO3 |
| CO4 | PO1, PO2 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Explain the Bridge substructures and superstructures.
CO3: Design and develop analytical skills.
CO4: Summarize the principles of design and detailing of bridges.
CO5: Understands the design and construction of different types of bridges.

| REFERENCES: | |
|---|---|
| 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 |
| 8 | Raina V.K., **"Concrete Bridge Practice"**- Tata McGraw Hill |
| 9 | Bakht B & Jaeggar, **"Bridge Analysis Simplified"**- McGraw Hill |
| 10 | Ponnuswamy. S, **"Bridge Engineering"**- Tata McGraw Hill |
| 11 | Derrick Beckett, **"An Introduction to Structural Design of Concrete Bridges"**-Surrey University Press |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO4, PO5 |
| CO3 | PO1,PO3 |
| CO4 | PO1, PO2 |
| CO5 | PO1 |

**Syllabus for IV Semester M Tech (2017-18)**

| Sub Title : OPTIMIZATION TECHNIQUES | | |
|---|---|---|
| Sub Code : CSE421 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

| **Course Objectives:** The objectives of this course is: |
|---|
| 7. To make students to learn principles of optimization.<br>8. To implement the optimization Concepts for the structural engineering problems<br>9. To evaluate by different methods of optimization |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **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 andbalgorithms constrained optimization solutions by penalty function techniques, Lagrange multipliers techniques and feasibility techniques. | 12 |
| 2 | **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. | 10 |
| 3 | **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. | 10 |
| 4 | 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. | 10 |
| 5 | **Geometric programming:** Geometric programming, conversion of NLP as a sequence of LP/ geometric programming.<br>**Dynamic programming:** Dynamic programming conversion of NLP as a sequence of LP/ Dynamic programming. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.

CO2: Understand the principles of optimization.

CO3: Design and develop analytical skills.

CO4: Summarize the Linear, Non-linear and Geometric Programming.

CO5: Understands the concept of Dynamic programming.

| REFERENCES: | |
|---|---|
| 1 | Spunt, "**Optimum Structural Design**"- Prentice Hall |
| 2 | S.S. Rao, "**Optimization – Theory and Practice**"- Wiley Eastern Ltd. |
| 3 | Uri Krisch, "**Optimum Structural Design**"- McGraw Hill |
| 4 | Richard Bronson, "**Operation Research**"- Schaum's Outline Series |
| 5 | Bhavikatti S.S "**Structural optimization using sequential linear programming"-** Vikas publishing house |
| 6 | NPTL: Related to Optimization |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO2, PO3, PO5 |
| CO3 | PO1, PO3 |
| CO4 | PO2 |
| CO5 | PO1, PO2 |

**Syllabus for IV Semester M Tech (2017-18)**

| Sub Title : DESIGN OF INDUSTRIAL STRUCTURES | | |
|---|---|---|
| **Sub Code : CSE422** | **No of Credits: 4, : 4:0:0** | **No of lecture hours/week : 04** |
| **Exam Duration : 3 hours** | **CIE+ SEE= 50 + 50 = 100** | **Total Number of contact hours : 52** |

**Course Objectives:** The objectives of this course is:

7. To make students to learn principles of Design of industrial building.
8. To design different components of industrial structures and to detail the structures
9. To evaluate the performance of the Pre- engineered buildings

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | Analysis of industrial building for Gravity and Wind load. Analysis and design of framing components namely, girders, trusses, gable frames | 12 |
| 2 | Analysis and design of gantry column (stepped column / column With bracket), purlins, girts, bracings including all connections. | 10 |
| 3 | Analysis of transmission line towers for wind load and design of towers including all connections. | 10 |
| 4 | Forms of light guage sections, Effective width computation of unstiffened, stiffened, multiple stiffened compression elements of cold formed light guage sections. Concept of local buckling of thin elements. Limiting width to thickness ratio. Post buckling strength. | 10 |
| 5 | Concept of Pre- engineered buildings, Design of compression and tension members of cold formed light guage sections, Design of flexural members (Laterally restrained / laterally unrestrained). | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the industrial building and the components.
CO3: Design and develop analytical skills.
CO4: Summarize the principles of Structural Design and detailing.
CO5: Understands the concept of Pre- engineered buildings.

| REFERENCES: | |
|---|---|
| 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 |
| 4 | Ramchandra and Virendra Gehlot " Design of Steel Structures " Vol 1 and |
| 5 | Duggal "Limit State of Design of Steel Structures" TMH |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3 |
| CO3 | PO1, PO3, PO5 |
| CO4 | PO1 |
| CO5 | PO1 |

**Syllabus for IV Semester M Tech (2017-18)**

| Sub Title : THEORY OF PLASTICITY AND FRACTURE MECHANICS | | |
|---|---|---|
| Sub Code : CSE423 | No of Credits: 4 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE + SEE = 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objectives of this course is

7. To compute the stress intensity factor, strain energy release rate, and the stress and strain fields around a crack tip for linear and non linear materials
8. Know experimental methods to determine the fracture toughness
9. Use the design principle of materials and structures using fracture mechanics approaches

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Plasticity**<br>General concept, yield criteria, flow rules for perfectly plastic and strain hardening materials -simple applications, Theories of failure. Plasticity models for concrete | 12 |
| 2 | **Linear Elastic Fracture mechanics**<br>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. | 10 |
| 3 | **Elasto-plastic fracture mechanics**<br>Crack-tip plasticity in metals. Mixed mode problems and evaluation of critical fracture parameters | 10 |
| 4 | **Fatigue damage theories.**<br>Fatigue test, endurance limit, fatigue fracture under combined loading, fatigue controlling factors, cumulative fatigue damage concepts. | 10 |
| 5 | **Fracture of Concrete**<br>Review of concrete behaviour in tension and compression, Basic frameworks for modeling of quasi-brittle materials, discrete crack concept/Smeared crack concept. FE Concepts and applications. | 10 |

Syllabus for IV Semester M Tech (2017-18)

| Sub Title : THEORY OF PLASTICITY AND FRACTURE MECHANICS | | |
|---|---|---|
| Sub Code : CSE423 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

| **Course Objectives:** The objectives of this course is: |
|---|
| 7. To compute the stress intensity factor, strain energy release rate, and the stress and strain fields around a crack tip for linear and non linear materials.<br>8. Know experimental methods to determine the fracture toughness.<br>9. Use the design principle of materials and structures using fracture mechanics approaches |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Plasticity**<br>General concept, yield criteria, flow rules for perfectly plastic and strain hardening materials -simple applications, Theories of failure. Plasticity models for concrete | 12 |
| 2 | **Linear Elastic Fracture mechanics**<br>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. | 10 |
| 3 | **Elasto-plastic fracture mechanics**<br>Crack-tip plasticity in metals. Mixed mode problems and evaluation of critical fracture parameters | 10 |
| 4 | **Fatigue damage theories,**<br>Fatigue test, endurance limit, fatigue fracture under combined loading, fatigue controlling factors, cumulative fatigue damage concepts. | 10 |
| 5 | **Fracture of Concrete**<br>Review of concrete behaviour in tension and compression, Basic frameworks for modeling of quasi-brittle materials, discrete crack concept/Smeared crack concept. FE Concepts and applications. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Explain and apply yield criteria & flow-rules.

CO2: Design of structures using fracture mechanics approaches.

CO3: Apply principles of fracture mechanics.

CO4: Solve problems related to plastic fracture mechanics.

| REFERENCES: | |
|---|---|
| 1 | Valliappan S. "Continuum Mechanics Fundamentals" (1982), Oxford IBH, N D. New Delhi |
| 2 | Broek, D., "Elementary Engineering Fracture Mechanics", 4th edition , Martinus Nijhoff (1987) |
| 3 | Venkataramanand Patel "Structural Mechanics with introduction to Elasticity and Plasticity" – McGraw Hill, 1990 |
| 4 | T. L. Anderson, Fracture Mechanics- Fundamentals and Applications, New Delhi |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO2 |
| CO2 | PO2, PO3 |
| CO3 | PO2, PO3, PO5 |
| CO4 | PO1 |

**Syllabus for IV Semester M Tech (2017-18)**

| Sub Title : MASONRY STRUCTURES | | |
|---|---|---|
| Sub Code : CSE424 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

| **Course Objectives:** The objectives of this course is: |
|---|
| 7. To make students to learn performance of masonry structures.<br>8. To design the masonry structures for earthquake resistance.<br>9. To evaluate the strength and stability of the masonry structures |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **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. | 12 |
| 2 | **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, influence of masonry bonding patterns on 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. | 10 |
| 3 | **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, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength. | 10 |
| 4 | **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. | 10 |
| 5 | **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. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of design and construction of masonry structures
CO3: Design and develop analytical skills.
CO4: Summarize the masonry Characteristics.
CO5: Evaluate the strength and stability of the masonry structures

| REFERENCES: | |
|---|---|
| 1 | Hendry A.W., **"Structural masonry"**- Macmillan Education Ltd., 2nd editi on |
| 2 | Sinha B.P & Davis S.R., "**Design of Masonry structures**"- E & FN Spon |
| 3 | Dayaratnam P, "**Brick and Reinforced Brick Structures**"- Oxford & IBH |
| 4 | Curtin, "**Design of Reinforced and Pre-stressed Masonry**"- Thomas Telford |
| 5 | Sven Sahlin, "**Structural Masonry**"-Prentice Hall |
| 6 | Jagadish K S, Venkatarama Reddy B V and Nanjunda Rao K S, "**Alternative Building Materials and Technologies**"- New Age International, New Delhi & Bengaluru |
| 7 | IS 1905, BIS, New Delhi |
| 8 | SP20(S&T),New Delhi |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3 |
| CO3 | PO1, PO3, PO5 |
| CO4 | PO6 |
| CO5 | PO1 |

**Syllabus for IV Semester M Tech (2017-18)**

| Sub Title : COMPOSITE AND SMART MATERIALS | | |
|---|---|---|
| Sub Code : CSE425 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

| **Course Objectives:** The objectives of this course is: |
|---|
| 7. To make students to learn principles of Composite materials.<br>8. To identify the actuators and sensors.<br>9. To characterize smart materials |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Introduction:** Introduction to Composite materials, classifications and applications. Anisotropic elasticity – unidirectional and anisotropic laminate, thermo – mechanical properties, micro – mechanical analysis, characterization tests. | 12 |
| 2 | Classical composite lamination theory, cross and angle – play laminates, symmetric, antisymmetric 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. | 10 |
| 3 | Introduction to smart materials and structures – piezoelectric materials –coupled electromechanical constitutive relations – depoling and coercive field – field – strain relation – hysterics – creep – strain rate effects – manufacturing. | 10 |
| 4 | 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. | 10 |
| 5 | 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 Piezo electric sensors and actuators – shape memory alloys. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.

CO2: Understand the principles of Composite materials

CO3: Design and develop analytical skills.

CO4: Summarize the smart materials and structures.

CO5: Understand the concepts of control systems.

| **REFERENCES:** | |
|---|---|
| 1 | Mechanics of Composite Materials and Structures by M. Mukhopadhya- Universities Press 2009 |
| 2 | Robart 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 |
| 4 | 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. |
| 5 | 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, April 1989 |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO2, PO3, |
| CO3 | PO1, PO3, PO5 |
| CO4 | PO1 |
| CO5 | PO1, PO6 |

**Dr. Ambedkar Institute of Technology, Bengaluru 56**
**(An autonomous Institute, affiliated to VTU, Belgaum)**
**Department of Civil Engineering –**
**MTech Structural Engineering**
**Syllabus for I Semester M Tech (2019-20)**

| Sub Title : COMPUTATIONAL STRUCTURAL MECHANICS | | |
|---|---|---|
| Sub Code : 18CSE11 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objective of this course is

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

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **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. | 12 |
| 2 | **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, plane trusses and rigid plane frames by flexibility method (having not more than 3 coordinates – 3x3 flexibility matrix) | 10 |
| 3 | **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 | 10 |

| | | |
|---|---|---|
| | coordinates – 3x3 stiffness matrix) | |
| 4 | **Effects of temperature change and lack of fit:**<br>Related numerical problems by flexibility and stiffness method as in Chapters 2 and 3. | **10** |
| 5 | **Solution techniques:**<br>Solution techniques including numerical problems for simultaneous equation, Gauss elimination and Cholesky method. Bandwidth consideration. | **10** |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of analysis, design and development of problem solving skills.

CO2: Understand the principles of Structural Analysis

CO3: Design and develop analytical skills and Summarize the Solution techniques

CO4: Understand the concepts of structural behaviour.

| **REFERENCES:** | |
|---|---|
| 1 | S.Rajasekaran, "**Computational Structural Mechanics**", PHI, New Dehi 2001 |
| 2 | F.W.Beaufait et al., "**Computer methods of Structural Analysis**", Prentice Hall, 1970 |
| 3 | W.Weaver and J.H.Gere, "**Matrix Analysis of Framed Structures**", Van Nastran, 1980 |
| 4 | H.Karde Stuncer, "**Elementary Matrix Analysis of Structures**", McGraw Hill 1974 |
| 5 | A.K.Jain "**Advanced Structural Analysis with Computer Application**" Nemchand and Brothers, Roorkee, India |
| 6 | M.F.Rubinstein "**Matrix Computer Methods of Structural Analysis**" Prentice – Hall |
| 7 | Damodhar Maithy "Computational Analysis of Framed Structures" |
| 8 | Martin "Matrix Method of Structural Anlysis" |

| **CO'S** | **Mapping with PO'S** |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3 |
| CO3 | PO1, PO2 |
| CO4 | PO3, PO4, PO6 |

**Syllabus for I Semester M Tech (2019-20)**

| Sub Title : ADVANCED DESIGN OF RCC STRUCTURES | | |
|---|---|---|
| Sub Code : 18CSE12 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objective of this course is

1. To make students 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 No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | Yield line method of design of slabs. Design of flat Slabs. | 12 |
| 2 | Design of grid floors, Design of Chimneys. | 10 |
| 3 | Design of continuous beams with redistribution of moments | 10 |
| 4 | Design of silos and bunkers. | 10 |
| 5 | Art of detailing earthquake resistant structures. Expansion and contraction joints. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of Structural Design.
CO3: Design and develop analytical skills.
CO4: Summarize the principles of Structural Design and detailing.
CO5: Understands the structural performance.

**REFERENCE BOOKS:**


1. A Park and Paulay, **"Reinforced Reinforced and Prestressed Concrete"**
2. Lin TY and Burns N H, **"Reinforced Concrete Design".**
3. Kong KF and Evans T H **"Design of Prestressed Concrete Structures**
4. P.C.Varghese, **"Advanced Reinforced Concrete Design"**, Prentice-Hall of India, New Delhi, 2005.
5. Dr.B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, **"Comprehensive RCC Design"**
6. Bungey and Mosley **"Reinforced concrete. Palgrave – Macmillan**
7. **Pillai and Menon "Reinforced Concrete Design"** McGraw Hill.
8. N. Krishnaraju "Advanced Reinforced Concrete".


| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO2, PO3, PO6 |
| CO3 | PO1, PO3 |
| CO4 | PO3, PO4 |

Syllabus for I Semester M Tech (2019-20)

| Sub Title : MECHANICS OF DEFORMABLE BODIES | | |
|---|---|---|
| Sub Code : 18CSE13 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objective of this course is

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 inter relations of the continuum.

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Theory of Elasticity:** Introduction: Definition of stress and strain and strain at a point, components of stress and strain at appoint of Cartesian and polar co-ordinates. Constitutive relations, equilibrium equations, compatibility equations and boundary conditions in 2-D and 3-D cases. | 12 |
| 2 | Transformation of stress and strain at a point, Principal stresses and principal strains, invariants of stress and strain, hydrostatic and deviatric stress, spherical and deviatoric strains, max. shear strain. | 10 |
| 3 | 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 |
| 4 | Elementary problems of elasticity in three dimensions, stretching of a prismatical 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 |
| 5 | **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 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of stress-strain behaviour of continuum.
CO3: Design and develop analytical skills.
CO4: Describe the continuum in 2 and 3- dimensions.
CO5: Understand the concepts of elasticity and plasticity.

| REFERENCES: | |
|---|---|
| 1 | Timoshenko & Goodier, "**Theory of Elasticity**", McGraw Hill |
| 2 | Srinath L.S., **Advanced Mechanics of Solids**, 10th print, Tata McGraw Hill, Publishing company, New Delhi, 1994 |
| 3 | Sadhu Singh, "**Theory of Elasticity**", Khanna Publishers |
| 4 | Verma P.D.S, "**Theory of Elasticity**", Vikas Publishing Pvt. Ltd |
| 5 | Chenn W.P and Hendry D.J, "**Plasticity for Structural Engineers**", Springer Verlag |
| 6 | Valliappan C, "**Continuum Mechanics Fundamentals**", Oxford IBH Publishing Co. Ltd. |
| 7 | Sadhu Singh, "**Applied Stress Analysis**", Khanna Publishers |
| 8 | Xi Lu, "**Theory of Elasticity**", John Wiley |
| 9 | T.G. Seetharam and L Govindaraju "Applied Elasticity Interline Publishing, 2005 |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO2, PO3, PO5 |
| CO3 | PO1, PO3 |
| CO4 | PO1, PO2 |

**Syllabus for I Semester M Tech (2019-20)**

| Sub Title : STRUCTURAL DYNAMICS | | |
|---|---|---|
| Sub Code : 18CSE14 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objective of this course is

1. To make students 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 No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **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. | 12 |
| 2 | Response of Single-degree-of-freedom systems to harmonic loading (rotation unbalance, reciprocating unbalance) including support motion, vibration isolation, transmissibility, Numerical methods applied to a Single-degree-of-Freedom systems-Duhamel integral, principle of vibration-measuring instruments – seismometer and accelerometer. | 10 |
| 3 | **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. | 10 |
| 4 | 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. | 10 |
| 5 | **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 discretised beam in matrix form. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.

CO2: Understand the principles of Structural Dynamics.

CO3: Design and develop analytical skills.

CO4: Summarize the Solution techniques for dynamics of Multi-degree freedom systems.

CO5: Understand the concepts of damping in structures.

**REFERENCE BOOKS:**


1. Mario Paz, "**Structural dynamics – Theory and Computation**", CBS Publishers
2. Biggs, "**Structural Dynamics**", McGraw Hill
3. R.W. Clough & J. Penzien, "**Dynamics of Structures**", McGraw Hill
4. Anil K. Chopra, "**Dynamics of Structures**", Prentice Hall of India
5. Timoshenko, S., "**Vibration Problems in Engineering**", VanNostrand Co.,
6. Mukyopadhyaya, "**Vibration and Structural Dynamics**", Oxford &IBH
7. William Thompson, "**Theory of Vibration with Applications**"
8. William Seto, "**Mechanical Vibrations**", McGraw Hill Pub., (Schaum Series)"
9. Vinod Hosur, "**Earthquake Resistant Design of Building Structures**", WILEY (India)
10. Thompson "**Dynamics of Structures**",


| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3, PO6 |
| CO3 | PO1, PO3 |
| CO4 | PO1, PO2 |
| CO5 | PO1 |

Syllabus for I Semester M Tech (2019-20)

| Sub Title : Advanced Design of Pre-stressed Concrete Structures | | |
|---|---|---|
| Sub Code : 18CSE151 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

| **Course Objectives:** The objective of this course is |
|---|
| 1. Design pre-stressed elements<br>2. Understand the behavior of pre-stressed elements<br>3. Understand the behavior of pre-stressed sections |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **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. | 12 |
| 2 | **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.<br>**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. | 10 |
| 3 | **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. | 10 |
| 4 | **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. | 10 |
| 5 | **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. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.

CO2: Analyze, Design and detail PSC elements.

CO3: Design and develop analytical skills.

CO4: Understand the concept of prestressed and post tensioned concrete.

| REFERENCES: | |
|---|---|
| 1 | Krishna Raju, "Prestressed concrete", Tata Mc Graw Hill Book – Co., New Delhi |
| 2 | T.Y. Lin and Burn, "Design of prestress concrete structures", John Wiley, New York |
| 3 | S. Ramamrutham "Prestressed concrete", Dhanpat Rai & Sons, Delhi |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO2, PO3 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |

Syllabus for I Semester M Tech (2019-20)

| Sub Title : SPECIAL CONCRETE | | |
|---|---|---|
| Sub Code : 18CSE152 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objective of this course is

4. To make students to learn principles of Concrete mix design.
5. To differentiate between different types of concrete.
6. To characterize the High Performance concrete.

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **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. | 12 |
| 2 | **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 | 10 |
| 3 | **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. | 10 |
| 4 | **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. | 10 |
| 5 | **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). | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of Concrete mix design.
CO3: Summarize the Light Weight concrete, Fibre reinforced concrete and High Performance concrete.
CO4: Understand the concepts of high Performance concrete.

| REFERENCES: | |
|---|---|
| 1 | Neville A.M, **"Properties of Concrete"** Pearson Education Asis, 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 | Gambhir "Concrete Technology" TMH |
| 5 | Short A and Kinniburgh.W, **"Light Weight Concrete"**- Asia Publishing House, 1963 |
| 6 | Aitcin P.C. **"High performance concrete"**-E and FN, Spon London 1998 |
| 7 | Rixom.R. and Mailvaganam.N., **"Chemical admixtures in concrete"**- E and FN, Spon London 1999 |
| 8 | Rudnai. G, **"Light Wiehgt concrete"**- Akademiaikiado, Budapest, 1963 |
| 9 | M.S. Shetty "Concrete Technology" |
| 10 | http://qcin.org/CAS//RMCPC/, IS: 10262-2009, IS: 456- 2000 |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO4 |
| CO2 | PO1, PO4, PO6 |
| CO3 | PO1, PO3 |
| CO4 | PO1, PO3 |

Syllabus for I Semester M Tech (2019-20)

| Sub Title : DESIGN OF PRECAST AND COMPOSITE STRUCTURES | | |
|---|---|---|
| Sub Code : 18CSE153 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

| **Course Objectives:** This course will enable students to |
|---|
| 7. Select or design precast elements suitable for project specific requirements.<br>8. Design precast systems to ensure integrity and safety of the structure and to avoid progressive collapse.<br>9. Design composite floors and beam elements. |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Concepts, components, Structural Systems and Design of precast concrete floors**<br>Need Andtypes of precast construction, Modular coordination, Precast elements- Floor, Beams, Columns and walls. Structural Systems and connections.<br>**Design of precast Concrete Floors:** Theoretical and Design Examples of Hollow core slabs. Precast Concrete Planks, floor with composite toppings with and without props. | 12 |
| 2 | **Design of precast reinforced and prestressed Concrete beams:** Theoretical and Design Examples of ITB, Full section precast, Semi Precast, propped and unpropped conditions. Design of RC Nibs | 10 |
| 3 | **Design of precast concrete columns and walls** Design of braced and unbraced columns with corbels subjected to pattern and full loading. Design of Corbels Design of RC walls subjected to Vertical, Horizontal loads and moments, Design of vertical ties and horizontal joints. | 10 |
| 4 | **Design of Precast Connections and Structural Integrity**<br>Beam bearing, Beam half Joint, Steel Inserts, Socket Connection, Structural integrity, Avoidance of progressive collapse, Design of Structural Ties. | 10 |
| 5 | **Design of Steel Concrete Composite Floors and Beams Composite Floors:** Profiled Sheeting with concrete topping, Design method, Bending and Shear Resistance of Composite Slabs, Serviceability Criteria, Design Example.<br>**Composite Beams:** Elastic Behaviour, Ultimate Load behavior of Composite beams, Stresses and deflection in service and vibration, Design Example of Simply Supported beams. | 10 |

**Course Outcomes: On completion of the course, students are able to**

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of Precast and Composite Structures.
CO3: Design and develop analytical skills.
CO4: Understand the concept of precast construction

**REFERENCES:**


| | |
|---|---|
| 1 | Hass A.M. – Precast Concrete – Design and applications Applied Science, 1983 |
| 2 | David Sheppard – "Plant cast, Precast and Prestressed concrete – McGraw Hill; 1989 |
| 3 | NBC – 2005 ( Part I to Part VII) BIS Publications, New Delhi, IS 15916-2011, IS 11447, IS 6061 – I and III |
| 4 | R.P.Johnson: Composite Structure of Steel and Concrete (Volume 1), Blackwell Scientific Publication (Second Edition), U.K., 1994 |
| 5 | IS: 11384-1985, Code of Practice for Composite Construction in Structural Steel and Concrete |
| 6 | INSDAG Teaching Resource Chapter 21 to 27: www.steel-insdag.org |


| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3, PO6 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |

**Syllabus for I Semester M Tech (2019-20)**

| Sub Title : RELIABILITY ANALYSIS OF STRUCTURES | | |
|---|---|---|
| Sub Code : 18CSE154 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** This course will enable students to

1. To make students to learn principles of reliability.
2. To implement the Probability Concepts for the Reliability Analysis.
3. To evaluate different methods of reliability analysis.

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **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 $y = ab$, and parabola, Coefficient of correlation | 12 |
| 2 | **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. | 10 |
| 3 | **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. | 10 |
| 4 | **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). | 10 |
| 5 | **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 | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of reliability.
CO3: Design and develop analytical skills.
CO4: Summarize the Probability distributions.
CO5: Understands the concept of System reliability


| REFERENCES: | |
|---|---|
| 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 |
| 5 | Nathabdndu, T., Kottegoda, and Renzo Rosso (1998). Statistics, "Probability and reliability for Civil and Environmental Engineers"- Mc Graw Hill international edition, Singapore |
| 6 | Achintya Haldar and Sankaran Mahadevan (2000). "Probability, Reliability and Statistical methods in Engineering design"- John Wiley and Sons. Inc. |
| 7 | Thoft-christensen, P., and Baker, M., J., (1982), "Structural reliability theory and its applications"- Springer-Verlag, Berlin, NewYork |
| 8 | Thoft-christensen, P., and Murotsu, Y. (1986). "Application of structural systems reliability theory"- Springer-Verlag, Berlin, NewYork |
| 9 | Srinath, "Reliability analysis of structures" |


| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO2, PO3, PO6 |
| CO3 | PO1,PO3, |
| CO4 | PO1, PO2, PO5 |
| CO5 | PO1 |

Syllabus for I Semester M Tech (2019-20)

| Sub Title : STRUCTURAL ENGINEERING LAB-1 | | |
|---|---|---|
| Sub Code : 18CSE16 | No of Credits:2, : 0:0:2 | No of lecture hours/week : 03 |
| Exam Duration : 3 hours | CIE+ SEE= 25 + 50 = 75 | Total Number of contact hours : 39 |

**Course Objectives:** The objectives of this course is

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 equipments.

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | Testing of beams for deflection, flexure and shear | 12 |
| 2 | Experiments on Concrete, including Mix design | 9 |
| 3 | Experiments on vibration of multi storey frame models for Natural frequency and modes. | 9 |
| 4 | Use of Non destructive testing (NDT) equipments – Rebound hammer, Ultra sonic pulse velocity meter and Profometer | 9 |

**References:** NPTL.Com, IISc, Code Books. IS: 456-2000, IS: 10262-2009

**Course Outcomes: On completion of the course, students are able to**

CO1: Achieve Knowledge of design and development of experimenting skills.
CO2: Understand the principles of design of experiments
CO3: Design and develop analytical skills.
CO4: Summarize the testing methods and equipments.

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO2, PO3, PO4 |
| CO2 | PO3, PO6 |
| CO3 | PO1, PO2, PO3 |
| CO4 | PO5 |

| Sub Title : Mini Project Work | | |
|---|---|---|
| Sub Code : 18CSE18 | No of Credits:2, : 0:0:2 | No of lecture hours/week : 04 |
| Project Viva-Voce : 3 hours | CIE+ SEE= 25 + 50 = 75 | Total Number of contact hours : 52 |

**Course Objectives:** The objectives of this course is

1. To make students to learn principles of Structural Analysis,
2. To analyse various types of structures.
3. To evaluate the force and displacement parameters of the structures.

| Syllabus | Reamrks |
|---|---|
| 1. Analysis and Design of Multi-storied frames,<br>2. Analysis and Design of Residential Building frames,<br>3. Smart Buildings and Construction<br>4. Analysis and Design of RCC / PSC / Steel Bridges,<br>5. Analysis and Design of Chimneys,<br>6. Analysis and Design of Tall Structures,<br>7. Analysis and Design of Suspension Bridges.<br>8. Analysis and Design of Silos and Bunkers.<br>9. Analysis and Design of raft / Pile foundation.<br>10. Analysis and Design of flat slab Structures.<br>11. Experimental investigation on engineering materials.<br>12. Experimental investigation on Special concrete.<br>13. Design of form work for high rise buildings.<br>14. Any other projects related to Structural Engineering in consultation with the Project Guide. | Students are advised to take any one of the topic |

**Course Outcomes: On completion of the course, students are able to**

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of Structural Analysis and concepts of structural behaviour.
CO3: Design and develop analytical skills and Summarize the Solution techniques.
CO4: Understand the material behaviour and Learn the Presentation skills.

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO2, PO3, PO6 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |

| Sub Title : ADVANCED DESIGN OF STEEL STRUCTURES | | |
|---|---|---|
| Sub Code : 18CSE21 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objectives of this course is:

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

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **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. | 12 |
| 2 | **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 | 10 |
| 3 | **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) | 10 |
| 4 | **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. | 10 |
| 5 | **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. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.

CO2: Able to design the roof truss, steel bridges and towers.

CO3: Design and develop analytical skills.

CO4: Understand the concept of design of various structural elements.

| **REFERENCES:** | |
|---|---|
| 1 | N. Subramanian, "Design of Steel Structures", Oxford, IBH. |
| 2 | Duggal S K "Design Of Steel Structures" |
| 3 | IS 1641, 1642, 1643 |
| 4 | IS 800: 2007, IS 811 |
| 5 | INSDAG Teaching Resource Chapter 11 to 20: www.steel-insdag.org |

| **CO'S** | **Mapping with PO'S** |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3 |
| CO3 | PO1, PO3, PO5 |
| CO4 | PO1 |
| CO5 | PO1 |

**Syllabus for II Semester M Tech (2019-20)**

| Sub Title : EARTHQUAKE RESISTANT STRUCTURES | | |
|---|---|---|
| Sub Code : 18CSE22 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

| **Course Objectives:** The objectives of this course is: |
|---|
| 1. To make students 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 No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | 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 devises, base isolation systems. | 12 |
| 2 | 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- storeyed buildings – using procedures (Equivalent lateral force and dynamic analysis) as per IS-1893. | 10 |
| 3 | 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 |
| 4 | 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 |
| 5 | 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 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of engineering seismology.
CO3: Design and develop analytical skills.
CO4: Summarize the Seismic evaluation and retrofitting of structures.
CO5: Understand the concepts of earthquake resistance of reinforced concrete buildings

| REFERENCES: | |
|---|---|
| 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 | Pankaj Agarwal, **Earthquake Resistant Design of Structures – Manish Shrikande - PHI India** |
| 5 | **IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS - 13828: 1993** |
| 6 | Minoru Wakabayashi, **Design of Earthquake Resistant Buildings, McGraw Hill Pub.** |
| 7 | T Paulay and M J N Priestley, **Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley and Sons** |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3, PO5 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |
| CO5 | PO1 |

**Syllabus for II Semester M Tech (2019-20)**

| Sub Title : FINITE ELEMENT METHOD OF ANALYSIS | | |
|---|---|---|
| **Sub Code : 18CSE23** | **No of Credits:4, : 4:0:0** | **No of lecture hours/week : 04** |
| **Exam Duration : 3 hours** | **CIE+ SEE= 50 + 50 = 100** | **Total Number of contact hours : 52** |

| **Course Objectives:** The objectives of this course is: |
|---|
| 1. To make students to learn principles of Analysis of Stress and Strain. |
| 2. To apply the Finite Element Method for the analysis of one and two dimensional problems. |
| 3. To evaluate the stress and strain parameters and their inter relations of the continuum. |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | Basic concepts of elasticity – Kinematic and Static variables for various types of structural problems – approximate method 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 & disadvantages – Finite element procedure. Finite elements used for one, two & three dimensional problems – Element aspect ratio – mesh refinement vs. higher order elements – Numbering of nodes to minimize band width. | 12 |
| 2 | 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. | 10 |
| 3 | 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 | 10 |
| 4 | Application of Finite Element Method for the analysis of one & two dimensional problems - Analysis of simple beams and plane trusses – Application to plane stress / strain / axisymmetric problems using CST & Quadrilateral Elements | 10 |
| 5 | Application to Plates & Shells- Choice of displacement function (C , C and C type) – Techniques for Non – linear Analysis | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of stress-strain behaviour of continuum.
CO3: Design and develop analytical skills.
CO4: Describe the state of stress in a continuum.
CO5: Understand the concepts of elasticity and plasticity.


| REFERENCES: | |
|---|---|
| 1 | Krishnamoorthy C S, "**Finite Element Analysis**"- Tata McGraw Hill |
| 2 | Desai C and Abel J F, "**Introduction to the Finite Element Method**"- East West Press Pvt. Ltd., 1972 |
| 3 | Bathe K J, "**Finite Element Procedures in Engineering Analysis**"- Prentice Hall |
| 4 | Rajasekaran. S, "**Finite Element Analysis in Engineering Design**"-Wheeler N Publishing |
| 5 | Cook R D, Malkan D S & Plesta M.E, "**Concepts and Application of Finite Element Analysis**" - 3rd Edition, John Wiley and Sons Inc., 1989 |
| 6 | Shames I H and Dym C J, "**Energy and Finite Element Methods in Structural Mechanics**" – McGraw Hill, New York. |


| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO2, PO4 |
| CO2 | PO1, PO5 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |
| CO5 | PO1 |

Syllabus for II Semester M Tech (2019-20)

| Sub Title : DESIGN CONCEPTS OF SUBSTRUCTURES | | |
|---|---|---|
| Sub Code : 18CSE24 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objectives of this course is:

1. To make students to learn principles of subsoil exploration.
2. To design the sub structures.
3. To evaluate the soil shear strength parameters.

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | Introduction, Site investigation, In-situ testing of soils, Subsoil exploration, classification of foundations systems. General requirement of foundations, Selection of foundations, Computations of Loads, Design concepts. | 12 |
| 2 | Concept of soil shear strength parameters, Settlement analysis of footings, Shallow foundations in clay, Shallow foundation in sand & C-Φ soils, Footings on layered soils and sloping ground, Design for Eccentric or Moment Loads | 10 |
| 3 | Types of rafts, bearing capacity & settlements of raft foundation, Rigid methods, Flexible methods, soil-structure interaction, different methods of modeling the soil. Combined footings (rectangular & trapezoidal), strap footings & wall footings, Raft – super structure interaction effects & general concepts of structural design, Basement slabs. | 10 |
| 4 | Deep Foundations: Load Transfer in Deep Foundations, Types of Deep Foundations, Ultimate bearing capacity of different types of piles in different soil conditions, Laterally loaded piles, tension piles & batter piles, Pile groups: Bearing capacity, settlement, uplift capacity, load distribution between piles, Proportioning and design concepts of piles. | 10 |
| 5 | Types of caissons, Analysis of well foundations, Design principles, Well construction and sinking. Foundations for tower structures: Introduction, Forces on tower foundations, Selection of foundation type, Stability and design considerations, Ring foundations – general concepts. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of subsoil exploration.
CO3: Design and develop analytical skills.
CO4: Identify and evaluate the soil shear strength parameters.
CO5: Understand the concepts of Settlement analysis.

| REFERENCES: | |
|---|---|
| 1 | Swami Saran – "**Analysis & Design of Substructures**"- Oxford & IBH Pub. Co. Pvt. Ltd. , 1998 |
| 2 | Nainan P Kurian – "**Design of Foundation Systems**"- Narosa Publishing House, 1992 |
| 3 | R.B. Peck, W.E. Hanson & T.H. Thornburn – "**Foundation Engineering"-** Wiley Eastern Ltd.,Second Edition, 1984 |
| 4 | J.E. Bowles – "**Foundation Analysis and Design**"- McGraw-Hill Int. Editions, Fifth Ed., 1996 |
| 5 | W.C. Teng – "**Foundation Design"-** Prentice Hall of India Pvt. Ltd., 1983 |
| 6 | Bureau of Indian Standards:IS-1498, IS-1892, IS-1904, IS-6403, IS-8009, IS-2950, IS-11089, IS-11233, IS-2911 and all other relevant codes |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO2, PO3, PO5 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |
| CO5 | PO1 |

Syllabus for II Semester M Tech (2019-20)

| Sub Title : DESIGN OF TALL STRUCTURES | | |
|---|---|---|
| Sub Code : 18CSE251 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

| **Course Objectives:** The objectives of this course is: |
|---|
| 1. To make students to learn principles of stability of tall buildings.<br>2. To design the tall buildings for earthquake and wind resistance.<br>3. To evaluate the performance of tall structures for strength and stability. |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Design Criteria:**<br>Design philosophy, loading, sequential loading, and materials–high performance concrete, fiber reinforced concrete, lightweight concrete, design mixes. Loading and Movement: Gravity loading: Dead and live load, methods of live load reduction, Impact, Gravity loading, Construction loads. | 12 |
| 2 | **Wind loading:**<br>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. | 10 |
| 3 | **Behavior of Various Structural Systems:**<br>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, Futigger – braced and hybrid mega system. | 10 |
| 4 | **Analysis and Design:**<br>Modeling for approximate analysis, accurate analysis and reduction techniques, analysis of building as total structural system considering overall integrity and major subsystem interaction, analysis for member forces; drift and twist, computerized general three dimensional analyses. | 10 |
| 5 | **Stability of Tall Buildings:**<br>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 in stability, effect of foundation rotation. Structural elements: sectional shapes, properties and resisting capacities, design, deflection, cracking, pre-stressing, shear flow. Design for differential movement, creep and shrinkage effects, temperature effects and fire. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of strength and stability.
CO3: Design and develop analytical skills.
CO4: Summarize the behavior of various structural systems.
CO5: Understand the concepts of P-Delta analysis.


| REFERENCES: | |
|---|---|
| 1 | Taranath B.S, **"Structural Analysis and Design of Tall Buildings"**- McGraw Hill |
| 2 | Wilf gang Schuller, **"High rise building structures"**- John Wiley |
| 3 | Bryan Stafford Smith & Alexcoull, **"Tall building structures Analysis and Design"**-John Wiley |
| 4 | T.Y Lin & D.Stotes Burry, **"Structural concepts and system for Architects and Engineers"-** John Wiley |
| 5 | Lynn S.Beedle, **"Advances in Tall Buildings"**- CBS Publishers and Distributors |
| 6 | 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'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3, PO5 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |
| CO5 | PO1 |

| Sub Title : REPAIR AND REHABILITATION OF STRUCTURES | | |
|---|---|---|
| Sub Code : 18CSE252 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 50 |

**Course Objectives:** The objectives of this course is:

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

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **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. | 12 |
| 2 | **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. | 10 |
| 3 | **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. | 10 |
| 4 | **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, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning. | 10 |
| 5 | **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. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the cause of deterioration of concrete structures.
CO3: Design and develop analytical skills.
CO4: Summarize the principles of repair and rehabilitation of structures.
CO5: Understand the concept of Serviceability and Durability.

| REFERENCES: | |
|---|---|
| 1 | Sidney, M. Johnson "**Deterioration, Maintenance and Repair of Structures**". |
| 2 | Denison Campbell, Allen & Harold Roper, "**Concrete Structures – Materials, Maintenance and Repair**"- Longman cientific and Technical |
| 3 | R.T.Allen and S.C. Edwards, "**Repair of Concrete Structures**"-Blakie and Sons |
| 4 | Raiker R.N., "**Learning for failure from Deficiencies in Design, Construction and Service**"- R&D Center (SDCPL) |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO2, PO5 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |
| CO5 | PO1 |

Syllabus for II Semester M Tech (2019-20)

| Sub Title : STABILITY ANALYSIS OF STRUCTURES | | |
|---|---|---|
| Sub Code : 18CSE253 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

| **Course Objectives:** The objectives of this course is: |
|---|
| 1. To make students 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 No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Beam – Column**<br>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 pined – pined, fixed – fixed, fixed – free and fixed – pinned column. | 12 |
| 2 | **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.<br>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. | 10 |
| 3 | **Stability analysis by finite element approach**<br>Deviation of shape function for a two nodded Bernoulli – Euler beam element (lateral and translation of) –element stiffness and element geometric stiffness matrices – assembled stiffness and geometric stiffness matrices for discretized 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. | 10 |
| 4 | **Lateral buckling of beams**<br>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. | 10 |
| 5 | **Expression for strain energy in plate bending with in plate forces (linear and non– linear).**<br>**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. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of strength and stability.
CO3: Design and develop analytical skills.
CO4: Appraise the Stability analysis by finite element approach.
CO5: Understand the concepts of Lateral buckling of beams.

| REFERENCES: | |
|---|---|
| 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 |
| 5 | H.Zeiglar, "**Principles of Structural Stability**"-Blaisdall Publications |
| 6 | Manica Selvam "Stability Analysis of Structures" |
| 7 | Chajes "Stability of Structures" |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3, PO4 |
| CO3 | PO1, PO3 |
| CO4 | PO1 |
| CO5 | PO2 |

| Sub Title : DESIGN OF PLATES AND SHELLS | | |
|---|---|---|
| Sub Code : 18CSE254 | No of Credits:4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objectives of this course is to make students to learn:

1. 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 No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | 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. | 12 |
| 2 | Energy methods for rectangular and circular plates with clamped edges subjected to Symmetric loadings | 10 |
| 3 | Introduction to Curved surfaces and classification of shells, Membrane theory of spherical shells, cylindrical shells, hyperbolic paraboloids, elliptic paraboloid and conoids | 10 |
| 4 | 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. | 10 |
| 5 | Design and detailing of folded plates with numerical examples Design and Detailing of simple shell problems – spherical domes, water tanks, barrel vaults and hyperbolic paraboloid roofs | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of Analysis and Design.
CO3: Design and develop analytical skills.
CO4: Summarize the performance of shells Understand the concepts of energy principle.

**REFERENCES:**


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
4. R. Szilard, **"Theory and analysis of plates - classical and numerical methods"**, Prentice Hall,1994
5. Chatterjee.B.K. – **"Theory and Design of Concrete Shell"**, – Chapman & Hall, Newyork-third edition, 1988

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1,PO2, PO3, PO6 |
| CO3 | PO1,PO2, PO3 |
| CO4 | PO1 |

**Syllabus for II Semester M Tech (2019-20)**

| Sub Title : STRUCTURAL ENGINEERING LAB-2 | | |
|---|---|---|
| Sub Code : 18CSEL26 | No of Credits: 2, : 0:0:2 | No of lecture hours/week : 03 |
| Exam Duration : 3 hours | CIE+ SEE= 25 + 50 = 75 | Total Number of contact hours : 39 |

**Course Objectives:** The objectives of this course is:

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

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | Static and Dynamic analysis of Building structure using software (ETABS / STAAD Pro. / ANSYS /NISA) | 12 |
| 2 | Design of RCC and Steel structure using software (ETABS / STAAD Pro.) | 9 |
| 3 | Analysis of folded plates and shells using software. | 9 |
| 4 | Preparation of EXCEL sheets for structural design | 9 |

**REFERENCES:**

- ANSYS Manual
- STAAD PRO. Manual

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of programming skills.
CO2: Understand the principles of structural analysis and design.
CO3: Design and develop analytical skills.

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO2, PO3, PO4 |
| CO2 | PO3, PO6 |
| CO3 | PO1, PO2, PO3 |
| CO4 | PO1, PO3 |

| Sub Title : RESEARCH METHODOLOGY | | |
|---|---|---|
| Sub Code : 18CSE27/RM27 | No of Credits: 2, : 2:0:0 | No of lecture hours/week : 02 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 26 |

| Course Objectives: The objectives of this course is: |
|---|
| 1. Have a basic understanding of the underlying principles of quantitative and qualitative research |
| 2. Identify the overall process of designing a research study from its inception to its report. |
| 3. Choose the most appropriate research method to address a particular research question |
| 4. Gain a overview of a range of quantitative and qualitative approaches to data analysis |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Unit – I, Overview of Research**<br>Research and its types, identifying and defining research problem and introduction to different research designs. Essential constituents of Literature Review. Basic principles of experimental design, Primary data and Secondary Data, methods of primary data collection, classification of secondary data, designing questionnaires and schedules. | 8 |
| 2 | **Unit – II, Sampling Methods**<br>Probability sampling: simple random sampling, systematic sampling, stratified sampling, cluster sampling and multistage sampling. Non-probability sampling: convenience sampling, judgment sampling, quota sampling. Sampling distributions | 6 |
| 3 | **Unit – III, Processing and analysis of Data**<br>Statistical measures and their significance: Central tendencies, variation, skewness, Kurtosis, time series analysis, correlation and regression, Testing of Hypotheses: Parametric (t and Chi Square). | 6 |
| 4 | **Unit-IV,**<br>**Essential of Report writing and Ethical issues:**<br>Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Ethical issues related to Research, Plagiarism and self-Plagiarism, Publishing. | 6 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Describe a range of quantitative and qualitative research designs and identify the advantages and disadvantages associated with these designs.

CO2: Choose appropriate quantitative or qualitative method to collect data.

CO3: Analyze and test the given data using appropriate methods.

CO4: Design an appropriate mixed-method research study to answer a research question.

| **REFERENCES:** | |
|---|---|
| 1 | Krishnaswami, K.N., Sivakumar, A. I. and Mathirajan, M., Management Research Methodology, Pearson Education: New Delhi. |
| 2 | Kothari C.R., Research Methodology Methods and techniques by, New Age International Publishers, 2nd edition |
| 3 | Levin, R.I. and Rubin, D.S., Statistics for Management, 7th Edition, Pearson Education: New Delhi. |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4, PO5 |
| CO2 | PO4, PO5 |
| CO3 | PO1, PO2, PO3 |
| CO4 | PO1, PO2 |

**Syllabus for IV Semester M Tech (2019-20)**

| Sub Title : DESIGN OF CONCRETE BRIDGES | | |
|---|---|---|
| Sub Code : 18CSE41 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objectives of this course is:

1. To make students 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 No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **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), Box Pre-Stressing. | 12 |
| 2 | **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. | 10 |
| 3 | **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. | 10 |
| 4 | **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 | 10 |
| 5 | **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. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Explain the Bridge substructures and superstructures.
CO3: Design and develop analytical skills.
CO4: Summarize the principles of design and detailing of bridges.
CO5: Understands the design and construction of different types of bridges.

| REFERENCES: | |
|---|---|
| 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 |
| 8 | Raina V.K., **"Concrete Bridge Practice"**- Tata McGraw Hill |
| 9 | Bakht B & Jaeggar, **"Bridge Analysis Simplified"**- McGraw Hill |
| 10 | Ponnuswamy. S, **"Bridge Engineering"**- Tata McGraw Hill |
| 11 | Derrick Beckett, **"An Introduction to Structural Design of Concrete Bridges"**-Surrey University Press |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO4, PO5 |
| CO3 | PO1,PO3 |
| CO4 | PO1, PO2 |
| CO5 | PO1 |

Syllabus for IV Semester M Tech (2019-20)

| Sub Title : OPTIMIZATION TECHNIQUES | | |
|---|---|---|
| Sub Code : 18CSE421 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objectives of this course is:

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

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **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 andbalgorithms constrained optimization solutions by penalty function techniques, Lagrange multipliers techniques and feasibility techniques. | 12 |
| 2 | **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. | 10 |
| 3 | **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. | 10 |
| 4 | 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. | 10 |
| 5 | **Geometric programming:** Geometric programming, conversion of NLP as a sequence of LP/ geometric programming.<br>**Dynamic programming:** Dynamic programming conversion of NLP as a sequence of LP/ Dynamic programming. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of optimization.
CO3: Design and develop analytical skills.
CO4: Summarize the Linear, Non-linear and Geometric Programming.
CO5: Understands the concept of Dynamic programming.

| REFERENCES: | |
|---|---|
| 1 | Spunt, **"Optimum Structural Design"**- Prentice Hall |
| 2 | S.S. Rao, **"Optimization – Theory and Practice"**- Wiley Eastern Ltd. |
| 3 | Uri Krisch, **"Optimum Structural Design"**- McGraw Hill |
| 4 | Richard Bronson, **"Operation Research"**- Schaum's Outline Series |
| 5 | Bhavikatti S.S **"Structural optimization using sequential linear programming"**- Vikas publishing house |
| 6 | NPTL: Related to Optimization |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO2, PO3, PO5 |
| CO3 | PO1, PO3 |
| CO4 | PO2 |
| CO5 | PO1, PO2 |

Syllabus for IV Semester M Tech (2019-20)

| Sub Title : DESIGN OF INDUSTRIAL STRUCTURES | | |
|---|---|---|
| Sub Code : 18CSE422 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objectives of this course is:

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 No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | Analysis of industrial building for Gravity and Wind load. Analysis and design of framing components namely, girders, trusses, gable frames | 12 |
| 2 | Analysis and design of gantry column (stepped column / column With bracket), purlins, girts, bracings including all connections. | 10 |
| 3 | Analysis of transmission line towers for wind load and design of towers including all connections. | 10 |
| 4 | Forms of light guage sections, Effective width computation of unstiffened, stiffened, multiple stiffened compression elements of cold formed light guage sections. Concept of local buckling of thin elements. Limiting width to thickness ratio. Post buckling strength. | 10 |
| 5 | Concept of Pre- engineered buildings, Design of compression and tension members of cold formed light guage sections, Design of flexural members (Laterally restrained / laterally unrestrained). | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the industrial building and the components.
CO3: Design and develop analytical skills.
CO4: Summarize the principles of Structural Design and detailing.
CO5: Understands the concept of Pre- engineered buildings.

| REFERENCES: | |
|---|---|
| 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 |
| 4 | Ramchandra and Virendra Gehlot " Design of Steel Structures " Vol 1 and |
| 5 | Duggal "Limit State of Design of Steel Structures" TMH |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3 |
| CO3 | PO1, PO3, PO5 |
| CO4 | PO1 |
| CO5 | PO1 |

Syllabus for IV Semester M Tech (2019-20)

| Sub Title : THEORY OF PLASTICITY AND FRACTURE MECHANICS | | |
|---|---|---|
| Sub Code : 18CSE423 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

| **Course Objectives:** The objectives of this course is: |
|---|
| 1. To compute the stress intensity factor, strain energy release rate, and the stress and strain fields around a crack tip for linear and non linear materials.<br>2. Know experimental methods to determine the fracture toughness.<br>3. Use the design principle of materials and structures using fracture mechanics approaches |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Plasticity**<br>General concept, yield criteria, flow rules for perfectly plastic and strain hardening materials -simple applications, Theories of failure. Plasticity models for concrete | 12 |
| 2 | **Linear Elastic Fracture mechanics**<br>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. | 10 |
| 3 | **Elasto-plastic fracture mechanics**<br>Crack-tip plasticity in metals. Mixed mode problems and evaluation of critical fracture parameters | 10 |
| 4 | **Fatigue damage theories,**<br>Fatigue test, endurance limit, fatigue fracture under combined loading, fatigue controlling factors, cumulative fatigue damage concepts. | 10 |
| 5 | **Fracture of Concrete**<br>Review of concrete behaviour in tension and compression, Basic frameworks for modeling of quasi-brittle materials, discrete crack concept/Smeared crack concept. FE Concepts and applications. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Explain and apply yield criteria & flow-rules.

CO2: Design of structures using fracture mechanics approaches.

CO3: Apply principles of fracture mechanics.

CO4: Solve problems related to plastic fracture mechanics.

| REFERENCES: | |
|---|---|
| 1 | Valliappan S. "Continuum Mechanics Fundamentals" (1982), Oxford IBH, N D. New Delhi |
| 2 | Broek, D., "Elementary Engineering Fracture Mechanics", 4th edition , Martinus Nijhoff (1987) |
| 3 | Venkataramanand Patel "Structural Mechanics with Introduction to Elasticity and Plasticity" – McGraw Hill, 1990 |
| 4 | T. L. Anderson, Fracture Mechanics- Fundamentals and Applications, New Delhi |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO2 |
| CO2 | PO2, PO3 |
| CO3 | PO2, PO3, PO5 |
| CO4 | PO1 |

**Syllabus for IV Semester M Tech (2019-20)**

| Sub Title : MASONRY STRUCTURES | | |
|---|---|---|
| Sub Code : 18CSE424 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

**Course Objectives:** The objectives of this course is:

1. To make students to learn performance of masonry structures.
2. To design the masonry structures for earthquake resistance.
3. To evaluate the strength and stability of the masonry structures

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **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. | 12 |
| 2 | **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, influence of masonry bonding patterns on 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. | 10 |
| 3 | **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, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength. | 10 |
| 4 | **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. | 10 |
| 5 | **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. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of design and construction of masonry structures
CO3: Design and develop analytical skills.
CO4: Summarize the masonry Characteristics.
CO5: Evaluate the strength and stability of the masonry structures

**REFERENCES:**


| | |
|---|---|
| 1 | Hendry A.W., **"Structural masonry"**- Macmillan Education Ltd., 2nd editi on |
| 2 | Sinha B.P & Davis S.R., **"Design of Masonry structures"**- E & FN Spon |
| 3 | Dayaratnam P, **"Brick and Reinforced Brick Structures"**- Oxford & IBH |
| 4 | Curtin, **"Design of Reinforced and Pre-stressed Masonry"**- Thomas Telford |
| 5 | Sven Sahlin, **"Structural Masonry"**-Prentice Hall |
| 6 | Jagadish K S, Venkatarama Reddy B V and Nanjunda Rao K S, **"Alternative Building Materials and Technologies"**- New Age International, New Delhi & Bengaluru |
| 7 | IS 1905, BIS, New Delhi |
| 8 | SP20(S&T),New Delhi |


| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO1, PO3 |
| CO3 | PO1, PO3, PO5 |
| CO4 | PO6 |
| CO5 | PO1 |

Syllabus for IV Semester M Tech (2019-20)

| Sub Title : COMPOSITE AND SMART MATERIALS | | |
|---|---|---|
| Sub Code : 18CSE425 | No of Credits: 4, : 4:0:0 | No of lecture hours/week : 04 |
| Exam Duration : 3 hours | CIE+ SEE= 50 + 50 = 100 | Total Number of contact hours : 52 |

| **Course Objectives:** The objectives of this course is: |
|---|
| 1. To make students to learn principles of Composite materials.<br>2. To identify the actuators and sensors.<br>3. To characterize smart materials |

| Unit No. | Syllabus | No of Hours of Teaching |
|---|---|---|
| 1 | **Introduction:** Introduction to Composite materials, classifications and applications. Anisotropic elasticity – unidirectional and anisotropic laminate, thermo – mechanical properties, micro – mechanical analysis, characterization tests. | 12 |
| 2 | Classical composite lamination theory, cross and angle – play laminates, symmetric, antisymmetric 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. | 10 |
| 3 | Introduction to smart materials and structures – piezoelectric materials –coupled electromechanical constitutive relations – depoling and coercive field – field – strain relation – hysterics – creep – strain rate effects – manufacturing. | 10 |
| 4 | 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. | 10 |
| 5 | 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 Piezo electric sensors and actuators – shape memory alloys. | 10 |

**Course Outcomes:** On completion of the course, students are able to

CO1: Achieve Knowledge of design and development of problem solving skills.
CO2: Understand the principles of Composite materials
CO3: Design and develop analytical skills.
CO4: Summarize the smart materials and structures.
CO5: Understand the concepts of control systems.

| **REFERENCES:** | |
|---|---|
| 1 | Mechanics of Composite Materials and Structures by M. Mukhopadhya- Universities Press 2009 |
| 2 | Robart 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 |
| 4 | 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. |
| 5 | 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, April 1989 |

| CO'S | Mapping with PO'S |
|---|---|
| CO1 | PO1, PO3, PO4 |
| CO2 | PO2, PO3, |
| CO3 | PO1, PO3, PO5 |
| CO4 | PO1 |
| CO5 | PO1, PO6 |

**Syllabus for 2020-21 Batch PG (CSE)**

| Semester: I | |
|---|---|
| **Course Title: COMPUTATIONAL STRUCTURAL MECHANICS** | |
| Course Code: **20CSE11** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| 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 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. | **12 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, plane trusses and rigid plane frames by flexibility method (having not more than 3coordinates– 3x3 flexibility matrix) | **10 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) | **10 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. | **10 Hrs** |
| **UNIT – V (Blended Learning)** | |
| **SOLUTION TECHNIQUES:** Solution techniques including numerical problems for simultaneous equation, Gauss elimination and Cholesky method. Bandwidth consideration. | **10 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:** |
|---|
| • The question paper will have ten full questions carrying equal marks.<br>• Each full question will be for 20 marks.<br>• There will be two full questions (with a maximum of four sub - questions) from each unit.<br>• Each full question will have sub - question covering all the topics under a unit.<br>• 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 Mukhopadhay 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 2020-21 Batch PG (CSE)**

| Semester: I | |
|---|---|
| **Course Title: ADVANCED DESIGN OF RCC STRUCTURES** | |
| Course Code: **20CSE12** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| 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 design of slabs. Design of flat Slabs. | **12 Hrs** |
| **UNIT – II** | |
| Design of grid floors, Design of Chimneys. | **10 Hrs** |
| **UNIT – III** | |
| Design of continuous beams with redistribution of moments. Design of circular beams. | **10 Hrs** |
| **UNIT – IV** | |
| Design of silos and bunkers. | **10 Hrs** |
| **UNIT – V (Blended Learning)** | |
| Design of portal frames. Art of detailing earthquake resistant structures. | **10 Hrs** |

| **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 2020-21 Batch PG (CSE)**

| Semester: I | |
|---|---|
| **Course Title: MECHANICS OF DEFORMABLE BODIES** | |
| Course Code: **20CSE13** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| 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:**<br>Introduction: Definition of stress and strain and strain at a point, components of stress and strain at appoint 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 deviatric 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 (Blended Learning)** | |
| **Theory of Plasticity**<br>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.<br>• Each full question will be for 20 marks.<br>• There will be two full questions (with a maximum of four sub - questions) from each unit.<br>• Each full question will have sub - question covering all the topics under a unit.<br>• 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 EldininBayoumi, “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 2020-21 Batch PG (CSE)**

| Semester: I | |
|---|---|
| **Course Title: STRUCTURAL DYNAMICS** | |
| Course Code: **20CSE14** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| Hours: 52 Hrs. (L:T:P:S:4:0:0:0) | 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. | **12 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. | **10 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. | **10 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. | **10 Hrs** |
| **UNIT – V (Blended Learning)** | |
| **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. | **10 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.<br>• Each full question will be for 20 marks.<br>• There will be two full questions (with a maximum of four sub - questions) from each unit.<br>• Each full question will have sub - question covering all the topics under a unit.<br>• The students will have to answer five full questions, selecting one full question from each unit. |

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

| Reference Books: | |
|---|---|
| 1 | Theory of Vibration with applications, William Thomson, 4th 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 2020-21 Batch PG (CSE)**

| Semester: I | |
|---|---|
| **Course Title: ADVANCED DESIGN OF PRE-STRESSED CONCRETE STRUCTURES** | |
| Course Code: **20CSE151** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| Hours: 52 Hrs. (L:T:P:S:4:0:0:0) | 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 :**<br>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. | **12 Hrs** |
| **UNIT – II** | |
| **DESIGN OF SECTION FOR FLEXURE:**<br>Allowable stresses, Elastic design of simple beams having rectangular and I-section for flexure, kern lines, cable profile and cable layout.<br>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.. | **10 Hrs** |
| **UNIT – III (Blended Learning)** | |
| **DEFLECTIONS OF PRESTRESSED CONCRETE BEAMS:**<br>Short term deflections of uncracked members, Prediction of long-term deflections, load–deflection curve for a PSC beam, IS code requirements for maximum deflections. | **10 Hrs** |
| **UNIT – IV** | |
| **TRANSFER OF PRESTRESS IN PRETENSIONED MEMBERS :**<br>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. | **10 Hrs** |
| **UNIT – V** | |
| **STATICALLY INDETERMINATE STRUCTURES:**<br>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. | **10 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:** |
|---|
| • The question paper will have ten full questions carrying equal marks.<br>• Each full question will be for 20 marks.<br>• There will be two full questions (with a maximum of four sub - questions) from each unit.<br>• Each full question will have sub - question covering all the topics under a unit.<br>• 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 2020-21 Batch PG (CSE)**

| Semester: I | |
|---|---|
| **Course Title: SPECIAL CONCRETE** | |
| Course Code:**20CSE152** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| Hours: 52 Hrs. (L:T:P:S:4:0:0:0) | 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** :<br>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. | **12 Hrs** |
| **UNIT – II** | |
| **Light Weight concrete:**<br>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. | **10 Hrs** |
| **UNIT – III** | |
| **Ferro cement:**<br>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. | **10 Hrs** |
| **UNIT – IV** | |
| **Fibre reinforced concrete*:***<br>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. | **10 Hrs** |
| **UNIT – V (Blended Learning)** | |
| **High Performance concrete:**<br>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). | **10 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 Concrete mix design. |
| 3 | Summarize the different types of concrete and its materials used. |

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

| Text Books: | |
|---|---|
| 1 | Neville A.M, “Properties of Concrete” Pearson Education Asis, 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 Wiehgt concrete”- Akademiaikiado, 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 2020-21 Batch PG (CSE)**

| Semester: I | |
|---|---|
| **Course Title: DESIGN OF PRECAST AND COMPOSITE STRUCTURES** | |
| Course Code: **20CSE153** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| Hours: 52 Hrs. (L:T:P:S:4:0:0:0) | SEE Duration: 3 Hrs. |

| **Course Learning Objectives:** | |
|---|---|
| 1 | To Learn the concepts and techniques of precast construction. |
| 2 | To select or design precast elements suitable for project specific requirements. |
| 3 | To design precast systems to ensure integrity and safety of the structure and to avoid progressive collapse. |
| 4 | To design composite floors and beam elements. |

| **UNIT – I** | |
|---|---|
| **CONCEPTS , COMPONENTS, STRUCTURAL SYSTEMS AND DESIGN OF PRECAST CONCRETE FLOORS:**<br>Need and types of precast construction, Modular coordination, Precast elements- Floor, Beams, Columns and walls. Structural Systems and connections.<br>**DESIGN OF PRECAST CONCRETE FLOORS:**<br>Theoretical and Design Examples of Hollow core slabs. Precast Concrete Planks, floor with composite toppings with and without props. | **12 Hrs** |
| **UNIT – II** | |
| **DESIGN OF PRECAST REINFORCED AND PRESTRESSED CONCRETE BEAMS:**<br>Theoretical and Design Examples of ITB – Full section precast, Semi Precast, propped and uncropped conditions. Design of RC Nibs | **10 Hrs** |
| **UNIT – III** | |
| **DESIGN OF PRECAST CONCRETE COLUMNS AND WALLS:**<br>Design of braced and unbraced columns with corbels subjected to pattern and full loading. Design of Corbels<br>Design of RC walls subjected to Vertical, Horizontal loads and moments, Design of vertical ties and horizontal joints. | **10 Hrs** |
| **UNIT – IV (Blended Learning)** | |
| **DESIGN OF PRECAST CONNECTIONS AND STRUCTURAL INTEGRITY:**<br>Beam bearing, Beam half Joint, Steel Inserts, Socket Connection, Structural integrity, Avoidance of progressive collapse, Design of Structural Ties. | **10 Hrs** |
| **UNIT – V** | |
| **DESIGN OF STEEL CONCRETE COMPOSITE FLOORS AND BEAMS COMPOSITE FLOORS:**<br>Profiled Sheeting with concrete topping, Design method, Bending and Shear Resistance of Composite Slabs, Serviceability Criteria, Design Example<br>**COMPOSITE BEAMS:**<br>Elastic Behaviour, Ultimate Load behavior of Composite beams, Stresses and deflection in service and vibration, Design Example of Simply Supported beams. | **10 Hrs** |

| **Course Outcomes:** The students will be able to | |
|---|---|
| 1 | Achieve Knowledge of design and development of problem solving skills. |
| 2 | Explore the concept of precast construction. |
| 3 | Learn the principles and Design of Precast and Composite Structures. |

| **Question paper pattern:** |
|---|
| • The question paper will have ten full questions carrying equal marks.<br>• Each full question will be for 20 marks.<br>• 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.<br>• The students will have to answer five full questions, selecting one full question from each unit. |

| **Text Books:** | |
|---|---|
| 1 | R.P.Johnson: Composite Structure of Steel and Concrete (Volume 1), Blackwell Scientific Publication (Second Edition), U.K., 1994. |
| 2 | S.Ramachandramurthy,Desihn & Construction of Precast Structures, Dipti Press OPC Private Limited – Chennai. |
| 3 | R.P.Johnson, Composite structures of Steel & Concrete,Blackwell Publishers. |

| **Reference Books:** | |
|---|---|
| 1 | Hubert Bachmann, Alfred Steinle, Design of Precast Concrete Structures,Ernst & John Publications. |
| 2 | David Sheppard – "Plant cast, Precast and Prestressed concrete – McGraw Hill; 1989. |
| 3 | NBC – 2005 ( Part I to Part VII) BIS Publications, New Delhi, IS 15916- 2011,IS 11447,IS6061 – I and III |
| 4 | Hass A.M. – Precast Concrete – Design and applications Applied Science, 1983. |
| 5 | IS: 11384, Code of Practice for Composite Construction in Structural Steel and Concrete. |

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

**Syllabus for 2020-21 Batch PG (CSE)**

| Semester: I | |
|---|---|
| **Course Title: RELIABILITY ANALYSIS OF STRUCTURES** | |
| Course Code: **20CSE154** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 100 |
| Credits: 03 | |
| Hours: 52 Hrs. (L:T:P:S:4:0:0:0) | 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:**<br>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 | **11 Hrs** |
| **UNIT – II** | |
| **Probability Concepts:**<br>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. | **11 Hrs** |
| **UNIT – III** | |
| **Random variables:**<br>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. | **10 Hrs** |
| **UNIT – IV** | |
| **Reliability Analysis:**<br>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) | **10 Hrs** |
| **UNIT – V (Blended Learning)** | |
| **System reliability:**<br>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:<br>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. | **10 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:** |
|---|
| • The question paper will have ten full questions carrying equal marks.<br>• Each full question will be for 20 marks.<br>• There will be two full questions (with a maximum of four sub - questions) from each unit.<br>• 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 | Nathabdndu, T., Kottegoda, 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 2020-21 Batch PG (CSE)**

| Semester: I | |
|---|---|
| **Course Title: OPTIMIZATION TECHNIQUES** | |
| Course Code: **20CSE161** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| Hours: 52 Hrs. (L:T:P:S:4:0:0:0) | 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:**<br>Introduction to optimization, engineering applications of optimization, Formulation of structural optimization problems as programming problems.<br>**Optimization Techniques**:<br>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. | **12 Hrs** |
| **UNIT – II** | |
| **Linear Programming:**<br>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. | **10 Hrs** |
| **UNIT – III** | |
| **Non-linear programming:**<br>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. | **10 Hrs** |
| **UNIT – IV** | |
| **Constrained optimization**:<br>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. | **10 Hrs** |
| **UNIT – V (Blended Learning)** | |
| **Geometric programming:**<br>Geometric programming, conversion of NLP as a sequence of LP/ Geometric programming.<br>**Dynamic programming:**<br>Dynamic programming conversion of NLP as a sequence of LP/ Dynamic programming. | **10 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.<br>• Each full question will be for 20 marks.<br>• There will be two full questions (with a maximum of four sub - questions) from each unit.<br>• Each full question will have sub - question covering all the topics under a unit.<br>• 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 2020-21 Batch PG (CSE)**

| Semester: I | |
|---|---|
| **Course Title: COMPOSITES AND SMART MATERIALS** | |
| Course Code: **20CSE162** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| 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 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. | **12 Hrs** |
| **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<br>First fly failure, vibration and buckling analysis. Sandwich structure face and core materials, secondary failure modes environmental effects, manufacturing of composites. | **10 Hrs** |
| **UNIT – III** | |
| Introduction to smart materials and structures – piezoelectric materials – coupled electromechanical constitutive relations – depoling and coercive field – field – strain relation – hysterics – creep – strain rate effects – manufacturing. | **10 Hrs** |
| **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. | **10 Hrs** |
| **UNIT – V (Blended Learning)** | |
| 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. | **10 Hrs** |

| **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. Mukhopadhya- Universities Press 2009 |
| 2 | Robart 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 2020-21 Batch PG (CSE)**

| Semester: I | |
|---|---|
| **Course Title: ADVANCED STRUCTURAL MECHANICS** | |
| Course Code: **20CSE163** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| Hours: 52Hrs (L:T:P:S:4:0:0:0) | SEE Duration: 3 Hrs. |

| **Course Learning Objectives:** | |
|---|---|
| 1 | To make students to acquaint with the principles of structural mechanics to solve Civil / Structural Engineering problems. |
| 2 | To make students to acquaint with the principles of Plastic analysis of structures. |
| 3 | To make students to acquaint with the lateral load analysis. |

| **UNIT – I** | |
|---|---|
| **Influence Line Diagram for Indeterminate Structures (ILD):** Muller Breslau principle for determinate and indeterminate structures, Influence lines for bending moment and shear forces in continuous beams. | **12 Hrs** |
| **UNIT – II** | |
| **Kani's Rotation Contribution method for unsymmetrical frames:** Kani's method for the analysis of symmetric and asymmetric frames. | **10 Hrs** |
| **UNIT – III** | |
| **Plastic Analysis of Structures**: Basic principles and advantages. plastic moment, plastic hinge, shape factors and computation of shape factors for different cross sectional shapes, Plastic collapse, mechanism conditions, types of mechanisms, combined/composite mechanisms, theorems, applications to the analysis of simple and continuous beams | **10 Hrs** |
| **UNIT – IV** | |
| **Plastic Analysis of Frames and Gable Structures and Plastic Design:** Combined / Composite mechanisms and plastic analysis of frames, Instantaneous centre of rotation, minimum weight design, plastic design of beams and frames. | **10 Hrs** |
| **UNIT – V (Blended Learning)** | |
| **Analysis of Building Frames for Vertical and Lateral Loads** Analysis of frames subjected to horizontal/lateral loads: portal method, cantilever method, and factor method, Substitute frame method of analysis/two cycle moment distribution for vertical loads. | **10 Hrs** |

| **Course Outcomes:** The students will be able to | |
|---|---|
| 1 | Understand the principles of influence lines for calculation of moments and forces. |
| 2 | Perform analysis of frames by Kani's method. |
| 3 | Perform Plastic analysis and design of structures. |
| 4 | Analyze the structures subjected to different types of vertical and lateral loadings. |

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

| **Text Books:** | |
|---|---|
| 1 | Reddy C.S, Basic Structural Analysis, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1997. |
| 2 | Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers, Tata McGraw Hill Edition, New Delhi, Third Edition, 2000, ISBN 0-07-042139-0. |

| | |
|---|---|
| 3 | N. Krishnaraju and K.U. Muthu, Numerical Methods for Engineering Problems, MACMILLAN India Ltd., 1992, SBN 033390-973-9. |

| **Reference Books:** | |
|---|---|
| 1 | Wang C.K, Intermediate Structural Analysis, McGraw Hill Publishing Co., USA, 1983. |
| 2 | Pandit G.S and Gupta S.P, Structural Analysis, Tata McGraw Hill, New Delhi, 2001. |
| 3 | Rajasekaran S and Sankarasubramanian G, Computational Structural Mechanics, Prentice Hall of India, New Delhi, 2001. |

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

**Syllabus for 2020-21 Batch PG (CSE)**

| Semester: I | |
|---|---|
| **Course Title: EARTH AND EARTH RETAINING STRUCTURES** | |
| Course Code: **20CSE164** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| Hours: 52 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:**<br>Types of slopes, causes and type of failure of slopes. Factor of safety, Stability analysis of Infinite slopes by limiting equillbrium condition, Stability analysis of finite slopes by Swedish slip circle method, Method of slices, Fellineous method, Taylor's stability number. Stability of slopes under steady seepage, sudden drawdown and during construction. | **11 Hrs** |
| **UNIT – II (Blended Learning)** | |
| **SEEPAGE ANALYSIS:**<br>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. | **10 Hrs** |
| **UNIT – III** | |
| **LATERAL EARTH PRESSURE:**<br>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). | **11 Hrs** |
| **UNIT – IV** | |
| **RETAINING WALLS:**<br>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. | **10 Hrs** |
| **UNIT – V** | |
| **BULK HEADS:**<br>Cantilever sheet pile walls and Anchored cantilever sheet pile walls in cohesion less soils and in clay.<br>**BRACED CUTS:**<br>Lateral earth pressure on sheeting and Design of various components of bracings. | **10 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.<br>• Each full question will be for 20 marks.<br>• There will be two full questions (with a maximum of four sub - questions) from each unit.<br>• 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 2020-21 Batch PG (CSE)**

| Semester: I | |
|---|---|
| **Course Title: STRUCTURAL ENGINEERING LABOROTARY** | |
| Course Code: **20CSEL17** | CIE + Record + SEE Marks |
| Credits: 02 | = 20 + 30 + 50 = 100 |
| 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 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 | **12 Hrs** |
| **UNIT – II** | |
| Experiments on Concrete, including Mix design | **9 Hrs** |
| **UNIT – III** | |
| Experiments on vibration of multi storey frame models for Natural frequency and modes. | **9 Hrs** |
| **UNIT – IV (Blended Learning)** | |
| Use of Nondestructive testing (NDT) equipments – Rebound hammer, Ultra sonic pulse velocity meter and Profometer. | **9 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. |

**Note:**
Two questions are to be set from each Unit of 20 marks each and Answer at least one question from each unit.

**References:**
NPTL.Com, IISc, Code Books. IS: 456-2000, IS: 10262-2009

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

**Syllabus for 2020-21 Batch PG (CSE)**

| Semester: I | |
|---|---|
| **Course Title: TECHNICAL SEMINAR** | |
| Course Code: **20CSES18** | CIE = 50 Marks |
| Credits: 02 | |
| Hours: 28 Hrs. (L:T:P:S:0:2:0:0) | |

| **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 | 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, 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 seminar reported 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 and chose appropriate topic of relevance. |
| 2 | Assimilate literature on technical articles of specified topic and develop comprehension. |
| 3 | Write technical report. |
| 4 | Design and develop presentation on a given technical topic. |

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

**Syllabus for 2020-21 Batch PG (CSE)**

| Semester: II | |
|---|---|
| **Course Title: ADVANCED DESIGN OF STEEL STRUCTURES** | |
| Course Code: **20CSE21** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 04 | |
| Hours: 52 Hrs. (L:T:P:S:4:0:0:0) | 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. | **12Hrs** |
| **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. | **10Hrs** |
| **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). | **10Hrs** |
| **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. | **10Hrs** |
| **UNIT – V (Blended Learning)** | |
| **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. | **10Hrs** |

| **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 | ✓ | | | | | ✓ |

**Syllabus for 2020-21 Batch PG (CSE)**

| Semester: II | |
|---|---|
| **Course Title: EARTHQUAKE RESISTANT STRUCTURES** | |
| Course Code:**20CSE22** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| 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 devises, base isolation systems. | **12 Hrs** |
| **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** |
| **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** |
| **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** |
| **UNIT – V (Blended Learning)** | |
| 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** |

| **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:**

- 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 | 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 2020-21 Batch PG (CSE)**

| Semester: II | |
|---|---|
| **Course Title: FINITE ELEMENT METHOD OF ANALYSIS** | |
| Course Code:**20CSE23** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| Hours: 52 Hrs. (L:T:P:S:4:0:0:0) | SEE Duration: 3 Hrs. |

| **Course Learning Objectives:** | |
|---|---|
| 1 | To learn principles of Analysis of Stress and Strain. |
| 2 | To apply the Finite Element Method for the analysis of one and two dimensional problems. |
| 3 | To analyze the structure by force / flexibility approach based on direct approach and energy based methods. |

| **UNIT – I** | |
|---|---|
| Basic concepts of elasticity – Kinematic and Static variables for various types of structural problems – approximate method 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 & disadvantages – Finite element procedure. Finite elements used for one, two & three dimensional problems – Element aspect ratio – mesh refinement vs. higher order elements – Numbering of nodes to minimize band width. | **12 Hrs** |
| **UNIT – II** | |
| Nodal displacement parameters – Convergence criterion – Compatibility requirements – Geometric invariance/Pascal Triangle – Shape function – Polynomial form of displacement function, Hermitian Polynomial, Generalized and Natural coordinates – Lagrangian interpolation function, – shape functions for one, two & three dimensional elements. | **10 Hrs** |
| **UNIT – III** | |
| 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. | **10 Hrs** |
| **UNIT – IV** | |
| Application of Finite Element Method for the analysis of one & two dimensional problems - Analysis of simple beams and plane trusses – Application to plane stress / strain / axisymmetric problems using CST & Quadrilateral Elements. | **10 Hrs** |
| **UNIT – V (Blended Learning)** | |
| Application to Plates & Shells- Choice of displacement function (C, C and C type) – Techniques for Non – linear Analysis. | **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:** |
|---|
| • The question paper will have ten full questions carrying equal marks.<br>• Each full question will be for 20 marks.<br>• There will be two full questions (with a maximum of four sub - questions) from each unit.<br>• Each full question will have sub - question covering all the topics under a unit.<br>• 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 Elemnts 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" - 3rd 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 2020-21 Batch PG (CSE)**

| Semester: II | |
|---|---|
| **Course Title: DESIGN CONCEPTS OF SUBSTRUCTURES** | |
| Course Code: **20CSE24** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 100 |
| Credits: 03 | |
| Hours: 52 Hrs. (L:T:P:S:4:0:0:0) | 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:**<br>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. | **10 Hrs** |
| **UNIT – II** | |
| **Bearing capacity of Shallow Foundations:**<br>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. | **11 Hrs** |
| **UNIT – III** | |
| **Proportioning of Shallow Foundations:**<br>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. | **10 Hrs** |
| **UNIT – IV** | |
| **Pile Foundations:**<br>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. | **11 Hrs** |
| **UNIT – V (Blended Learning)** | |
| **Drilled Piers and Caissons:**<br>Construction of drilled pier, Construction of open caisson, Pneamatic caisson and floating caisson.<br>**Well foundations:**<br>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. | **10 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.<br>• Each full question will be for 20 marks.<br>• There will be two full questions (with a maximum of four sub - questions) from each unit.<br>• 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 2020-21 Batch PG (CSE)**

| Semester: II | |
|---|---|
| **Course Title: DESIGN OF TALL STRUCTURES** | |
| Course Code: **20CSE251** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| 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 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:**<br>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 | **12 Hrs** |
| **UNIT – II** | |
| **Wind loading**:<br>Static and dynamic approach, Analytical and wind tunnel experimentation method.<br>**Earthquake loading**:<br>Equivalent lateral force, modal analysis, combinations of loading, working stress design, Limit state design, Plastic design. | **10 Hrs** |
| **UNIT – III** | |
| **Behavior of Various Structural Systems:**<br>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. | **10 Hrs** |
| **UNIT – IV** | |
| **Analysis and Design:**<br>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. | **10 Hrs** |
| **UNIT – V (Blended Learning)** | |
| **Stability of Tall Buildings:**<br>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 n 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. | **10 Hrs** |

| **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.<br>• Each full question will be for 20 marks.<br>• 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.<br>• 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 2020-21 Batch PG (CSE)**

| Semester: II | |
|---|---|
| **Course Title: REPAIR AND REHABILITATION OF STRUCTURES** | |
| Course Code: **20CSE252** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| Hours: 52 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:**<br>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. | **12 Hrs** |
| **UNIT – II** | |
| **Influence on Serviceability and Durability**:<br>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. | **10 Hrs** |
| **UNIT – III** | |
| **Maintenance and Repair Strategies:**<br>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. | **10 Hrs** |
| **UNIT – IV** | |
| **Materials for Repair:**<br>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, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning. | **10 Hrs** |
| **UNIT – V (Blended Learning)** | |
| **Examples of Repair to Structures:**<br>Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weatherir wear, fire, leakage, marine exposure, engineered demolition techniques for dilapidated structures case studies | **10 Hrs** |

| **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. |

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

| 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 2020-21 Batch PG (CSE)**

| Semester: II | |
|---|---|
| **Course Title: STABILITY OF STRUCTURES** | |
| Course Code: **20CSE253** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 100 |
| Credits: 03 | |
| Hours: 52 Hrs. (L:T:P:S:4:0:0:0) | 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.**<br>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 pined – pined, fixed – fixed, fixed – free and fixed – pinned column. | **11 Hrs** |
| **UNIT – II** | |
| **Buckling of frames and continuous beams.**<br>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 | **10 Hrs** |
| **UNIT – III** | |
| **Stability analysis by finite element approach.**<br>Deviation of shape function for a two nodded 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. | **11 Hrs** |
| **UNIT – IV** | |
| **Lateral buckling of beams.**<br>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. | **10 Hrs** |
| **UNIT – V (Blended Learning)** | |
| Expression for strain energy in plate bending with in plate forces (linear and non – linear). Buckling of simply supported rectangular plate<br>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. | **10 Hrs** |

| **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:** |
|---|
| • The question paper will have ten full questions carrying equal marks.<br>• Each full question will be for 20 marks.<br>• There will be two full questions (with a maximum of four sub - questions) from each unit.<br>• 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 2020-21 Batch PG (CSE)**

| Semester: II | |
|---|---|
| **Course Title: DESIGN OF PLATES AND SHELLS** | |
| Course Code: **20CSE254** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| Hours: 52 Hrs. (L:T:P:S:4:0:0:0) | 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. | **12Hrs** |
| **UNIT – II** | |
| Energy methods for rectangular and circular plates with simply supported and clamped edges subjected to symmetric loadings, Raleigh-Ritz. Method. | **10Hrs** |
| **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. | **10Hrs** |
| **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. | **10Hrs** |
| **UNIT – V (Blended Learning)** | |
| 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. | **10Hrs** |

| **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:**

- 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 | 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. |

| **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 2020-21 Batch PG (CSE)**

| Semester: II | |
|---|---|
| **Course Title: DESIGN OF INDUSTRIAL STRUCTURES** | |
| Course Code: **20CSE261** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| 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 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 | **12 Hrs** |
| **UNIT – II** | |
| Analysis and design of gantry column (stepped column / column with bracket), purlins, girts, bracings including all connections. | **10 Hrs** |
| **UNIT – III** | |
| Analysis of transmission line towers for wind load and design of towers including all connections. | **10 Hrs** |
| **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. | **10 Hrs** |
| **UNIT – V (Blended Learning)** | |
| Concept of Pre-engineered buildings, Design of compression and tension members of cold formed light guage sections, Design of flexural members (Laterally restrained/laterally unrestrained). | **10 Hrs** |

| **Course Outcomes:** The students will be able to | |
|---|---|
| 1 | Design the components of industrial buildings. |
| 2 | Design the components of transmission towers |
| 3 | Understand the use of light gauge sections |
| 4 | To evaluate the performance of Pre-engineered buildings |

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

| **Text Books** | |
|---|---|
| 1 | Jurgen Axel Adam, Katharria Hausmann, Frank Juttner, Klauss Daniel, Industrial Buildings: A Design Manual, Birkhauser Publishers, 2004. |
| 2 | B.C. Punmia, A.K. Jain "Design of Steel Structures", Laxmi Publications, New Delhi**.** |

| **Reference Books:** | |
|---|---|
| 1 | Santhakumar A.R. and Murthy S.S., Transmission Line Structures, Tata McGraw Hill, 1992. |

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

**Syllabus for 2020-21 Batch PG (CSE)**

| Semester: II | |
|---|---|
| **Course Title: THEORY OF PLASTICITY AND FRACTURE MECHANICS** | |
| Course Code: **20CSE262** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| Hours: 52Hrs (L:T:P:S:4:0:0:0) | 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**<br>General concept, yield criteria, flow rules for perfectly plastic and strain hardening materials-simple applications, Theories of failure. Plasticity models for concrete | **12 Hrs** |
| **UNIT – II** | |
| **Linear Elastic Fracture mechanics**<br>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. | **10 Hrs** |
| **UNIT – III** | |
| **Elasto-plastic fracture mechanics**<br>Crack-tip plasticity and in metals. Mixed mode problems and evaluation of critical fracture parameters. | **10 Hrs** |
| **UNIT – IV** | |
| **Fatigue damage theories**<br>Fatigue test, endurance limit, fatigue fracture under combined loading, fatigue controlling factors, cumulative fatigue damage concepts. | **10 Hrs** |
| **UNIT – V (Blended Learning)** | |
| **Fracture of Concrete**<br>Review of concrete behaviour in tension and compression, Basic frame works for modelling of quasi-brittle materials, discrete crack concept/Smeared crack concept. FE Concepts and applications. | **10 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.<br>• Each full question will be for 20 marks.<br>• There will be two full questions (with a maximum of four sub - questions) from each unit.<br>• Each full question will have sub - question covering all the topics under a unit.<br>• 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. |

| **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 2020-21 Batch PG (CSE)**

| Semester: II | |
|---|---|
| **Course Title: MASONRY STRUCTURES** | |
| Course Code: **20CSE263** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| Hours: 52 Hrs. (L:T:P:S:4:0:0:0) | 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. | **10 Hrs** |
| **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. | **10 Hrs** |
| **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. | **10 Hrs** |
| **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. | **12 Hrs** |
| **UNIT – V (Blended Learning)** | |
| **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. | **10 Hrs** |

| **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.<br>• Each full question will be for 20 marks.<br>• There will be two full questions (with a maximum of four sub - questions) from each unit.<br>• Each full question will have sub - question covering all the topics under a unit.<br>• 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 2020-21 Batch PG (CSE)**

| Semester: II | |
|---|---|
| **Course Title: DESIGN OF CONCRETE BRIDGE STRUCTURES** | |
| Course Code: **20CSE264** | CIE + Assignment + Group Activity + Seminar + SEE Marks = 30 + 10 + 5 + 5 + 50 = 100 |
| Credits: 03 | |
| Hours: 52 Hrs. (L:T:P:S:4:0:0:0) | 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. | **12 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. | **10 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. | **10 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. | **10 Hrs** |
| **UNIT – V (Blended Learning)** | |
| **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. | **10 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.<br>• Each full question will be for 20 marks.<br>• There will be two full questions (with a maximum of four sub - questions) from each unit.<br>• Each full question will have sub - question covering all the topics under a unit.<br>• 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 2020-21 Batch PG (CSE)**

| Semester: II | |
|---|---|
| **Course Title: COMPUTATIONAL STRUCTURAL LABORATORY** | |
| Course Code: **20CSEL28** | CIE + SEE Marks = 50 + 50 |
| Credits: 02 | |
| Hours: 39 Hrs. (L:T:P:S:0:0:3:0) | 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). | **12 Hrs** |
| **UNIT – II** | |
| Design of RCC and Steel structure using software (ETABS /STAADPRO). | **09 Hrs** |
| **UNIT – III** | |
| Analysis of folded plates and shells using software. | **09 Hrs** |
| **UNIT – IV (Blended Learning)** | |
| Preparation of EXCEL sheets for structural design. | **09 Hrs** |

| **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 2020-21 Batch PG (CSE)**

| Semester: II | |
|---|---|
| **Course Title: Project Work Phase – I(Presentation of Synopsis)** | |
| Course Code: **20CSEP29** | CIE = 50 Marks |
| Credits: 02 | |
| Hours: 28 Hrs. (L:T:P:S:0:0:12:0) | |

| **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. |

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 2020-21 Batch PG (CSE)**

| Semester: III | |
|---|---|
| **Course Title: SELF STUDY – MASSIVE OPEN ONLINE COURSE (MOOC)*** | |
| Course Code: **20CSE31** | CIE + SEE Marks = 50 + 50 |
| Credits: 03 | |
| Hours: 39Hrs (L:T:P:S:0:8:0:0) | SEE Duration: 3 Hrs |

| **Course Learning Objectives:** | |
|---|---|
| 1 | Build self-esteem by discovering their unique abilities and characteristics. |
| 2 | Exploiting the advances in information and communication technology. |

| **Syllabus:** |
|---|
| Students shall register for MOOC during 1st /2nd /3rd semester and shall be completed before the last working day of the 3rd semester pertaining to the domain (preferably NPTEL courses).<br>The assignment and examination marks along with certificate should be submitted to the examination section. |

| **Course Outcomes:** The students will be able to | |
|---|---|
| 1 | Recognize the field of interest in the global community. |
| 2 | Develop skills for lifelong learning. |

| **Reference / Web links:** | |
|---|---|
| 1 | https://Swayam.gov.in |
| 2 | https://nptel.ac.in |

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

**Syllabus for 2020-21 Batch PG (CSE)**

| Semester: III | |
|---|---|
| **Course Title: INTERNSHIP** | |
| Course Code: **20CSEI32** | CIE + SEE Marks = 50 + 50 |
| Credits:08 | |
| Hours: 39Hrs (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:**
Internship should be completed in all respect in first 8 weeks of the course.

| **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 2020-21 Batch PG (CSE)**

| Semester: III | |
|---|---|
| **Course Title: TECHNICAL SEMINAR** | |
| Course Code: **20CSES33** | CIE + Assignment + Group Activity + Seminar + SEE Marks = |
| Credits: 02 | |
| Hours: 52 Hrs. (L:T:P:S:0:4:0:0) | 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, 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 seminar reported 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 2020-21 Batch PG (CSE)**

| Semester: III | |
|---|---|
| **Course Title: EVALUATION OF PROJECT PHASE I** | |
| Course Code: **20CSEP34** | CIE + Assignment + Group Activity + Seminar + SEE Marks = |
| Credits: 07 | |
| Hours: 52 Hrs. (L:T:P:S:0:0:12:0) | SEE Duration: |

| **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 about 25% of the objectives of their intended research.

| **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 | ✓ | ✓ | | ✓ | | ✓ |