ADVANCED STEEL DESIGN

IV Year II-Sem **L T P C**

3 0 0 3

Course Objectives: To impart knowledge on behavior and design of various connections, industrial and steel girders.

UNIT-I

Simple Connections –Bolted Pinned and Welded Connections: Bolted Connections –Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip-Critical connections – Prying Action – Combined Shear and Tension for Slip-Critical Connections. Design of Groove Welds - Design of Fillet Welds – Design of Intermittent Fillet Welds – Failure of Welds.

UNIT-II Plastic Analysis:

Introduction – Plastic Theory – Plastic neutral Axis plastic moment, Elastic & Plastic Section modulii shape factors plastic Hinge – Fundamental condition conditions in plastic analysis, methods of plastic analysis – collapse load – simply supported, propped cantilever beam, fixed beams continuous beams, portal frame single bay single storey portal frame at different level subjected to vertical and horizontal loads.

UNIT-III

Eccentric and Moment Connections: Introduction – Beams – Column Connections – Connections Subjected to Eccentric Shear – Bolted Framed Connections –Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections- Welded Bracket Connections – Moment Resistant Connections.

UNIT-IV

Analysis and Design of Industrial Buildings:

Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular truss, truss for a railway platform, Design of purlins for roofs, design of built up purlins, design of knee braced trusses and stanchions,Design of bracings.

UNIT-V

Design of Steel Truss Girder Bridges:

Types of truss bridges, component parts of a truss bridge, economic Proportions of trusses, self weight of truss girders, design of bridge Compression members, tension members; wind load on truss girder Bridges; wind effect on top lateral bracing; bottom lateral bracing; portal Bracing; swaybracing Design of Lacing.

Course Outcomes: The learner will be able to design different steel structures.

References:

1. Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education PrivateLtd. New Delhi.
2. Design of Steel Structures. P.Dayaratnam, Publisher : S. Chand, Edition 2011-12.
3. Design Steel Structures Volume – II, Dr. Ramachandra & Vivendra Gehlot Scientitic Publishes Journals Department..
4. Design of Steel Structures. P.Dayaratnam, Publisher : S. Chand, Edition 2011-12.
5. Design of Steel Structures Galyord & Gaylord, Publisher : Tata Mc Graw Hill,Education. Edition 2012.
6. Indian Standard Code – IS – 800-2007.
7. Indian Standard Code – IS – 875 – Part III - 2015

DESIGN OF FORM WORK
(PE(PG) -3)

IV Year II-Sem

L	T	P	C
3	0	0	3

Pre- requisites: Concrete Technology

Course Objectives: To impart knowledge about the design of formwork for various structural elements.

UNIT- I

Introduction: Requirements and Selection of Formwork.

UNIT- II

Formwork Materials- Timber, Plywood, Steel, Aluminum, Plastic, and Accessories. Horizontaland Vertical Formwork Supports.

UNIT- III

Formwork Design: Concepts, Formwork Systems and Design for Foundations, Walls, Columns,Slab and Beams.

Formwork Design for Special Structures: Shells, Domes, Folded Plates, OverheadWater Tanks, Natural Draft Cooling Tower, Bridges.

UNIT- IV

Flying Formwork: Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete, Formwork Management Issues –Pre- and Post-Award.

UNIT- V

Formwork Failures : Causes and Case studies in Formwork Failure, Formwork Issues in Multi-Story Building Construction.

Course Outcomes: At the end of the course, students will be able to

- Select proper formwork, accessories and material.
- Design the form work for Beams, Slabs, columns, Walls and Foundations.
- Design the form work for Special Structures.
- Understand the working of flying formwork.
- Judge the formwork failures through case studies.

Reference Books:

1. Formwork for Concrete Structures, Peurify, Mc Graw Hill India, 2015.
2. Concrete Technology by A.R. Santhakumar, Oxford Univ. Press
3. Formwork for Concrete Structures, Kumar NeerajJha, Tata McGraw Hill Education,2012.
4. IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS.

DESIGN OF HIGH RISE BUILDINGS
(PE(PG)-3)

IV Year II-Sem

L	T	P	C
3	0	0	3

Pre requisites: Structural analysis I and II

Course Objectives: To impart the knowledge about the various principles in the design of tall buildings

UNIT I

Loading and Design Principles: Loading- sequential loading, Gravity loading, Wind loading, Earthquake loading, - Equivalent lateral force, modal analysis - combination of loading, – Static and Dynamic approach - Analytical and wind tunnel experimental methods - Design philosophy - working stress method, limit state method and plastic design.

UNIT II

Behaviour of Various Structural Systems: Factors affecting growth, height and structural form. High rise behaviour, Rigid frames, braced frames, In filled frames, shear walls, coupled shear walls, wall-frames, tubulars, cores, outrigger - braced and hybrid mega systems.

UNIT III

Analysis And Design: Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of buildings as total structural system considering overall integrity and major subsystem interaction, Analysis for member forces, drift and twist - Computerized three dimensional analysis – Assumptions in 3D analysis – Simplified 2D analysis.

UNIT IV

Structural Elements: Sectional shapes, properties and resisting capacity, design, deflection, cracking, prestressing, shear flow, Design for differential movement, creep and shrinkage effects, temperature effects and fire resistance.

UNIT V

Stability of Tall Buildings: Overall buckling analysis of frames, wall- frames, Approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first-order and P-Delta analysis, Translational, Torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation.

Course Outcomes: At the end of the course, students will be able to analyze a tall building for various loads.

References:

1. Taranath B.S., “Structural Analysis and Design of Tall Buildings”, McGraw Hill, 1988.
2. Beedle.L.S., “Advances in Tall Buildings”, CBS Publishers and Distributors, Delhi, 1986.
3. Bryan Stafford Smith and Alexcoull, “Tall Building Structures - Analysis and Design”, JohnWiley and Sons, Inc., 2005.

4. Gupta.Y.P.,(Editor), Proceedings of National Seminar on High Rise Structures - Design and Construction Practices for Middle Level Cities, New Age International Limited, New Delhi,1995.
5. Lin T.Y and Stotes Burry D, “Structural Concepts and systems for Architects and Engineers”, John Wiley, 1988.

ADVANCED STRUCTURAL CONCRETE LABORATORY

IV Year II-Sem

L	T	P	C
0	0	4	2

Pre-requisites: Concrete Technology.

Course Objectives:

- To understand the behaviour of cementitious composite systems inclusive of the effects of particulate and fibrous ingredients.
- To analyze and evaluate the performance of structural elements in the laboratory an field.
- To decide upon the type of material to be used for a particular exposure condition.
- To evaluate parameters required to determine the service life of structures.

List of Experiments/Assignments:

A. Tests on following Fresh Concretes:

Self- Compacting Concrete, High Strength Concrete, Normal Strength Concrete

The tests shall include.

1. Mix Design.
2. Workability tests.
3. Material characterization of ingredients.
    a. Specific gravity test.
    b. Water absorption test.
    c. Gradation Analysis (Sieve Analysis).
    d. Tests on setting times.

B. Tests on Hardened Concrete:

1. Compression test on High strength Concrete Cubes and Cylinders.
2. Flexure tests on Normal strength concrete under reinforced, Over reinforced and balancedbeams.
3. Flexure tests on Normal strength concrete beams with and without Shear reinforcement.

C. Durability Tests:

4. Water Permeability.
5. Rapid Chloride Permeability Test.
6. Carbonation tests.
7. Half-cell potential test.

D. Non-Destructive testing of concrete using rebound hammer & ultrasonic pulse velocity.

Course Outcomes: After completion of the course, students should be able to

- Design normal and special concretes and evaluate the parameters affecting its performance.
- Conduct Non-Destructive Tests on existing concrete structures.
- Apply engineering principles to understand mechanical and durability characteristics of structural elements.
- Evaluate the corrosion characteristics through RCPT and ACC tests.

Reference Books:

1. Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall, 2012.
2. Concrete Technology, Shetty M. S., S. Chand and Co., 2006.
3. Concrete Technology by A.R. Santhakumar, Oxford University Press.

RESEARCH METHODOLOGY AND IPR

IV Year II-Sem

L	T	P	C
2	0	0	2

UNIT –I :

Meaning of research problem, Sources of research problem, Criteria Characteristicsof a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT - II:

Effective literature studies approaches, analysisPlagiarism,
Research ethics.

UNIT - III:

Effective technical writing, how to write report, Paper

Developing a Research Proposal, Format of research proposal, a presentation and assessmentby a review committee.

UNIT - IV:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process ofPatenting and Development: technological research, innovation, patenting, development.

International Scenario: International cooperation on Intellectual Property. Procedure forgrants of patents, Patenting under PCT.

UNIT - V:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT - VI:

New Developments in IPR: Administration of Patent System. New developments inIPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case

Studies, IPR and IITs.

Course Outcomes:

At the end of this course, students will be able to

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction forscience & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

FINITE ELEMENT METHODS IN STRUCTURAL ENGINEERING

V Year I-Sem

L	T	P	C
3	0	0	3

Objectives: The objectives of this course is to impart knowledge of

- About the fundamentals of domain discretization, interpolation, application of boundary conditions, assembly of global matrices, and solution of the resulting algebraic systems.
- Understand the core concepts of variational and weighted residual methods in FEM.
- Derive the element stiffness matrix for 1-D, 2-D and 3-D problems.
- Formulate the simple structural problems in to finite elements.

UNIT – I

Introduction to FEM: Types of Problems–Types of Materials–Elastic / Inelastic situations– Types of forces: Body forces / Surface Traction / Point loads – Deformable bodies – Types of Deformations – Homogeneous / Non homogeneous Problems – Equations of equilibrium for elastic 2-D / 3-D continua - Equilibrium equations for 2-D / 3-D boundary elements – Boundary conditions.

– Strain-displacement relation for 2-D / 3-D – Stress-strain relation for 2-D / 3-D – Plane stress / Plane strain problems.

Virtual Work Formulation: Application to problems of plane trusses with static indeterminacy not exceeding three.

Finite Difference Method with Central Differences: Solving ODE's and PDE's with central differences. Application to beam and plate bending problems of simple geometry.

UNIT – II

Variational Formulation: Finite Element Formulation - Stationarity of Functional–Given the Functional or Differential equation – Number of elements limited to two.

1-D Elements: Strain-displacement relation matrix / stiffness matrix / Minimum Potential Energy Approach / Rayleigh-Ritz Method / introduction to natural coordinates / stiffness matrix of second order bar element / Axial bar subjected to point loads, body forces and surface traction forces / Problems with kinematic indeterminacy not exceeding two.

Triangular Elements: Displacement models / criterion for convergence / geometric invariance /conforming and non-conforming elements - 3-node triangular elements (CST) / determination of strain-displacement matrix / area coordinates-shape functions / determination of element stiffness and load matrices, assembling global stiffness and load matrices / Problems with kinematic indeterminacy not exceeding three.

2nd Order triangular elements: Shape functions–degradation technique / strain-displacement matrix /Expression for stiffness matrix / Load matrices due to body forces and surface traction.

UNIT – III

Iso-parametric elements:

Quadrilateral elements: Construction of shape functions using natural coordinates/Strain- displacement matrices/Load matrices for body force and surface traction/ Expressions for stiffness matrix, load matrices for 4-noded quadrilateral elements/ Gauss Quadrature of numerical integration / Problems with rectangular elements, kinematic indeterminacy not exceeding three.

2nd Order Quadrilateral elements: - Determination of shape functions for 2nd order quadrilateral elements and for elements of with serendipity / Strain-displacement matrices / Load matrices for body force and surface traction.

UNIT – IV

Method of Weighted Residuals:

Galerkin's Method of Weighted Residuals –Application to problems of mathematics / structural engineering, number of trial functions not exceeding two.

Galerkin's Finite Element Method –Weak form of Trial Function - Application to problems of mathematics / structural engineering, number of elements limited to two.

Axi-symmetric Problems: Strain-displacement relationship/stress-strain relationship / determination ofstiffness matrix for 3-noded ring element and load matrices for body force and surface traction/ Problems with kinematic indeterminacy not exceeding three for 3-noded ring elements only.

UNIT – V

Tetrahedron elements: Volume coordinates, Strain-displacement matrix, stiffness matrix, load matricesdue to body force and surface traction/ introduction to Hexahedron (brick) elements.

Non-linear Finite element analysis: Introduction–problems with material non-linearity– problems with geometric non-linearity – problems with both material and geometric non-linearity. **Introduction to MSC Nastran:** Illustration on different modules of Nastran / Structural engineering applications of the package/Creation of a simple 1-D model, 2-D model and a 3-D model/ analysis and post processing of the results.

Outcomes: At the end of this course, students will be able to

- Build and analyse the FEA models for various engineering problems.
- Identify the requirements and sources for analysis, design and evaluation.
- Use the standard finite element software to solve the structural engineering problems.
- Interpret the results obtained from FEA software, and arrive at the conclusions.
- To solve problems of non linear finite element.

Suggested Reading:

1. Cook, R. D. (1981). ―Concepts and Application of Finite Element Analysis, John Wileyand Sons.
2. Zienkiewicz, O. C. And Taylor, R. L, (1989). ―The Finite Element Method‖, Vol.1, McGrawHill Company Limited, London.
3. Reddy, J. N, (1993). ―An Introduction to the Finite Element Method, McGraw Hill, NewYork.
4. Chandrupatla, T. R. And Belegundu, A. D, (2001). ―Introduction to Finite Elements in Engineering, Prentice Hall of India, New Delhi.
5. Seshu. P, (2003). ―Finite Element Analysis‖, Prentice Hall of India Private Limited,

NewDelhi.

6. David V. Hutton, (2005). ―Fundamentals of Finite Element Analysis, Tata McGraw-Hill Publishing Company Limited, New Delhi.
7. Bathe, K. J, (2006). ―Finite Element Procedures‖, Prentice Hall of India, New Delhi.

EARTHQUAKE RESISTANT DESIGN OF BUILDINGS

(PE (PG) – 4)

V Year I-Sem

L	T	P	C
3	0	0	3

Prerequisites : Structural Dynamics, Reinforced Concrete Design

Objectives:
To impart knowledge on the seismology and behavior of buildings during earthquakes.

UNIT - I
Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- Plate tectonics- Seismic waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales- Energy released- Earthquake measuring instruments-Seismoscope, Seismograph, accelerograph- Characteristics of strong ground motions- Seismic zones of India.
Introduction-Functional planning-Continuous load path-Overall form-simplicity and symmetry- elongated shapes-stiffness and strength - Seismic design requirements-regular and irregular configurations-basic assumptions.

UNIT - II
Conceptual Design - Horizontal and Vertical Load Resisting Systems - System and Members for Lateral Loads and High Rise / Tall Structures.
Twisting of Buildings – Flexible Building and Rigid Building Systems.
Strength and Stiffness – Ductility – Definition – Ductility Relationships – Choice of construction Materials – Unconfined Concrete & Confined Concrete - Design Earthquake Loads – Basic Load Combinations – Permissible Stresses.
Seismic Methods of Analysis – Static Method – Equivalent Lateral Force Method. Dynamic Analysis – Response Spectrum Method.

UNIT - III
Introduction to Earthquake Resistant Design – Seismic Design Requirements and Methods.
RC Buildings – IS Code based Method.- Vertical Irregularities – Mass Irregularity Torsional Irregularity - Plan Configuration Problem - Design Lateral Force, Base Shear Evaluation – Lateral Distribution of Base Shear – Structural Walls Strategies and the Location of Structural Walls – Sectional Shapes – Behaviour of Unreinforced and Reinforced Masonry Walls – Behaviour of Walls Box Action and Bands – Behaviour of infill Walls - Non Structural Elements – Failure Mechanism of Nonstructural Elements – Effects of Nonstructural Elements on Structural System – Analysis – Prevention of Damage to Nonstructural Elements – Isolation of Non-Structures.

UNIT - IV
Design of Shear walls: Classification according to Behavior, Loads in Shear walls, Design of Rectangular and Flanged Shear walls, Derivation of Formula for Moment of Resistance of Rectangular Shear walls – Behaviour of Coupled Shear Walls.

UNIT - V

Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction- Impact of Ductility- Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility- Ductile detailing considerations as per IS 13920. Behavior of beams, columns and joints in RC buildings during earthquakes- Vulnerability of open ground storey and short columns during earthquake.
Capacity Based Design: Introduction to Capacity Design, Capacity Design for Beams and Columns-Case studies.

Outcomes : The learner will be able to analyse and design buildings to resist seismic forces.

References :

1. Earthquake Resistant Design of structures – S. K. Duggal, Oxford University Press
2. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.
3. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons
4. Masory and Timber structures including earthquake Resistant Design –Anand S.Arya,Nem chand & Bros
5. Earthquake –Resistant Design of Masonry Building –Miha Tomazevic, Imperialcollege Press.
6. Design of Reinforced Concrete Structures by N.Subramanian, Oxford UniversityPress.
7. Earthquake Tips – Learning Earthquake Design and Construction C.V.R. Murty

Reference Codes:

1. IS: 1893 (Part-1) -2016. “Criteria for Earthquake Resistant – Design of structures.” B.I.S., NewDelhi.
2. IS:4326-1993, “ Earthquake Resistant Design and Construction of Building”, Code of PracticeB.I.S., New Delhi.
3. IS:13920-2016, “ Ductile detailing of concrete structures subjected to seismic force” –Guidelines, B.I.S., New Delhi.

PRE-ENGINEERED BUILDINGS
(PE(PG)-4)

V Year I-Sem

L	T	P	C
3	0	0	3

Pre-requisites : Design of Steel Structures & Structural Analysis

Course Objectives:
To impart knowledge about pre engineered structures their analysis and design for different conditions.

UNIT-I:
Introduction to Pre-Engineered Buildings: Introduction – History - Advantages of PEB - Applications of PEB – Materials used for manufacturing of PEB. Difference between Conventional Steel Buildings and Pre-Engineered buildings.

UNIT-II:
Pre-Engineered Building Components: Primary System: Main frames, Gable End Frame - Secondary frame system: Sizes and Properties of Purlins & Girts – Bracing System: Rod, angle, Portal, Pipe bracing – Sheeting and Cladding: Roof Sheeting and Wall sheeting – Accessories: Turbo Ventilators, Ridge vents, Sky Lights, Louvers, Insulation, Stair cases, Design of PEB frame under the influence of Dead, Live, Collateral, Wind, Seismic and Other applicable Loads. Serviceability Limits as per code, Design Parameters of PEB Frames - Depth of the section, Depth to Flange width ratios, Thickness of Flange to thickness of Web ratio. d/t_w, bf/t_f ratios of sections as per IS code. Section Sizes as per Manufacturing Limitations, Analysis and Design of Rigid Frames.

UNIT-III:
PEB Frame Connection Design Methodology: Rigid Frame Moment Connection, Shear Connection, High strength bolts & grades, Lever arm, bolt Patten its effect on connection design, thickness of connection plate, Selection of governing forces for connection design.

UNIT-IV:
Mezzanine Floor Systems: Design of Mezzanine Beams, Columns and joists – Mezzanine decking, Different types of Mezzanine Floor systems – Grating, Chequered plate and Rigid floor System, Types of base plate Pinned , Fixed, strength bolts, different types of bolts & grades, Lever arm, bolt Patten its effect on connection design, thickness of connection plate, base plate size, Selection of governing forces for base connection design & Anchor bolt.

UNIT-V:
Analysis and Design of Pre-Engineered Buildings: 2D and 3D Modelling of Portal Frames, Optimization Techniques, Comparison of software output with manual calculations. Design of Cold Formed Sections i.e., Purlins and Girts, Design of Roof Sheeting , trapezoidal , Standing seam sheeting, Welding technology, Manufacturing process , Erection Procedures.

Course Outcomes:

The learner will be able to understand and design various components of pre engineered buildings and will be able to analyze and design the pre engineered buildings

References :

1. Pre-Engineered Steel Building, K.S. Vivek and P.Vyshnavi, LAP Lamdert Academic Publishing.
2. Metal building systems: Design and Specifications, Third edition, Alexander Newman, McGraw- Hill Education.

REHABILITATION AND RETROFITTING OF STRUCTURES
(PE(PG)-4)

V Year I-Sem

L	T	P	C
3	0	0	3

Pre-requisites: Reinforced Concrete Design, Steel Design, Concrete Technology.

Objectives:
To impart knowledge about different types of determination of structures testing the structures for the deterioration of structures testing the structures for the diagnosis defects and different types of repairing methods.

UNIT – I

Introduction – Definition of Repair, Retrofitting, Strengthening and rehabilitation, Deterioration of Structures – Distress in Structures – Causes and Prevention, Mechanism of Damage – Types of Damage, Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake

UNIT – II

Corrosion of Steel Reinforcement – Causes – Mechanism and Prevention. Damage of Structures due to Fire – Fire Rating of Structures – Phenomena of Desiccation, Damage Assessment, Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems, **I**nfluence 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.

UNIT – III

Maintenance and Retrofitting Techniques: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post- tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building, Inspection and Testing – Symptoms and Diagnosis of Distress -Damage assessment – NDT.

UNIT – IV

Repair of Structure – Common Types of Repairs – Repair in Concrete Structures – Repairs in Under Water Structures – Guniting – Shot Create – Underpinning. Strengthening of Structures – Strengthening Methods – Retrofitting – Jacketing.

UNIT – V

Materials for Repair and Retrofitting: Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, 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. Health Monitoring of Structures – Use of Sensors – Building Instrumentation.

Course Outcomes: After studying this course, students will be able to:

- Understand the cause of deterioration of concrete structures.
- Able to assess the damage for different type of structures.
- Summarize the principles of repair and rehabilitation of structures.
- Recognize ideal material for different repair and retrofitting technique.

References:

1. Concrete Technology by A.R. Santa Kumar, Oxford University press
2. Defects and Deterioration in Buildings, E F & N Spon, London
3. Non-Destructive Evaluation of Concrete Structures by Bungey - Surrey University Press
4. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, StandardPublications.
5. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ranso,(1981)
6. Building Failures : Diagnosis and Avoidance, EF & N Spon, London, B. A. Richardson, (1991).
7. "Deterioration, Maintenance and Repair of Structures ", Sidney, M. Johnson
8. "Concrete Structures – Materials, Maintenance and Repair"- Denison Campbell, Allen & HaroldRoper, Longman Scientific and Technical.
9. "Learning for failure from Deficiencies in Design, Construction and Service" R.T.Allen and
   S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons Raiker R.N., - R&D Center(SDCPL).

GREEN BUILDING TECHNLOGIES

(Open Elective – PG)

V Year I-Sem

L	T	P	C
3	0	0	3

Course Objectives:

- Exposure to the green building concepts and their significance.
- Understand the judicious use of energy and its management.
- Enhance awareness of end-user energy requirements in the society.
- Develop suitable technologies for energy management.

UNIT-I

Overview of the significance of energy use and energy processes in building - Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

UNIT-II

Indoor environmental requirement and management - Thermal comfort - Ventilation and air quality – Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement.

UNIT-III

Climate, solar radiation and their influences - Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT-IV

End-use, energy utilization and requirements - Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building. Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer.

UNIT-V

Energy management options - Energy audit and energy targeting - Technological options for energy management.

Course Outcomes:

After completing this course, the student will

- Understand the fundamentals of energy use and energy processes in building.
- Identify the energy requirement and its management.
- Identify the Sun-earth relationship vis-a-vis its effect on climate.
- Extract the end-user energy requirements.
- Understand the audit procedures of energy.

Text books *:*

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

References:

1.Sahni, Pardeep et.al. (eds.) 2002, Disaster Mitigation Experiences and Reflections.
2.Prentice Hall of India, New Delhi.
3.Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.

Online Resourses:

1.https://nptel.ac.in/courses/105/102/105102195

DISSERTATION PHASE -I

V Year I-Sem

L	T	P	C
0	0	20	10

ADVANCED STRUCTURAL DESIGN LABORATORY

V Year I - Sem

L	T	P	C
0	0	4	2

Pre-requisites: RCC and Steel design.

Course Objectives:

- To model the beams, frames and trusses.
- To analyze the beams, frames and trusses.
- To interpret the results from post processing.

List of Experiments

1. Analysis of a Bridge Deck by Grillage Analogy.
2. Analysis and Design of a PEB Structure.
3. Analysis and design of a Gantry Girder.
4. Analysis and design of a High Rise Multi storied Building.
5. Analysis and design of a Highrise Multi storey Building with shear wall.
6. Analysis and design of a Highrise Multi storey Building with Flat Slab System.
7. Analysis and design of Flat Slab Raft foundation.
8. Analysis and design of Beam Slab Raft foundation.

Course Outcomes: After completion of the course, students should be able to

- Analyze the Beams, Portal Frames and Trusses.
- Analyze and Design of Multistory RC Buildings for various loads.
- Analyze and Design of PEB components.
- Analyse and design raft foundations.

DISSERTATION PHASE -II

V Year II-Sem	L	T	P	C
	0	0	32	16