ELECTIVES

140ST9111 STRUCTURAL OPTIMIZATION 3 0 0 3

AIM:

The aim of the course is to expose students to the principles and methods of optimization techniques involved in structural Engineering

OBJECTIVES:

Students should be able:

- To understand theory of linear and non linear programming.
- To solve problems of conversion of a final value problem into an initial value problem
- To solve dynamic programming in optimization
- To apply concepts on practical structures subjected to dynamic loading as well

UNIT I INTRODUCTION TO OPTIMIZATION 9

Introduction-Engineering applications of optimization-statement of an optimization problem-classification of optimization problems-optimization techniques

UNIT II LINEAR PROGRAMMING 9

Standard form of a linear programming problem-Geometry of linear programming problems-simplex method-basic solution-computation-maximization and minimization. Duality in linear programming-General primal-Dual relations-Dual simplex method-revised simplex method.

UNIT III NON-LINEAR PROGRAMMING 9

One Dimensional minimization methods-Dichotomous search - Fibonacci Method - Golden section method. Unconstrained optimization Techniques-classification-direct search, pattern search, cauchy's steepest descent method and davidon Fletcher powell method. Constrained function of a single variable-several variables.

UNIT IV DYNAMIC PROGRAMMING 9

Multistage decision processes-representation and types-concept of sub-optimization problems and the principle of optimality-conversion of a final value problem into an initial value problem-linear programming as a case of dynamic programming.

UNIT V STRUCTURAL APPLICATIONS 9

Methods for optimal design of structural elements, continuous beams and single storied frames using plastic theory - Minimum weight design for truss members - Fully stressed design - Optimization principles to design of R.C. structures such as multistorey buildings, water tanks and bridges.

L: 45, T: 0, Total: 45

REFERENCES:

1. Rao,S.S. Engineering Optimization: Theory and Practice, 3rd Edition, New Age International, New Delhi, 2010.
2. Belegundu A.D., Chandrupatla T.R., Optimization Concepts and Applications in Engineering, 2nd Edition, Cambridge University Press, Delhi, 2011.
3. Christensen P.W., Klarbring A., An Introduction to Structural Optimization, Springer, 2008.
4. Spunt L., Optimization in Structural Design, Prentice-Hall, New Jersey, 1971.
5. Iyengar.N.G.R and Gupta.S.K.,Structural Design Optimisation, Affiliated East West Press Ltd, New Delhi, 2008.

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140ST9112 **THEORY OF PLATES AND SHELLS** **3 0 0 3**

AIM:

The aim of the course is to provide students with fundamental knowledge of theory of rectangular and circular plates and design of folded plates and cylindrical shells.

OBJECTIVES:

Students should be able:

- To know about various folded plates and shells and loading on them
- To make them to understand the behavior of various folded plates and shells
- To study about the theory and concepts of rectangular and circular plates
- To impart knowledge about the design of folded plates and cylindrical shells

UNIT I **RECTANGUALR PLATES** **9**

Differential equation of laterally loaded thin rectangular plates- Levy and Navier solution of plates - small deflection theory of plates - analysis of laterally loaded (concentrically loaded)

UNIT II **CIRCULAR PLATES** **9**

Differential equation of laterally loaded thin circular- solution for simply supported or clamped edges.

UNIT III **DESIGN OF FOLDED PLATE ROOFS** **9**

Assumptions in the analysis of folded plates - Analysis of folded plate roofs as per the ASCE task committee recommendations -Design steps - Minimum thickness and reinforcements as per I.S. specifications for R.C. folded plates.

UNIT IV **THEORY OF CIRCULAR AND CYLINDRICAL SHELLS** **9**

Structural behaviour of thin shells - Geometry of shells-Classification of shells - membrane theory of circular and cylindrical shells.

UNIT V **DESIGN OF CYLINDRICAL SHELLS** **9**

Design of R.C. cylindrical shell with edge beams using theory for long shells - Design of shells with ASCE manual.

L: 45, T: 0, Total: 45

REFERENCES:

1. Ramaswamy, G.S., "Design and Construction of Concrete Shell roofs", Revised Ed. R.E.Kriegger, Malabar, Florida, 1984.
2. Timoshenko, S. "Theory of Plates and Shells, McGraw Hill Book Co., New York,1990.
3. Chatterjee, B.K., "Theory and design of concrete Shells", Oxford and IBH publishing co, 1971.
4. "Phase 1 - Report on Folded plate construction – Report of the Task Committee on Folded Plate Design, ASCE Structural Division" – Dec.1963, pp 365– 406.
5. Kelkar, V.S. and Sewell , R.T., "Fundamentals of the analysis and design of shell structures". Prentice Hall, Inc. New Jersey, 1987.

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140ST9113 CONCRETE TECHNOLOGY 3 0 0 3

AIM:

The aim of the course is to provide knowledge to students for various concretes and their strength and behavior under different circumstances

OBJECTIVES:

The objectives of this subject are to enable students:

- To familiar with the new types of concretes and admixtures
- To know about the types of special concretes
- To develop an idea of how to provide form work and quality control
- To familiarize with concretes under special circumstances

UNIT I INTRODUCTION 9

Concrete: Past, Present and Future- Strength of Concrete-Dimensional Stability of Concrete- Chemical and Mineral Admixtures-Properties of Fresh and hardened Concrete - Principles of Concrete Mix Design-Methods of Concrete mix design.

UNIT II SPECIAL CONCRETES 9

Lightweight and Heavy Weight Concrete-High Strength Concrete-High Performance Concrete-Polymers in Concrete-Steel fiber Reinforced Concrete-Ferrocement Concrete-Vaccum Concrete-Shotcrete-Ready Mixed Concrete-SIFCON.

UNIT III DURABILITY OF CONCRETE 9

Permeability-chemical attack-sulphate attack-Quality of water-marine conditions-Thermal properties of concrete-fire resistance-methods of making durable concrete.

UNIT IV FORMWORK AND QUALITY CONTROL 9

Formwork Materials and Systems-formwork pressure-Specifications-Design-Recommendations of IS 456- 2000 on Quality- Statistical Parameters and Variability-Errors in Concrete Constructions-Quality Management.

UNIT V CONCRETING UNDER SPECIAL CIRCUMSTANCES 9

Underground Construction-Under water Construction-Hot weather and Cold weather concreting.

L: 45, T: 0, Total: 45

REFERENCES

1. Shetty M.S., Concrete Technology, S.Chand and Company Ltd, New Delhi, 2003.
2. Gambir,M.L. , Concrete Technology, Tata McGraw Hill Publishing Co,Ltd, NewDelhi,2004.
3. Krishnaraju.N., Design of Concrete mixes, CBS publishers, New Delhi, 2002.
4. Santhakumar,A.R., Concrete Technology, Oxford University Press, New Delhi, 2006.

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140ST9114 **DESIGN OF BRIDGES** **3 0 0 3**

AIM:
The aim of the course is to enhance the knowledge of students in designing various bridge structures used in practical field.

OBJECTIVES:
Students should be able:

- To understand general principle in the design of steel and concretes bridges
- To design short span and long span bridges
- To design prestressed bridges
- To make them to design of plate girder bridges and substructures

UNIT I INTRODUCTION **6**
Classification, investigations and planning, choice of type, I.R.C.specifications for road bridges, standard live loads, other forces acting on bridges, general design considerations.

UNIT II SHORT SPAN BRIDGES **9**
Load distribution theories, analysis and design of slab culverts, tee beam and slab bridges.

UNIT III LONG SPAN GIRDER BRIDGES **12**
Design principles of continuous bridges, box girder bridges and balanced cantilever bridges.

UNIT IV DESIGN OF PRESTRESSED BRIDGES **9**
Flexural and torsional parameters – Courbon's theory – Distribution co-efficient by exact analysis – Design of girder section – maximum and minimum prestressing forces – Eccentricity – Live load and dead load shear forces – Cable Zone in girder – check for stresses at various sections – check for diagonal tension – Diaphragms – End block – short term and long term deflections.

UNIT V DESIGN OF PLATE GIRDER BRIDGES, BEARINGS AND SUBSTRUCTURES **9**
Design of riveted and welded plate girder bridges for highway and railway loading – wind effects – main section, splicing, curtailment, stiffeners – Different types of bearings – Design of bearings – Design of masonry and concrete piers and abutments – Types of bridge foundations – Design of foundations.

L: 45, T: 0, Total: 45

REFERENCES:

1. Jagadeesh.T.R. and Jayaram.M.A., Design of Bridge Structures, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2009.
2. Ponnuswamy, S., Bridge Engineering, 2nd Edition, Tata McGraw Hill Education pvt Ltd., New Delhi, 2007.
3. Johnson Victor, D. Essentials of Bridge Engineering, 6th Edition, Oxford and IBH Publishing Co. New Delhi, 2007.
4. Raina V.K., Concrete Bridge Practice Analysis, Design and Economics, 3rd Edition, Shroff Pub & Dist. Pvt. Ltd, New Delhi, 2007.
5. Bakht, B. and Jaegar, L.G., Bridge Analysis Simplified, McGraw Hill, 1985.
6. Krishnaraju, N., Prestressed Concrete Bridges, CBS publishers, New Delhi, 2009.

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22/7/16

BoS Chairman

140ST9115 STABILITY ANALYSIS OF STRUCTURES 3 0 0 3

AIM:
The aim of the course is to expose students to the principles and methods of stability analysis of structures.

OBJECTIVES:
Students should be able:

- To understand the theory of buckling behaviour of various structures
- To solve problems of buckling of beam column, column and frames
- To solve the problems in buckling of plates
- To apply concepts on practical structures and analyze structures with torsional and inelastic buckling

UNIT I BUCKLING OF COLUMNS 12

States of equilibrium - Classification of buckling problems - concept of equilibrium, energy, imperfection and vibration approaches to stability analysis - Eigen value problem. Governing equation for columns - Analysis for various boundary conditions - using Equilibrium, Energy methods. Approximate methods - Rayleigh Ritz, Galerkins approach - Numerical Techniques - Finite difference method - Effect of shear on buckling.

UNIT II BUCKLING OF BEAM-COLUMNS AND FRAMES 9

Theory of beam column - Stability analysis of beam column with single and several concentrated loads, distributed load and end couples Analysis of rigid jointed frames with and without sway - Moment distribution - Slope deflection and stiffness method. .

UNIT III TORSIONAL AND LATERAL BUCKLING 9

Torsional buckling - Torsional and flexural buckling - Local buckling. Buckling of Open Sections. Numerical solutions.Lateral buckling of beams, pure bending of simply supported beam and cantilever.

UNIT IV BUCKLING OF PLATES 9

Governing differential equation - Buckling of thin plates, various edge conditions -Analysis by equilibrium and energy approach - Approximate and Numerical techniques

UNIT V INELASTIC BUCKLING 6

Double modulus theory - Tangent modulus theory - Shanley's model - Eccentrically loaded inelastic column. Inelastic buckling of plates - Post buckling behaviour of plates

L: 45, T: 0, Total: 45

REFERENCES:

1. Timoshenko, S.P., Gere G.M., Theory of Elastic Stability, 2nd Edition, Dover publications, 2009.
2. Chajes, A., Principles of Structures Stability Theory, Prentice Hall, 1974.
3. Ashwini Kumar, Stability Theory of Structures, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1995.
4. Iyenger.N.G.R., Elastic Stability of Structural Elements, Macmillan India Ltd, New Delhi, 2007.
5. Gambhir M.L., Stability Analysis and Design of Structures, Springer Publishing Company, New York , 2009.

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22/7/15

BoS Chairman

140ST9116 NONLINEAR STRUCTURAL ANALYSIS 3 0 0 3

AIM:

The aim of the course is to provide knowledge on elastic and inelastic analysis of plates and flexural members in structural engineering.

OBJECTIVES:

Students should be able:

- To understand various elastic and inelastic analysis and their concepts in general
- To formulate and make them to analysis the flexural members and plates
- To impart knowledge of application of vibration theory and analysis of flexural members.
- To make them to know about non linear vibration and instability

UNIT I ELASTIC ANALYSIS OF FLEXURAL MEMBERS 9

Introduction to nonlinear mechanics; statically determinate and statically indeterminate flexible bars of uniform and variable thickness.

UNIT II INELASTIC ANALYSIS OF FLEXURAL MEMBERS 9

Inelastic analysis of uniform and variable thickness members subjected to small deformations; inelastic analysis of flexible bars of uniform and variable stiffness members with and without axial restraints.

UNIT III VIBRATION THEORY AND ANALYSIS OF OF FLEXURAL MEMBERS 9

Vibration theory and analysis of flexible members; hysteretic models and analysis of uniform and variable stiffness members under cyclic loading

UNIT IV ELASTIC AND INELASTIC ANALYSIS OF PLATES 9

Elastic and inelastic analysis of uniform and variable thickness plates

UNIT V NONLINEAR VIBRATION AND INSTABILITY 9

Nonlinear vibration and Instabilities of elastically supported beams.

L: 45, T: 0, Total: 45

REFERENCES:

1. Sathyamoorthy, M., Nonlinear Analysis of Structures, CRC Press, Boca Raton, Florida, 1997.
2. Fertis, D. G. Nonlinear Mechanics, CRC Press, Boca Raton, Florida, 1998.
3. Reddy.J.N, Non linear Finite Element Analysis, Oxford University Press, 2nd Edition 2008.

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22/7/15

BoS Chairman

140ST9117 CONSTRUCTION TECHNIQUES AND MANAGEMENT 3 0 0 3

AIM:

The aim of the course is to provide knowledge to students for various types of construction and the management of the equipments used

OBJECTIVES:

The objectives of this subject are to enable students:

- To make the students be familiar with the advanced methods of constructions
- To know about the sub and super structure constructions
- To develop an idea about the construction of special structures
- To familiarize with the use of construction equipments and their managements in fields

UNIT I SUB STRUCTURE CONSTRUCTION 10

Box jacking - pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - piling techniques - driving well and caisson - sinking cofferdam - cable anchoring and grouting - driving diaphragm walls, sheet piles - laying operations for built up offshore system - shoring for deep cutting - large reservoir construction - well points - dewatering and stand by plant equipment for underground open excavation.

UNIT II SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS 10

Vacuum dewatering of concrete flooring – concrete paving technology – techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – launching techniques – suspended form work – erection techniques of tall structures, large span structures – launching techniques for heavy decks – insitu prestressing in high rise structures, aerial transporting handling erecting lightweight components on tall structures.

UNIT III CONSTRUCTION OF SPECIAL STRUCTURES 10

Erection of lattice towers and rigging of transmission line structures – construction sequence in cooling towers, silos, chimney, sky scrapers, bow string bridges, cable stayed bridges – launching and pushing of box decks – Advanced construction techniques for offshore structures – construction sequence and methods in domes and prestress domes – support structure for heavy equipment and conveyor and machinery in heavy industries – erection of articulated structures, braced domes and space decks.

UNIT IV CONSTRUCTION EQUIPMENTS 10

Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders, Earth Movers. Forklifts and related equipment - Portable Material Bins – Conveyors - Hauling Equipment. Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Hauling, Pouring and Pumping Equipment – Transporters. Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting - Equipment for Compaction - Erection Equipment - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Foundation and Pile Driving Equipment –Equipment for Demolition.

UNIT V CONSTRUCTION EQUIPMENT MANAGEMENT 5

Identification – Planning - Equipment Management in Projects - Maintenance Management – Replacement - Cost Control of Equipment - Depreciation Analysis – Safety Management

L: 45, T: 0, Total: 45

REFERENCES:

1. Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 1995.
2. Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 1992.
3. Jerry Irvine, Advanced Construction Techniques, CA Rocketr, 1984
4. Peter.H.Emmons, "Concrete repair and maintenance illustrated", Galgotia Publications Pvt. Ltd., 2001.
5. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008.

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BoS Chairman

140ST9118 **DESIGN OF TALL STRUCTURES** **3 0 0 3**

AIM:

The aim of the course is to enhance the knowledge of students in behavior of structural systems and designing of tall buildings

OBJECTIVES:

Students should be able:

- To understand general principle in the design and loading on tall structures
- To impart the knowledge in the behavior of various structural systems
- To make them analysis and design of tall buildings
- To solve the problems in stability of tall buildings

UNIT I DESIGN PRINCIPLES AND LOADING **9**

Design philosophy, Loading, sequential loading, materials - high performance, concrete - Fibre reinforced Concrete - Light weight concrete - design mixes. Gravity loading Wind loading Earthquake loading

UNIT II BEHAVIOUR OF VARIOUS STRUCTURAL SYSTEMS **9**

Factors affecting growth, Height and Structural form. High rise behaviour, Rigid frames, braced frames, Infilled frames, shear walls, coupled shear walls, wall-frames, tubulars, cores, futrigger - braced and hybrid mega systems.

UNIT III ANALYSIS AND DESIGN **9**

Modelling 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, computerised general three dimensional analysis.

UNIT IV STRUCTURAL ELEMENTS **9**

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 **9**

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.

L: 45, T: 0, Total: 45

REFERENCES:

1. Bryan Stafford Smith and Alexcoull, Tall Building Structures - Analysis and Design, John Wiley and Sons, Inc., 1991.
2. Taranath B.S., Structural Analysis and Design of Tall Buildings, McGraw Hill, 1988.
3. 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. Smith. B.S. and Coull. A., Tall building structures, John Wiley & Sons 1991.
6. Lynn S.Beedle, 'Advances in Tall Buildings', CBS Publishers and Distributors, New Delhi, 1996.

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BoS Chairman

140ST9119 DESIGN OF INDUSTRIAL STRUCTURES 3 0 0 3

AIM:
The aim of the course is to enhance the knowledge of students in designing various Industrial structures used in Industries

OBJECTIVES:
Students should be able:

- To understand general planning and functional requirements of Industrial buildings
- To design gantry girder and corbels used in Industries
- To design principles involved in the power plant structures and their foundations
- To know the concept of design of power transmission towers and auxiliary structures

UNIT I PLANNING AND FUNCTIONAL REQUIREMENTS 9
Classification of Industries and Industrial structures - planning for Layout Requirements regarding Lighting, Ventilation and Fire Safety - Protection against noise and vibration - Guidelines of Factories Act.

UNIT II INDUSTRIAL BUILDINGS 9
Roofs for Industrial Buildings - Steel and RCC - Gantry Girders - Design of Corbels and Nibs – Machine foundations.

UNIT III POWER PLANT STRUCTURES 9
Types of power plants – Design of Turbo generator foundation – containment structures.

UNIT IV POWER TRANSMISSION STRUCTURES 9
Transmission Line Towers - Substation Structures - Tower Foundations - Testing Towers.

UNIT V AUXILLIARY STRUCTURES 9
Chimneys and cooling Towers – Bunkers and Silos – Pipe supporting structures.

L: 45,
T: 0, Total: 45

REFERENCES:

1. Dayaratnam. P., Deign of Steel Structures, A.H. Wheeler & Co., Ltd., Allahabad, 2008
2. Santhakumar A.R.an d Murthy S.S., Transmission Line Structures, Tata McGraw Hill, 1992.
3. Dr. Rajagopalan. K., Storage Structures, Oxford IBH Publishing Company Ltd. 1989.
4. Jurgen Axel Adam, Katharria Hausmann, Frank Juttner, Klauss Daniel, Industrial Buildings: A Design Manual, Birkhauser Publishers, 2004.
5. Procs. of Advanced course on Industrial Structures, Structural Engineering Research Centre, Chennai, 1982.

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22/7/15

BoS Chairman

140ST9120 **SPECIAL CONCRETES** **3 0 0 3**

AIM:

The aim of the course is to create knowledge to students for various types of special concretes and their mix proportions

OBJECTIVES:

The objectives of this subject are to enable students:

- To know the modern concrete and their mix proportioning
- To study about light weight and high density concrete
- To develop an idea about the application of Ferro cement and fiber reinforced concrete
- To study the concepts of high performance concretes

UNIT I MODERN CONCRETE AND MIX PROPORTIONING 9

Role of constituents, Development in cements and cement replacement materials, - pozzolona, fly ash, silica fume, rice husk ash, recycled aggregates, chemical admixtures - Mix proportioning - Principles and methods.

UNIT II LIGHT WEIGHT CONCRETE AND HIGH DENSITY CONCRETE 9

Introduction - classification, properties, strength and durability - mix proportioning and problems. Radiation shielding ability of concrete - materials for high density concrete - mix proportioning - properties in fresh and hardened state, placement methods.

UNIT III FERRO CEMENT 9

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.

UNIT IV FIBRE REINFORCED CONCRETE 9

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.

UNIT V HIGH PERFORMANCE CONCRETE 9

Constituents, mix proportioning, properties in fresh and hardened states, applications and limitations. Ready Mixed Concrete, Self Compacting Concrete, Reactive powder concrete, bacterial concrete.

L: 45, T: 0, Total: 45

REFERENCES:

1. Neville A.M, Properties of Concrete Pearson Education Asis, 2000
2. Kumar Mehta. P., Paul J.N.Monterio, CONCRETE, Microstructure, Properties and Materials Tata McGraw Hill New Delhi 2004
3. Santhakumar. A.R., (2007) Concrete Technology Oxford University Press, New Delhi, 2007.
4. Short A and Kinniburgh.W, Light Weight Concrete Asia Publishing House, 1963
5. Aitcin P.C. High performance concrete E and FN, Spon London 1998
6. Rixom.R. and Mailvaganam.N., Chemical admixtures in concrete E and FN, Spon London1999
7. Rudnai.G., Light Wiehgt concrete Akademiaikiado, Budapest, 1963.

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22/7/15

BoS Chairman

140ST9121 PRESTRESSED CONCRETE STRUCTURES 3 0 0 3

AIM:

The aim of the course is to enhance the knowledge of students in concept of prestressing and design of various prestressed concrete structures

OBJECTIVES:

Students should be able:

- To understand general principle in the principle of prestressing
- To design flexural members and continues beams
- To design the tension and compression members
- To design the composite members

UNIT I PRINCIPLES OF PRESTRESSING 9

Principles of Prestressing - types and systems of prestressing, need for High Strength materials, Analysis methods losses, deflection (short-long term), camber, cable layouts.

UNIT II DESIGN OF FLEXURAL MEMBERS 9

Behaviour of flexural members, determination of ultimate flexural strength – Codal provisions -Design of flexural members, Design for shear, bond and torsion. Design of end blocks.

UNIT III DESIGN OF CONTINUOUS BEAMS 9

Analysis and design of continuous beams - Methods of achieving continuity – concept of linear transformations, concordant cable profile and gap cables

UNIT IV DESIGN OF TENSION AND COMPRESSION MEMBERS 9

Design of tension members - application in the design of prestressed pipes and prestressed concrete cylindrical water tanks - Design of compression members with and without flexure - its application in the design piles, flagmasts and similar structures.

UNIT V DESIGN OF COMPOSITE MEMBERS 9

Composite beams - analysis and design, ultimate strength - their applications. Partial prestressing - its advantages and applications.

L: 45, T: 0, Total: 45

REFERENCES:

1. Krishna Raju, Prestressed Concrete, Tata McGraw Hill Publishing Co, New Delhi, 2000.
2. Sinha.N.C.and.Roy.S.K, Fundamentals of Prestressed Concrete, S.Chand and Co, New Delhi 1998.
3. Lin. T. Y. and Burns Ned. H., Design of Prestressed Concrete Structures, John Wiley and Sons, New York, 2009.
4. Nilson Arthur. H., Design of Prestressed Concrete, John Wiley and Sons, New York, 2004
5. Guyon. Y., Prestressed Concrete, Vols I and II, C. R. Books Ltd., London, 2008
6. Rajagopalan.N, Prestressed Concrete, Narosa Publications, New Delhi, 2008

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22/7/16

BoS Chairman

140ST9122 **PREFABRICATED STRUCTURES** **3 0 0 3**

AIM:

The aim of the course is to provide students with fundamental knowledge of theory of principle of fabrication and production and hoisting technology

OBJECTIVES:

Students should be able:

- To know about the general principles of fabrication
- To make them to understand the formulation of prefabricated elements
- To study about the production and hoisting technology
- To impart knowledge about the application of prefabricated structures

UNIT I GENERAL PRINCIPLES OF FABRICATION 9

Comparison with monolithic construction – Types of prefabrication – site and plant prefabrication -Economy of prefabrication – Modular coordination – Standardization – Planning for Components of prefabricated structures – Disuniting of structures – Design of simple rectangular beams and I beams –Handling and erection stresses – Elimination of erection stresses – Beams, columns – Symmetrical frames.

UNIT II PREFABRICATED ELEMENTS 9

Roof and floor panels, ribbed floor panels – wall panels – footings – Joints for different structural connections – Effective sealing of joints for water proofing – Provisions for non-structural fastenings – Expansion joints in pre-cast construction.

UNIT III PRODUCTION TECHNOLOGY 9

Choice of production setup – Manufacturing methods – Stationary and mobile production – Planning of production setup – Storage of precast elements – Dimensional tolerances – Acceleration of concrete hardening.

UNIT IV HOISTING TECHNOLOGY 9

Equipments for hoisting and erection – Techniques for erection of different types of members like Beams, Slabs, Wall panels and Columns – Vacuum lifting pads.

UNIT V APPLICATIONS 9

Designing and detailing of precast unit for factory structures – Purlins, Principal rafters, roof trusses, lattice girders, gable frames – Single span single storeyed frames – Single storeyed buildings – slabs, beams and columns.

L: 45, T: 0, Total: 45

REFERENCES:

1. Mokk. L., Prefabricated Concrete for Industrial and Public Structures, Publishing House of the
2. Hungarian Academy of Sciences, Budapest, 2007.
3. Koncz. T., Manual of Precast Concrete Construction, Vol. I, II, III & IV, Berlin, 1971
4. Lewicki. B., Building with Large Prefabricates, Elsevier Publishing Company, Amsterdam, London, New York, 1998
5. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag, 2009

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BoS Chairman

140ST9123 **ENERGY EFFICIENT BUILDINGS** **3 0 0 3**

AIM:

The aim of the course is to provide knowledge to students for various types of energy and energy efficient buildings and their implementation

OBJECTIVES:

The objectives of this subject is

- To know about the different energy available to use in the buildings
- To develop an idea about the energy efficient building systems
- To understand the energy efficient building implementation
- To know about the energy efficient assessment in building

UNIT I ENERGY **9**

Conventional versus energy efficient building delivery systems – energy efficient building project execution - the integrated design process – energy efficient building documentation requirements - design versus ecological design - historical perspective - contemporary ecological design - future ecological design – energy efficient design to regenerative design.

UNIT II ENERGY EFFICIENT BUILDING SYSTEMS **9**

Sustainable sites and landscaping – enhancing ecosystems - building envelop – selection of green materials - products and practices - passive design strategy – internal load reduction – indoor environment quality – building water and waste management – relevance to LEED / IGBC EFFICIENT

UNIT III ENERGY EFFICIENT BUILDING IMPLEMENTATION **9**

Site protection planning - health and safety planning - construction and demolition waste management - reducing the footprint of construction operations - maximizing the value of building commissioning in HVAC System, lighting and non mechanical Systems - costs and benefits relevance to LEED / IGBC standards.

UNIT IV ENERGY EFFICIENT BUILDING ASSESSMENT **9**

USGBC LEED building assessment standard - LEED certification process – green globes building assessment protocol- international building assessment systems - LEED-NC Platinum / gold / silver building case studies – trends in building rating systems – IGBC standards – ECBC compliances.

UNIT V ECONOMICS OF ENERGY EFFICIENT BUILDINGS **9**

Business case for high-performance energy efficient buildings - the economics of energy efficient building - benefits - managing initial costs - cost barrier in project management - long-term environment benefits.

L: 45, T: 0, Total: 45

REFERENCES:

1. Means, R.S., Green building: project planning & cost estimating: a practical guide for constructing sustainable buildings: cost data. Kingston, Mass., 2006.
2. Means, R.S., Green building: project planning & cost estimating: a practical guide to materials, systems and standards; green, 2nd Edition. Kingston, Mass., 2006.
3. Alex Wilson and Mark Peipkorn., Green Building Products: the GreenSpec guide to residential building materials, 2nd Edition, Gabriola Island, BC: 2004
4. Jane Anderson, David E. Shiers, and Mike Sinclair. The green guide to specification: an environmental profiling system for building materials and components, 3rd Edition, Oxford; Malden, MA: Blackwell Science, 2002.
5. Charles J. Kibert, Sustainable Construction: Green Building Design and Delivery, 2nd Edition, Wiley, 2007.

6 ECBC 2007 Manual, Bureau of Energy Efficiency, Prentice Hall New Delhi 2003

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22/7/15

BoS Chairman

140ST9124 **SOIL STRUCTURE INTRACTION** **3 0 0 3**

AIM:
The aim of the course is to provide knowledge of the concepts on soil and structures intraction

OBJECTIVES:
Students should be able:

- To understand the provision of beam on elastic foundations
- To make them to know the behavior of plate on elastic medium
- To impart knowledge of elastic analysis of pile foundation
- To familiar with the concept of laterally loaded pile

UNIT I SOIL-FOUNDATION INTERACTION 6

Introduction to soil-foundation interaction problems – Soil behaviour, Foundation behaviour, Interface behaviour, Scope of soil foundation interaction analysis, Soil response models, Winkler, Elastic continuum, two parameter elastic models, Elastic plastic behaviour, Time dependent behaviour.

UNIT II BEAM ON ELASTIC FOUNDATION- SOIL MODELS 10

Infinite beam, two parameters, Isotropic elastic half-space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness.

UNIT III PLATE ON ELASTIC MEDIUM 10

Infinite plate, Winkler, Two parameters, Isotropic elastic medium, Thin and thick plates, Analysis of finite plates, rectangular and circular plates, Numerical analysis of finite plates, Simple solutions.

UNIT IV ELASTIC ANALYSIS OF PILE 10

Elastic analysis of single pile, Theoretical solutions for settlement and load distributions, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap.

UNIT V LATERALLY LOADED PILE 9

Load deflection prediction for laterally loaded piles, Sub grade reaction and elastic analysis, Interaction analysis, Pile raft system, Solutions through influence charts.

L: 45, T: 0, Total: 45

REFERENCES :

1. Selvadurai, A.P.S., Elastic Analysis of Soil Foundation Interaction, Elsevier,1999.
2. Poulos, H.G., and Davis, E.H., Pile Foundation Analysis and Design, JohnWiley, 2001
3. Scott, R.F., Foundation Analysis, Prentice Hall, 2002
4. Structure-Soil Interaction - State of Art Report, Institution of Structural Engineers, 1996
5. ACI 336, Suggested Analysis and Design Procedures for combined footings and Mats, American Concrete Institute, Delhi, 1988

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22/7/15

BoS Chairman

140ST9125 **OFFSHORE STRUCTURES** **3 0 0 3**

AIM:

The aim of the course is to provide knowledge to students of different offshore structures and their interaction behavior with waves

OBJECTIVES:

The objectives of this subject is

- To know about the wave theories
- To understand the forces on offshore structures
- To solve the problems in analysis of offshore structures
- To make them to design the offshore structures

UNIT I **WAVE THEORIES** **8**

Wave generation process, small and finite amplitude wave theories.

UNIT II **FORCES OF OFFSHORE STRUCTURES** **8**

Wind forces, wave forces on vertical, inclined cylinders, structures - current forces and use of Morison equation.

UNIT III **OFFSHORE SOIL AND STRUCTURE MODELLING** **9**

Different types of offshore structures, foundation modeling, structural modeling.

UNIT IV **ANALYSIS OF OFFSHORE STRUCTURES** **10**

Static method of analysis, foundation analysis and dynamics of offshore structures.

UNIT V **DESIGN OF OFFSHORE STRUCTURES** **10**

Design of platforms, helipads, Jacket tower and mooring cables and pipe lines.

L: 45, T: 0, Total: 45

REFERENCES:

1. Chakrabarti, S.K. Hydrodynamics of Offshore Structures, Computational Mechanics Publications, 1987.
2. Dawson.T.H., Offshore Structural Engineering, Prentice Hall Inc Englewood Cliffs, N.J. 1983
3. Brebia, C.A and Walker, S., Dynamic Analysis of Offshore Structures, New Butterworths, U.K. 1979.
4. API, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms, American Petroleum Institute Publication, RP2A, Dallas, TX,2000.
5. Reddy, D.V. and Arockiasamy, M., Offshore Structures, Vol.1 and Vol.2, Krieger Publishing Company, Florida, 1991.

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BoS Chairman

140ST9126 MECHANICS OF COMPOSITE MATERIALS 3 0 0 3

AIM:

The aim of the course is to provide knowledge to students to the properties and behavior of composite materials and design of some simple composite beams

OBJECTIVES:

The objectives of this subject are to enable students:

- To make know the mechanical properties and analysis of composite laminae
- To understand the behavior of glass – fibre - laminates
- To develop an idea of structural design with properties
- To familiarize with design of GRP Box beams

UNIT I INTRODUCTION 9

Requirements of structural materials, influence of nature of materials in structural form' Nature of structural materials- Homogeneous materials, composite materials

UNIT II MACROMECHANICAL PROPERTIES AND ANALYSIS OF COMPOSITE LAMINAE 9

Introduction – Assumptions and Idealizations, stress strain relationship for composite Laminae- Isotropic, orthotropic laminae- strength Characteristics-Basic concepts- hypothesis for isotropic and orthotropic laminae- Macro mechanical Analysis of composite laminae: introduction, Assumptions and Limitations, stiffness characteristics of glass reinforced laminae- Stress- Strain relationships in continuous' discontinuous fiber laminae, strength characteristics of glass reinforced laminae - strengths in continuous discontinuous fibre laminae.

UNIT III BEHAVIOUR OF GLASS FIBRE-REINFORCED LAMINATES 9

Introduction, stiffness characteristics of Laminated composites-Behaviour of laminated beams and plates, strength characteristics of Laminated composites- strength analysis and failure criteria, Effect of inter laminar structures' Glass Reinforced composites: Introduction, continuously reinforced laminates- uni-directionally and multi directionally continuously reinforced laminates, Discontinuously reinforced laminates - Stiffness and Strength properties.

UNIT IV GRP PROPERTIES RELEVANT TO STRUCTURAL DESIGN 9

Introduction, short-term strength and stiffness-Tensile' compressive, Flexural and Shearing Long term strength and Stiffness properties, Temperature effects, Effect of Fire-Structural joints-Adhesive, mechanical, Combinational, Transformed sections

UNITV DESIGN OF GRP BOX BEAMS 9

Introduction, loading, span and cross-sectional shape selection of material, Beam manufacture, beam stresses, Experimental Behaviour, Effect on Beam performance- Modulus of Elasticity, Compressive strength, I value, prevention of compression buckling failure Behaviour under long term loading. Design of Stressed skinned roof structure: Introduction, loading and material properties, preliminary design, and computer analysis.

L: 45, T: 0, Total: 45

REFERENCES:

1. Holmes. M. and Just. D.J., GRP in Structural Engineering, Narosa Publications, New Delhi, 2008
2. Madhujith Mukhopadhyay Mechanics of composite materials and Structures Universities Press 2001
3. Robart M.Jones, Mechanical of Composite Materials McGraw Hill Publishing Co. 2002
4. Bhagwan D Agarvalm, and Lawrence J Brutman, Analysis and Performance of Fiber Composites John Willy and Sons. 2004.

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22/7/15

BoS Chairman