# Dr.M.G.R
# Educational and Research Institute
# Univeristy

(Decl. U/S 3 of UGC Act 1956)

**DEPARTMENT OF CIVIL ENGINEERING**

**M.Tech. Civil Engineering (Part Time)**

**Curriculum & Syllabus**

**2013 Regulation**

**M.Tech. STRUCTURAL ENGINEERING**

| SEMESTER I | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Subject Code** | **Subject Name** | **L** | **T** | **P** | **C** |
| 1. | MMA130004 | Advanced Engineering Mathematics for Structural Engineers | 3 | 1 | 0 | 4 |
| 2. | MCE13S001 | Theory of Elasticity and Plasticity | 3 | 1 | 0 | 4 |
| 3. | MCE13S002 | Advanced Analysis of Structures | 3 | 1 | 0 | 4 |
| 4. | MCE13SL01 | Structural Engineering Lab | 0 | 0 | 2 | 1 |
| | | **TOTAL** | **9** | **3** | **2** | **13** |

| SEMESTER II | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Sub. Code** | **Subject Name** | **L** | **T** | **P** | **C** |
| 1. | MCE13S003 | Structural Dynamics | 3 | 1 | 0 | 4 |
| 2. | MCE13S004 | Sustainable Concrete Technology | 3 | 0 | 0 | 3 |
| 3. | MCE13S005 | Prefabricated Structures | 3 | 1 | 0 | 4 |
| | | **TOTAL** | **9** | **2** | **0** | **11** |

| SEMESTER III | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Sub. Code** | **Subject Name** | **L** | **T** | **P** | **C** |
| 1. | MCE13S006 | Design of Concrete Structures | 3 | 1 | 0 | 4 |
| 2. | MCE13S007 | Experimental Stress Analysis | 3 | 1 | 0 | 4 |
| 3. | MCE13S008 | Theory of Elastic Stability | 3 | 1 | 0 | 4 |
| | | **TOTAL** | **9** | **3** | **0** | **12** |

| SEMESTER IV | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Sub. Code** | **Subject Name** | **L** | **T** | **P** | **C** |
| 1. | MCE13S009 | Theory of` Plates and Shells | 3 | 1 | 0 | 4 |
| 2. | MCE13S010 | Repair and Rehabilitation of Structures | 3 | 0 | 0 | 3 |
| 3. | | Elective I | 3 | 1 | 0 | 4 |
| 4. | MCE13SL02 | Computer Aided Structural Design Lab | 0 | 0 | 2 | 1 |
| | | **TOTAL** | **9** | **2** | **2** | **12** |

| SEMESTER V | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Sub. Code** | **Subject Name** | **L** | **T** | **P** | **C** |
| 1. | MCE13S011 | Design of Steel Structures | 3 | 1 | 0 | 4 |
| 2. | MCE13S012 | Design of Seismic Resistant Structures | 3 | 1 | 0 | 4 |
| 3. | | Elective II | 3 | 1 | 0 | 4 |
| 4. | MCE13SL03 | Project Phase -I | 0 | 0 | 6 | 3 |
| | | **TOTAL** | **9** | **3** | **6** | **15** |

| SEMESTER VI | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Sub. Code** | **Subject Name** | **L** | **T** | **P** | **C** |
| 1. | MCE13SL04 | Project Phase-II | 0 | 0 | 24 | 12 |

**TOTAL CREDITS : 13+11+12+12+15+12=75**

## LIST OF ELECTIVE SUBJECTS

| S.No | Sub. Code | Title of Subject | L | T | P | M |
|---|---|---|---|---|---|---|
| | | **ELECTIVE I** | | | | |
| 1. | MCE13SE01 | Prestressed Concrete Structures | 3 | 1 | 0 | 4 |
| 2. | MCE13SE02 | Finite Element Methods in Engineering | 3 | 1 | 0 | 4 |
| 3. | MCE13SE03 | Tall Structures | 3 | 1 | 0 | 4 |
| 4. | MCE13SE04 | Advanced Construction Management | 3 | 1 | 0 | 4 |
| 5. | MCE13SE05 | Probabilistic Methods in Civil Engineering | 3 | 1 | 0 | 4 |
| 6. | MMA13SE01 | Optimization Techniques | 3 | 1 | 0 | 4 |

| S.No | Sub. Code | Title of Subject | L | T | P | M |
|---|---|---|---|---|---|---|
| | | **ELECTIVE II** | | | | |
| 7. | MCE13SE06 | CAD in Civil Engineering | 3 | 1 | 0 | 4 |
| 8. | MCE13SE07 | Soil Structure Interaction | 3 | 1 | 0 | 4 |
| 9. | MCE13SE08 | Disaster Resistant Structures | 3 | 1 | 0 | 4 |
| 10. | MCE13SE09 | Design of Bridges | 3 | 1 | 0 | 4 |
| 11. | MCE13SE10 | Environmental Engineering Structures | 3 | 1 | 0 | 4 |
| 12. | MCE13SE11 | Experimental Techniques And Instrumentation | 3 | 1 | 0 | 4 |
| 13. | MCE13CE08 | Disaster Management | 3 | 1 | 0 | 4 |

## MMA130004 ADVANCED ENGINEERING MATHEMATICS FOR STRUCTURAL ENGINEERS 3104

### UNIT I TRANSFORM METHODS 12 hrs

Laplace Transform methods for one dimensional wave equation – Displacements in a string – Fourier Transform methods – One dimensional heat conduction problems in infinite and semi- infinite rod.

### UNIT II CALCULUS OF VARIATIONS 12 hrs

Variation and its properties – Euler's equations – Functionals dependent on First and higher order derivatives – Functionals depend on functions of several independent variables – Problems with moving boundaries – Direct methods – Ritz and Kantorovich methods.

### UNIT III ONE DIMENSIONAL RANDOM VARIABLES 12 hrs

Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Exponential, and normal distributions – Functions of a Random variable.

### UNIT IV TWO DIMENSIONAL RANDOM VARIABLES 12 hrs

Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Correlation – Regression.

### UNIT V ESTIMATION THEORY 12 hrs

Unbiased estimators – Method of moments –Maximum likelihood estimation – Curve fitting by Principle of least squares.

**Total no. of hrs: 60**

### REFERENCE BOOKS

**1** Sneddon I.N., Elements of Partial Differential Equations, Dover Publications, (2006).
**2** Sankara Rao K., Introduction to Partial Differential Equations (3rd ed.), PHI, (2010).
**3** Gupta A.S., Calculus of variations with applications, Prentice Hall of India, (2004).
**4** Richard Johnson A., Miller & Freund's Probability and statistics for Engineers (8th ed), Prentice Hall of India, (2009).
**5** Richard Johnson A., Wichern .D.W, Applied Multivariate Statistical Analysis (6th ed), Prentice Hall of India, (2007).
**6** Gupta S.C., Kapoor V.K., Fundamentals of Mathematical Statistics, S.Chand & Co., (2007).
**7** Soong T.T., Fundamentals of Probability and Statistics for Engineers, John Wiley & Sons, (2004).

**MCE13S001** **THEORY OF ELASTICITY AND PLASTICITY** **3 1 0 4**

**OBJECTIVE**

- To understand the concept of 3D stress, strain analysis and its Applications to simple problems.

**UNIT I: ANALYSIS OF STRESS AND STRAIN** **12Hrs**

Analysis of stress and strain, stress strain relationship. Generalized Hook's law. Plane stress and plane strain.

**UNIT II: 2D PROBLEMS** **12 Hrs**

Two-dimensional problems in Cartesian and polar co-ordinates for simple problems.

**UNIT III: TORSION** **12 Hrs**

Torsion of non-circular section - methods of analysis - membrane analogy – torsion of thin rectangular section and hollow thin walled sections.

**UNIT IV: ENERGY METHODS** **12 Hrs**

Energy methods - principle of virtual work - energy theorem - Rayleigh Ritz methods - Finite Difference method.

**UNIT V: INTRODUCTION TO PROBLEMS IN PLASTICITY** **12 Hrs**

Physical assumption - criterian of yielding, yield surface, Flow rule (plastic stress strain relationship). Elastic plastic problems of beams in bending - plastic torsion.

**Total No of Hours: 60**

**REFERENCES**

1. Timoshenko, S. and Goodier T.N. "Theory of Elasticity", McGraw Hill Book Co., Newyork, II Edition 1988.
2. Chwo P.C. and Pagano, N.J. "Elasticity Tensor, Dyadic and Engineering applications", D.Van Nestrand Co., In Co., 1967.
3. Chenn, W.P. and Henry D.J. "Plasticity for Structural Engineers", Springer Verlag Newyork 1988.
4. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, New Delhi 1988.
5. Verma, PDS, "Theory of Elasticity", Vikas Publishing Pvt. Ltd. New Delhi -1997.
6. Sadhu Singh, "Theory of Plasticity", Khanna Publishers, New Delhi 1988.

**MCE13S002 ADVANCED ANALYSIS OF STRUCTURES 3 1 0 4**

**OBJECTIVE**

- To understand the concept of matrix methods and computer application Matrix methods.

**UNIT I: INTRODUCTION** **12 Hrs**

Introduction to matrix methods of analysis - statically indeterminacy and kinematics indeterminacy - degree of freedom - coordinate system - structure idealization stiffness and flexibility matrices - suitability element stiffness equations - elements flexibility equations - mixed force - displacement equations - for truss element, beam element and tensional element. Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates

**UNIT II: FLEXIBILITY METHOD** **12 Hrs**

Matrix flexibility methods - general formulation - application to plane rigid frames - plane trusses.

**UNIT III: FLEXIBLITY METHOD** **12 Hrs**

Direct Stiffness method and application to 3-D frames and trusses, and grids (with three members only

**UNIT IV: COMPUTER APPLICATION** **12 Hrs**

Computer Applications and use of Computer packages - Programming techniques and problems.

**UNIT V: ANALYSIS BY SUBSTRUCTURE TECHNIQUE** **12 Hrs**

A special analysis procedure - static condensation and sub structuring - initial and thermal stresses. Shear walls- Necessity - structural behaviour of large frames with and without shear walls - approximate methods of analysis of shear walls.

**|Total No of Hours: 60**

**TEXT BOOKS**

1. Rajasekharan S. and Sankarasubramainian G., "Computational Structural Mechanics", Prentice Hall, India, 2001.
2. Manikaselvam – Elements of Matrix Analysis and Elastic Stability, Khanna Publishers, New Delhi Sixth Edition-2009.
3. Negi, "Structural Analysis" , Tata Mc Graw Hill Publishing Company 2007.

**REFERENCES**

1. Coates, R.C., Coutie. M.G., and Kong, F.K., Structural Analysis ,John Wiley and Sons, 1979.
2. McGuire, W., and Gallagher, R.H., Matrix Structural Analysis , John Wiley and Sons, 1979.
3. John L.Meek., Matrix Structural Analysis , Mc Graw Hill Book Company, 1971.

**MCE13S003** **STRUCTURAL DYNAMICS** **3 1 0 4**

**OBJECTIVE**

- To expose the students the principles and methods of dynamic analysis of structures and to prepare them for designing the structures for wind, earthquake and other dynamic loads.

**UNIT I : PRINCIPLES OF DYNAMICS** **15 Hrs**

Formulation of equations of motion by different methods, single degree of freedom systems, free and forced response, effect of damping.

**UNIT II: MULTIDEGREE OF FREEDOM SYSTEMS** **15 Hrs**

Formulation of structure property matrices, Eigen values problems, Modes shapes and ortho normality of modes, approximate methods of extraction of Eigen values.

**UNIT III: DYNAMIC RESPONSE OF MDOF SYSTEMS** **10 Hrs**

Mode superposition techniques, Numerical integration procedures.

**UNIT IV: CONTINUOUS SYSTEMS** **10 Hrs**

Modeling - free and forced vibration of bars and beams.

**UNIT V: APPLICATIONS** **10 Hrs**

Idealization of structures to mathematical models, examples of wind, earthquake and impact.

**Total No of Hours: 60**

**TEXT BOOKS**

1. Roy R.Craig, Jr., Structural Dynamics - An Introduction to computer methods , John Wiley & Sons, Los Angeles.1981.

***Note: (Use of approved data books permitted)**

**REFERENCES**

1. Clough R.W and Penzien,J., Dynamics of Structures , Mc Graw Hill, New Delhi 1975.
2. Paz Mario, Structural Dynamics, Academic Press, Los Angeles 1985.
3. 3. Anderson R.A., Fundamentals of vibration, Amerind Publishing Co. New Delhi, 1972.

**MCE13S004** **SUSTAINABLE CONCRETE TECHNOLOGY** **3 1 0 3**

**OBJECTIVE**

- To study the properties of materials, tests and mix design for concrete.

**UNIT I : CONCRETE MAKING MATERIALS** **9 Hrs**

Aggregates classification, IS Specifications, Properties, Grading, Methods of combining aggregates, specified grading, Testing of aggregates, Fibers. Cement, Grade of cement, Chemical composition, Testing of concrete, Hydration of cement, Structure of hydrated cement, Special cements

**UNIT II: CONCRETE** **9 Hrs**

Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and shrinkage, Variability of concrete strength.

**UNIT III: MIX DESIGN** **9 Hrs**

Principles of concrete mix design, Methods of concrete mix design, Testing of concrete.

**UNIT IV: SPECIAL CONCRETE** **9 Hrs**

Light weight concrete, Fly ash concrete, Fibre reinforced concrete, Polymer Concrete, Super plasticised concrete, Epoxy resins and screeds for rehabilitation - Properties and Applications - High performance concrete.

**UNIT V: WASTE MATERIALS**

Waste materials used in concrete structures, E- Waste – Solid hazardous waste – Plastics – GGBS – Fly Ash – Rice husk ash - Quarry dust.

**9 Hrs**

**Total No of Hours: 45**

**REFERENCES**

1. Neville, A.M., Properties of Concrete , Pitman Publishing Limited, London.
2. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi.
3. Rudhani G., Light Weight Concrete Academic Kiado, Publishing Home of Hungarian Academy of Sciences, New Delhi 1963.
4. SanthaKumar A.R.Oxford university press.

**MCE13S005** **PREFABRICATED STRUCTURES** **3 1 0 4**

**OBJECTIVE**

- To Study the design principles, analysis and design of elements.

**UNIT I: INTRODUCTION** **12 Hrs**

Concept of planning and layout of prefabricated plant. IS Code specification. Modular co-ordination, standardization, production, transportation, erection, stages of loading and coal provisions, safety factors, material properties, Deflection control, Lateral load resistance, Location and types of shear walls.

**UNIT II: REINFORCED CONCRETE** **12 Hrs**

Prefabricated structures - Long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, Framed buildings with partial and curtain walls

**UNIT III: FLOORS, STAIRS AND ROOFS** **12 Hrs**

Types of floor slabs, analysis and design example of cored and panel types and two-way systems, staircase slab design, types of roof slabs and insulation requirements, Description of joints

**UNIT IV: WALLS** **12 Hrs**

Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls, types of wall joints, Leak prevention, joint sealants, sandwich wall panels.

**UNIT V: ACCESSORIES AND PLUMPING** **12Hrs**

Folded plate and hyper-prefabricated shells, Erection and jointing, joint design, Water leakage, damp proofing

**Total No of Hours: 60**

***Note: (Use of approved data books permitted)**

**REFERENCES**

1. B.Lewicki, Building with Large Prefabricates, Elsevier Publishing Company, Amsterdam/ London/ New York, 1966.
2. Koncz.T., Manual of Precast Concrete Construction, Vol.I II and III, Bauverlag, GMBH, 1971.
3. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precase Concrete, Netherland Betor Verlag, London 1978.
4. Lasslo Mokk, Prefabricated Concrete for Industrial and Public Sectors, Akademiai Kiado, Budapest, 1964.
5. Murashev.V., Sigalov.E., and Bailov.V., Design of Reinforced Concrete Structures, Mir Publishers, London 1968.
6. CBRI, Building Materials and Components, 1990, India.
7. Gerostiza. C.Z., Hendrikson, C., Rehat D.R., Knowledge Based Process Planning for Construction and Manufacturing, Academic Press, Inc., London 1989.
8. Warszawski, A., Industrialization and Robotics in Building - A managerial approach, Harper & Row, London 1990.

**MCE13S006 DESIGN OF CONCRETE STRUCTURES 3 1 0 4**

**OBJECTIVE**

- To study the behaviour, analysis and design of R.C. structures.

**UNIT I: OVERALL REVIEW** **14 Hrs**

Review of limit state design of beams - Slabs and columns according to IS 456-2000 - Calculation of deflection and crack width according to IS 456-2000.

**UNIT II: DESIGN OF SPECIAL RC ELEMENTS** **11 Hrs**

Design of Slender columns - Design of R.C walls - Ordinary and shear walls - Design of Corbels - Deep – beams and grid floors.

**UNIT III: FLAT SLABS AND FLAT PLATES** **10 Hrs**

Design of flat slabs and flat plates according to ACI method - Design of shear load - reinforcement and edge(spandrel) beams - Yield line theory and Hillerberg method of design of slabs.

**UNIT IV: INELASTIC BEHAVIOUR OF CONCRETE BEAMS** **15 Hrs**

Inelastic behavior of concrete beams - moment - rotation curves - moment redistribution - Baker's method of plastic design - Design of cast-in-situ joints in frames.

**UNIT V: GENERAL** **10** Hrs

Detailing for ductility - fire resistance of buildings - field control of concrete**.**

**Total No of Hours: 60**

**TEXT BOOKS**

1. Purushothaman, P, Reinforced Concrete Structure Structural Elements: Behaviour Analysis and Design , Tata Mc Graw Hill, New Delhi 1986.
2. Varghese, P.C., Limit State Design of Reinforced Concrete, Prentice Hall of India New Delhi, 1995.
3. Krishna Raju, N.Advanced Reinforced Concrete Design, CBS Publishers and New Delhi Distributors, 1986.

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**MCE13S007** **EXPERIMENTAL STRESS ANALYSIS** **3 1 0 4**

**OBJECTIVE**

- To learn the principles of measurements of static and dynamic response of Structures and carryout the analysis of results.

**UNIT I: STRAIN GUAGES** **10** Hrs

Mechanical, optical and acoustic gauges, description and operation of gauges, electrical resistance strain gauges, types of gauges, static and dynamic strains, strain rosette, calibration of gauges and circuit theory – Effect of transverses strain recorders and loads cells.

**UNIT II: MODEL ANALYSIS** **10 Hrs**

Structural similitude, use of models, model analysis, structural and dimensional analysis, Buckingham Pi theorem, applications, Muller Breslau principle for indirect model analysis, use of Begg's Eney's and R.P.I. deformeters and moment indicator, design of models for direct and indirect analysis.

**UNIT III: PHOTOELASTICITY** **10 Hrs**

Introduction of photoelasticity; polariscope, compensators, models materials, calibration of photoelastic materials Isochromatic and Isoclinic Fringes, stress determination, time – Edge effects, three dimensional photoelasticity, freezing techniques. Moiré fringe technique, Grid methods – Holography and interferometry use of X-ray and laser beams in stress analysis – Elementary ideas.

**UNIT IV: ANALOGIES** **10 Hrs**

Membrane analogy for torsion and flexure, sand heap analogy, hydrodynamic and electrical analogies.

**UNITV: MISCELLANEOUS METHODS** **20 Hrs**

Brittle acquer techniques, linear transducers, accelerometers, choice of experimental methods, model loadings, basic standards and accuracy of measurements , Introduction Of Dynamic Analysis- (Non – destructive testing, ultrasonic and sonic testers, flaw detectors).

**Total No of Hours: 60**

**REFERENCES**

**1.** Dr. T.P. Ganesan, "Model analysis of Structures', Universities Press Hyderabad, 2000.
**2.** Dove, R.C. and Adams, P.H., Experimental stress Analysis and Motion measurement. Prentice Hall of India (Private Ltd., New Delhi) 1965.
**3.** Dally, J.W. and Riley, W.F. Experimental Stress Analysis, McGraw Hill, 2nd Edn. New York, 1978.
**4.** Heteryi (ed) Handbook of experimental stress analysis, John Wiley and sons, New york, 1950.Coker, E.G. and Filon, L.N.G. A treatise on Photoelasticity, Cambridge University Press, 2nd Edn., Revised by H.T.Jesop, London, 1957.
**5.** Forcht, M.M. Photoelasticity, Vol.I and Vol.II John Wiley and sons, Newyork, 1941.
**6.** Durelli, A.J. Applied Stress Analysis, Prentice Hall, New Jersey, 1967.

**MCE13S008** **THEORY OF ELASTIC STABILITY** **3 1 0 4**

**OBJECTIVE**

- To study the concept of buckling and analysis of structural elements.

**UNIT I: INTRODUCTION** **15 Hrs**

Concept of stability approaches to stability analysis, characteristics of stability problems, Columns - Buckling of columns with various end conditions, imperfect columns, Elastically supported columns, non-prismatic columns, Built-up columns, Inelastic buckling, Experimental study of column behavior, Empirical column formulae. Buckling of bars on elastic foundations, Large deflection of buckled bars.

**UNIT II: BEAMS – COLUMNS** **8 Hrs**

Beam-column theory, Application to buckling of frames.

**UNIT III: TORSIONAL BUCKLING** **14 Hrs**

Combined tensional and flexural buckling. Lateral Buckling - Lateral buckling of beams, pure bending of simply supported beam and cantilever, numerical solutions.

**UNIT IV: PLATES** **8 Hrs**

Buckling of thin plates, various edge conditions, inelastic buckling, post buckling strength.

**UNIT V: APPROXIMATE METHODS** **15 Hrs**

Energy methods, Iterative procedure and Finite element formulation.

**Total No of Hours: 60**

**REFERENCES**

1. Allen, H.G., and Bulson, P.S., Background to Buckling, McGraw Hill Book Company, New Delhi 1980.
2. Smitses, Elastic Stability of Structures, Prentice Hall, New Delhi 1973.
3. Timoshenko, S., and Gere., Theory of Elastic Stability, McGraw Hill Book Company, New Delhi 1961.
4. Brush and Almorth.,Buckling of Bars, Plates and Shells, McGraw Hill Book Company, New Delhi 1975.
5. Chajes, A. Principles of Structures Stability Theory, Prentice Hall, New Delhi 1974.
6. Ashwini Kumar, Stability Theory of Structures, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1985.

**MCE13S009** **THEORY OF PLATES AND SHELLS** **3 1 0 4**

**OBJECTIVE**

- To study the behaviour and analysis of thin plates and the behaviour of anisotropic and thick plates.
- Study the behaviour and design of shells, design of plates.

**UNIT I : BENDING OF RECTANGULAR PLATES** **8 Hrs**

Bending of plate to cylindrical surface long uniformly loaded plates – Rectangular plates – Differential equations of laterally loaded plates – Navier's and Levy's solutions – Pure bending in two perpendicular directions.

**UNIT II: BENDING OF CIRCULAR PLATES** **7 Hrs**

Circular plates – Clamped and simply supported – bending of concentrically loaded circular plates. Analysis of stress and deformation of plates bent by transverse loads – plates on elastic supports – Energy methods and approximate methods of solution.

**UNIT III: CLASSIFICATION OF SHELLS** **15 Hrs**

Synclastic – Anticlastic – Singly and Doubly curved – Translation and revolution.

**UNIT IV: MEMBRANE THEORY** **15 Hrs**

Analysis of singly and doubly shells – Applications of elliptic paraboloid and hyperbolic paraboloid shells – Analysis of shells of evolutions like conical and circular domes.

**UNIT V: FLEXURE THEORY** **15 Hrs**

Shells of revolution – edge disturbance – problems of symmetrically loaded spherical shells – Cylindrical tanks with uniform wall thickness – Circular cylindrical shell roof – Dischinger and Finster Waalder theories – Application of numerical methods of shells.

**Total No of Hours: 60**

**REFERENCE BOOKS**

1. Flugge, Stresses in shells, 2nd ed., Springer – Verglag, Berlin, 1960
2. Sziland, R. Theory and Analysis of Plates (Classical and Numerical Methods) Prentice Hall, Ijc. New Jersy, 1974.
3. Billington, D.P. Thin Shell concrete structures 2nd ed. McGraw Hill Book Co., New York, 1965.
4. Ugural, Il. Theory and practice of shell structures, Wilhelm Ernst and John Berlin, 1968.
5. Timoshenko.S and Krieger.S.W., Theory of Plates and Shells, McGraw Hill Co., New York 1990.

**MCE13S010 REPAIR AND REHABILITATION OF STRUCTURES 3 0 0 3**

**OBJECTIVE**

- To study the damages, repair, rehabilitation of structures.

**UNIT I: GENERAL** **6 Hrs**

Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking.

**UNIT II: INFLUENCE ON SERVICEBILITY AND DURABILITY** **6 Hrs**

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, catholic protection.

**UNIT III: MAINTENANCE AND REPAIR STRATEGIES** **8 Hrs**

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.

**UNIT IV: MATERIALS FOR REPAIR** **8 Hrs**

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete.

**UNIT V: TECHNIQUES FOR REPAIR** **9 Hrs**

Rust eliminators and polymers coating for rebars during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

**UNIT VI: EXAMPLES OF REPAIR TO STRUCTURES** **8 Hrs**

Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure .Engineered demolition techniques for Dilapilated structures - case studies

**Total No of Hours: 45**

**TEXT BOOKS**

1. Denison Campbell, Allen and Harold Roper, " Concrete Structures ", Materials, Maintenance and Repair,Longman Scientific and Technical UK, 1991.
2. R.T.Allen and S.C.Edwards, " Repair of Concrete Structures ", Blakie and Sons, UK, 1987.

**REFERENCES**

1. M.S.Shetty, " Concrete Technology - Theory and Practice ", S.Chand and Company, New Delhi, 1992.
2. Santhakumar, A.R., " Training Course notes on Damage Assessment and repair in Low Cost Housing "," RHDC-NBO " Anna University, July, 1992.
3. Raikar, R.N., " Learning from failures - Deficiencies in Design ", Construction and Service - R & D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
4. N.Palaniappan, " Estate Management, Anna Institute of Management ", Chennai, 1992.
5. Lakshmipathy, Metal Lecture notes Workshop on " Repairs and Rehabilitation of Structures ",29 - 30th October 1999.

**MCE13SL01 STRUCTURAL ENGINEERING LAB 0 0 2 1**

**OBJECTIVE**

- Students should get good knowledge about various tests conducted for concrete.

1. Tests on Cement -Consistency, Setting Times, Soundness, Compressive Strength.
2. Workability Test on Fresh Concrete
3. "E" value for concrete.
4. Casting of Reinforced concrete beams for conducting flexure and shear tests.
5. Bending test on steel flat
6. Testing of various types of reinforcement using mechanical and electrical strain gauges.
7. Creep and Shrinkage.
8. Permeability of Concrete.
    a. Rapid chloride Penetration Test,
    b. Freeze and Thaw test,
    c. Acid Test ,
    d. Alkali aggregate reaction test
    e. VCC testing fire resistance
    g. Autoclaving
9. Non Destructive Testing Of Concrete.
    a. Ultra Sonic Pulse velocity Test,
    b. Rebound Hammer test
    c. Cover Meter
    d. Rebar Locator
    e. Concrete Analyzer

**Total No of Hours: 30**

**REFERENCES**

1. Purushothaman, P, Reinforced Concrete Structure Structural Elements : Behaviour Analysis and Design , Tata Mc Graw Hill, New Delhi 1986.
2. Varghese, P.C., Limit State Design of Reinforced Concrete, Prentice Hall of India New Delhi, 1995.
3. Krishna Raju, N.Advanced Reinforced Concrete Design, CBS Publishers and New Delhi Distributors, 1986.
4. Neville, A.M., Properties of Concrete , Pitman Publishing Limited, London.
5. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi.

**MCE13S011** **DESIGN OF STEEL STRUCTURES** **3 1 0 4**

**OBJECTIVE**

- To study the behaviour of members and connections, analysis and design of steel towers, chimneys.
- Study the design of with cold formed steel and plastic analysis of structures.

**UNIT I: GENERAL** **12 Hrs**

Design of members subjected to lateral loads and axial loads - Analysis and design of Industrial buildings and bents - Sway and non-sway frames - Design of Purlins, Louver rails, Gable column and Gable wind grider –Analysis of Gable Frames check for deflection.

**UNIT II: DESIGN OF CONNECTIONS** **12 Hrs**

Types of connections - Design framed beam connections - Seated beam connections - Unstiffened, Stiffened seat connections, Continuous beam-to-beam connections and continuous beam-to-column connection both welded riveted.

**UNIT III: ANALYSIS AND DESIGN OF STEEL TOWERS** **12 Hrs**

Analysis and design of Transmission Line Towers Types of bracing patterns - Sag and Tension calculations –Design of self supporting chimney(lined and unlined) and guyed steel stacks - Stresses due to wind and earthquake forces - Design of foundations - Along with loads - calculation Gust Factor Method.

**UNIT IV: PLASTIC ANALYSIS OF STRUCTURES** **12 Hrs**

Introduction - Shape factor - Moment redistribution - Static, Kinematic and Uniqueness theorems – Combined mechanism - Analysis of single bay and two bay portal frames - Methods of plastic moment distribution – Effect of axial force and shear force on plastic moments - Connections Moment resisting connection - Design of continuous beams.

**UNIT V: DESIGN OF LIGHT GAUGE STEEL STRUCTURES** **12 Hrs**

Types of cross sections - local bucking and lateral bucking - concepts of Effective width - Design of compression and tension members, Beams, Deflection of beams and design of beam webs. Combined stresses and connections, wall studs.

**Total No of Hours: 60**

***Note: (Use of approved data books permitted)**

**REFERENCES**

1. Horne, M.R., and Morris, L.J., Plastic Design of Low -rise frames, Granada Publishing Ltd.,UK 1981.
2. Salmon, C.G., and Johnson, J.E. Steel Structure -Design and Behaviour, Harper and Row, UK 1980.
3. Dayarathnam, P., Design of Steel Structure, A.H.Wheeler, UK 1990.
4. Kuzamanovic,B.O. and Willems,N., Steel Design for Structural Engineers, Prentice Hall, New Delhi 1977.
5. Wie - Wen Yu., Cold-formed Steel Structures, McGraw Hill Book Company, New Delhi 1973.
6. William McGuire, Steel Structures, Prentice Hall, Inc., Englewood Cliffs, New b

**MCE13S012** **DESIGN OF SEISMIC RESISTANT STRUCTURES** **3 1 0 4**

**OBJECTIVE**

- To understand seismic design concepts.

**UNIT I: INTRODUCTION** **7 Hrs**
Elements of Engineering Seismology - Theory of Vibration - Response Spectrum.

**UNIT II: HISTORICAL** **7 Hrs**
Indian Seismicity - Earthquake History - Behaviour of Structres in the past Earthquakes.

**UNIT III: DESIGN CONCEPTS** **7 Hrs**
Seismic Design Concepts - Cyclic load behaviour of RC, Steel and Prestressed Concrete elements – Design spectrum - Principles of capacity design.

**UNIT IV: CODAL PROVISIONS** **12 Hrs**
Provisions of Seismic Code (IS 1893) - Building systems frames, shear walls, Braced Frames, Combinations - Torsion.

**UNIT V: DESIGN AND DETAILING** **13 Hrs**
Performance of Regular Buildings 3 D Computer Analysis of Building Systems (Theory Only) - Design and Detailing of frames - Shear walls and Frame walls.

**UNIT VI: SPECIAL PROBLEMS AND CASE STUDIES** **14 Hrs**
Structural Configuration - Seismic performance - Irregular Buildings - Soil performance, Modern Concepts – Base Isolation - Adoptive system - Case studies.

**Total No of periods: 60**

***Note: (Use of approved data books permitted)**

**REFERENCES**

1. Course Notes "Design of Reinforced Concrete Building", IIT, Kanpur, June 1999.
2. Bungale S.Taranath "Structural Analysis and Design of Tall Buildings" McGraw Hill Book Company, New York, 1999.

**MCE13SL02** **COMPUTER AIDED STRUCTURAL DESIGN-LAB** **0 0 2 1**

**OBJECTIVE**

- Student should aware of computer application of structural design.

1. Program Using Arrays and Functions for Matrix Manipulation.
2. Programs to Draw Bending Moment and Shear Force Diagrams. Using Graphic in C
3. Program for Design of Slabs. Using Excel
4. Program for Design of Beams. Using Excel
5. Program for Design of Column and Footing Using Excel
6. Analysis of Truss Using STAAD Pro.
7. Analysis of Multistoried Space Frame, Using STAAD Pro.
8. Analysis of Bridge Deck Slab.

**Total No of Hours: 30**

**TEXT BOOKS/REFERENCES**

1. Computer Aided Design by C.S.Krishnamoorthy and S.Rajeev.
2. Computational Structures by S.Rajasekharan.

**MCE13SE01 PRESTRESSED CONCRETE STRUCTURES 3 1 0 4**

**OBJECTIVE**

- Principle of prestressing, analysis and design of prestressed concrete structures.

**UNIT I : DESIGN PRINCIPLES FOR FLEXURE SHEAR BOND AND END BLOCKS INTRODUCTION AND CODAL PROVISIONS 12Hrs**

Principles of Prestressing - types and systems of prestressing, need for High Strength materials, Analysis methods losses, deflection (short-long term), camber, cable layouts. Behaviour under flexure - codal provisions (IS, British ACI and DIN), ultimate strength. Design of flexural members,

**UNIT II: DESIGN OF COMPRESSION MEMBERS 12 Hrs**

Design for Shear, bond and torsion. Design of End blocks and their importance 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 III: COMPOSITE BEAMS 12 Hrs**

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

**UNIT IV: CONTINUOUS BEAMS 12 Hrs**

Application of prestressing in continuous beams, concept of linear transformation, concordant cable profile and cap cables.

**UNIT V: DESIGN OF SPECIAL STRUCTURES 12 Hrs**

Special structures like prestressed folded plates, prestressed cylindrical shells, prestressed concrete poles.

**Total No of Hours: 60**

**TEXT BOOKS**

1. Prestressed Concrete by Krishna Raju, Tata McGraw Hill Publishing Co. 2nd Edition, Berlin 1988.
2. Fundamentals of Prestressed Concrete by N.C.Sinha & S.K.Roy S.Chand & Co., New Delhi 1985.

**REFERENCES**

1. T.Y.Lin, Design of Prestressed Concrete Structures, John Wiley and Sons, Inc Berlin1960.
2. Leonhardt.F., Prestressed Concrete, Design and Construction, Wilhelm Ernst and Shon, Berlin, 1964.

**MCE13SE02** **FINITE ELEMENT METHODS IN ENGINEERING** **3 1 0 4**

**OBJECTIVE**

- To study the energy principles, finite element concept, stress analysis ,meshing, nonlinear problems and applications.

**UNIT I: INTRODUCTION** **10 Hrs**

Boundary Value Problem - Approximate Solution - Variation and Weighted Residual Methods - Ritz and Gale kin Formulations - Concepts of Piecewise Approximation and Finite Elements - Displacement and Shape Functions - Weak Formulation - Minimum Potential Energy - Generation of Stiffness Matrix and Load Vector.

**UNIT II: STRESS ANALYSIS** **10 Hrs**

Two Dimensional problems - Plane Stress, Plain Strain and Ax symmetric Problems - Triangular and Quadrilateral Elements - Natural Coordinates - Isoperimetric Formulation - Numerical Integration - Plate Bending and Shell Elements - Brick Elements - Elements for Fracture Analysis.

**UNIT III: MESHING AND SOLUTION PROBLEMS** **10 Hrs**

Higher Order Elements - p and h Methods of refinement - IIL conditioned Elements - Discrimination Errors –Auto and Adaptive Mesh Generation Techniques - Error Evaluation.

**UNIT IV: NONLINEAR AND VIBRATION PROBLEMS** **10 Hrs**

Material and Geometric No linearity - Methods of Treatment - Consistent System Matrices – Dynamic Condensation - Eigen Value Extraction.

**UNIT V: THERMAL ANALYSIS** **5 Hrs**

Application to Thermal analysis Problem

**PRACTICALS IN FEM ANALYSIS** **15 Hrs**

**Total No of Hours: 60**

**REFERENCES**

1. Bathe , K.J., Finite Elements Procedures in Engineering analysis, Prentice Hall Inc., New Delhi 1995.
2. Zienkiewicz, O.C, and Taylor, R.L., The Finite Elements Methods , Mc Graw Hill New Delhi, 1987.
3. Chandrupatla, R.T. and Belegundu, A.D ., Introduction to Finite Elements in Engineering, 2nd Edition , Prentice Hall of India, New Delhi 1997.
4. Moaveni,S., Finite Element Analysis : Theory and Application with ANSYS, Prentice Hall Inc., New Delhi 1999.

**MCE13SE03** **TALL STRUCTURES** **3 1 0 4**

**OBJECTIVE**

- To study the behaviour, analysis and design of tall structures.

**UNIT I: DESIGN CRITERIA** **7 Hrs**

Design philosophy, Loading, Sequential loading, materials - high performance Concrete - Fiber reinforced Concrete - Light weight Concrete - Design mixes.

**UNIT II: LOADING AND MOVEMENT** **8 Hrs**

**Gravity Loading :** Dead and live load, methods of live load reduction, Impact, gravity loading, construction loads.
**Wind loading :** Static and dynamic approach, Analytical and wind tunnel experimental method.
**Earthquake loading :** Equivalent lateral force, modal analysis, combinations of loading working stress design, Limit state design, plastic design.

**UNIT III: BEHAVIOUR OF VARIOUS STRUCTURAL SYSTEMS** **10 Hrs**

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 system.

**UNIT IV: ANALYSIS AND DESIGN** **25 Hrs**

Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of building as total structural system considering overall integrity and major subsystem interaction, Anlysis for member forces, drift and twist, computerised general three dimentional analysis.
**Structural Elements :** Sectional shapes, properties and resisting capacity, design, deflection, cracking, prestressing, shear flow. Design for diffenential movement, creep and shrinkage effects, temperature effects and fire resistance.

**UNIT V: STABILITY OF TALL BUILDINGS** **10 Hrs**

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 plum effects, stiffness of member in stability, effect of foundation rotation.

**Total No of periods: 60**

**TEXT BOOKS**

1. Taranath B.S., Structural Analysis and Design of Tall Building, McGraw Hill, 1988.

**REFERENCES**

1. Dr. Y.P.Gupta, Editor. Proceedings National Seminar on High Rise Structures Design and Construction practices for middle level cities Nov. 14 -16, 1995, New Age International Limited, Publishers, Madras -20.
2. Wilf gang Schuller, High Rise Building Structures, John Wiley and Sons, New Jercy 1977.
3. Bryan stafford Smith, Alexcoull, Tall Building Structures , Analysis and Design,John Wiley and Sons, Inc New Jercy 1977

**MCE13SE04** **ADVANCED CONSTRUCTION MANAGEMENT** **3 1 0 4**

**OBJECTIVE**

- To study about CPM &PERT ,Types of contract, construction finance, construction process control.

**UNIT I : MANAGEMENT SCIENCE** **10 Hrs**

Introduction in construction – The organization of projects and contracts, control of time and money, engineering economics, planning and programming techniques. Scheduling Procedure & Techniques -CPM project planning & Searching – GANTT charts, milestone schedules – PERT & CPM and their use. Resource allocation, Resource leveling, Resource smoothing, updating.

**UNIT II: CONSTRUCTION CONTRACTS** **10** Hrs

Indian Contract, Types of Contract, International Contract Document, Law of Traits Estimating and Pricing, FIDIC contract.

**UNIT III: PROJECT FINANCING** **15** Hrs

Construction finance, planning of funds, budgeting, measurement and valuation, monitoring and reporting, linking time and money cost models, cost control and reporting project appraisal.

**UNIT IV: PRODUCTION MANAGEMENT ORGANIZING** **15** Hrs

Materials planning, budgeting and inventory control management of surplus materials, equipment control, Quality Control. Development of human resources – Motivation, Performance & satisfaction.

**UNIT V: CONSTRUCTION PROCESS** **10** Hrs

Construction process control, work-study, crew size, layout computers in project planning and construction management.

**Total No of periods: 60**

**REFERENCES**

1. Hira A. Ahuja, Project Management – techniques in planning and controlling construction projects, wiley, Interscience London 1998.
2. Anthony Walker, project Management in Construction. London 1998
3. Frank Harris and Ronald Mc Catfer, Management and Investment Decisions Constructions Plant. London 1998
4. Thompson P.A., Organisation and Economics of Construction McGraw Hill, 1981. London
5. James. A.F. Stoner and Charles Wankel – Management – Prentice Hall of India, New Delhi, 1986.

**MCE13SE05 PROBABILISTIC METHODS IN CIVIL ENGINEERING 3 1 0 4**

**OBJECTIVE**

- To study about concepts of structural safety, Probablistic analysis.
- Semi – probabilistic design at various limit states.

**UNIT I : BASIC CONCEPTS OF STRUCTURAL SAFETY** **15** Hrs

Basic concepts of structural safety Random variables and distribution probabilistic models – Nature of random variables and probabilities, union of events, conditional event, Baye's rule, uniform law, hyper geometric law, Binomial law, Expected values, Calculation means and variances,

**UNIT II: APPROXIMATION** **15** Hrs

Approximation by central limit theorem, Chebysheve inequality, Gauss inequality Monte Caralo approximation – Statistical inference, Least squares, significance test, Chi – Square test. Basic formulation of linear regression. Multiple linear and non-linear regression

**UNIT III: APPLICATIONS** **15 Hrs**

Applications –Collection and analysis of data on material strengths and loads safety factors – Reliability of structural systems.

**UNIT IV: PROBALISTIC ANALYSIS** **7 Hrs**

Probalistic analysis and design of reinforced concrete and prestressed concrete beams.

**UNIT V: SEMI- PROBABILISTIC ANALYSIS** **8 Hrs**

Semi – probabilistic design at various limit states – Design of columns – Reliability design of tension members, beams and columns, structural safety against dynamic forces.

**Total No. of Hours: 60**

**REFERENCES**

1. Ang & Tang., Probability concepts in Engineering Planning & Design Tata McGraw Hill Publishing Co. 2nd Edition, Berlin 1988.
2. Benjamin & Cornell, Probability, Statistics and Decisions for Civil Engineers,
3. Tata McGraw Hill Publishing Co. 2nd Edition,Berlin 1988. Stark & Nichols, Mathematical Foundations for Designing Civil Engineering systems.Laportati, E., The Assessment of Structural Safety. Tata McGraw Hill Publishing Co. 2nd Edition,Berlin 1988.
4. Thoft Christensus & Bkaer, Structural Reliability Theory and its Applications, Springer Verlay. Tata McGraw Hill Publishing Co. 2nd Edition,Berlin 1988.
5. Papoulis A., Probability, Random Variables and Stochastic Process.Haugen,
6. Probabilistic Approaches to Design, John wiley. Tata McGraw Hill Publishing Co. 2nd Edition, Berlin 1988.

**MMA13SE01** **OPTIMIZATION TECHNIQUES** **3 1 0 4**

**OBJECTIVE**

- To study about optimization techniques and algorithms and theorems.

**UNIT I : INTRODUCTION** **12Hrs**

Basic concepts of minimum weight, minimum cost design, Objective function, constraints, classical methods.

**UNIT II: OPTIMIZATION TECHNIQUES AND ALGORITHMS** **16 Hrs**

Linear programming, Integer Programming, Quadratic Programming, Dynamic Programming and Geometric Programming methods for Optimal design of structural elements.

**UNIT III: COMPUTER SEARCH METHODS** **16 Hrs**

Linear Programming methods for plastic design of frames, Computer search methods for univariate and multivariate Minimization.

**UNIT IV: OPTIMIZATION THEOREMS** **12 Hrs**

Optimization by structural theorems, Maxwell, Mitchell and Heyman's Theorems for trusses and frames, fully stresses design with deflection constraints.

**UNIT V: OPTIMALITY CRITERION METHODS** **04 Hrs**

**Total No. of Hours: 60**

**REFERENCES**

1. Spunt, Optimum Structural Design, Civil Engineering and Engineering Mechanics Services,Prentice-Hall, New Jersey 1971.
2. S.S.Rao, Optimization Theory and Applications, Wiley Eastern Limited, New Delhi, 1977.
3. Uri Krisch, Optimum Structural Design, McGraw Hill Book Co. 1981.
4. Richard Bronson, Operation Research, Schaum's Outline Series, McGraw Hill Singapore, 1983.

**MCE13SE06** **CAD IN CIVIL ENGINEERING** **3 1 0 4**

**OBJECTIVE**

- To learn the principles of Computer graphics, Structural analysis, Finite element analysis and Application packages, Optimization and Artificial intelligence.

**UNIT I :** Introduction to computing – principles of operation of computers – Hardware – Software and operating systems, application programs – data handling file structures Elements of CAD system – Hardware – CAD work stations – Details of Low End and High End work stations – Graphics processors – Hardware structure of a PC based and a high end workstation – Major specifications of work station – Typical CAD work station configuration.

**8 Hrs**

**UNIT II:** CAD hardware input media – Key board cursor – Thumb wheels – Joy stick – Light pen – digitizer etc., - Display types – Storage – raster scan, refresh graphics and plasma panel – Output clenches – plotter – printer and other hand copy devices.

**8 Hrs**

**UNIT III:** Software: Details of 2D drafting software packages – Lazering and drawing primitives – display techniques. Editing – utilities – scaling dim ensuring – 3D work frame and solid modeling – shading – perspective views. Design phases – concept ional design – Design documentation – automated drafting of multistory buildings – information creation – 3D shaded views.

**8 Hrs**

**UNIT IV:** Software package for Analysis for vertical views – Wind loads – program to choose preliminary dimensions – analysis of multistory frames – with or without shear walls. Finite element method of analyzing the frames. **8 Hrs**

**UNIT V:** Design of components – slab – beam – column and footing both in RC and Steel – rolling expert system in the design of multistory steel and RC buildings. **8 Hrs**

Packages for estimation – using Lotus 123 – software for Management – program for CPM & PERT.

**Total No. of Hours: 60**

**REFERENCES**

1. Rajasekaran, S., "CAD in Civil Engineering," Lecture, Notes.
2. C.S. Krishnamoorthy and S. Rajeev, Computer Aided Design, Narosa Publishing House, New Delhi, 1991.
3. H.B. Harrison, Structural Analysis and Design Vol. I & II, Tata McGraw Hill Publishing Co. 2nd Edition, Berlin 1988.
4. Billy E. Gillet, Introduction to Operations Research, A Computer Oriented Algorithmic approach, Tat McGraw Hill Co., 1982.
5. Richard Forsyth (Ed) Expert System Principles and Case Studies – Chapman & Hall. Tata McGraw Hill Publishing Co. 2nd Edition,Berlin 1988.

**MCE13SE07** **SOIL STRUCTURE INTERACTION** **3 1 0 4**

**OBJECTIVE**

- To study about soil – Foundation Interaction problems Analysis of pile Foundation.

**UNIT I: SOIL-FOUNDATION INTERACTION** **9 Hrs**

Introduction to soil-Foundation interaction problems, soil behaviour, Foundation behavior, 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** **14 Hrs**

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** **14 Hrs**

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** **13 Hrs**

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** **10 Hrs**

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

**Total No of periods: 60**

**REFERENCES**

1. Selva durai, A.P.S.., Elastic Analysis of Soil Foundation Interaction,Elsevier,1979
2. Poulos, H.G., and Davis,E.H., Pile Foundation Analysis and Design, John Wiley,Tata McGraw Hill Publishing Co. 2nd Edition,Berlin 1988.
3. Scott,R.F.,Foundation Analysis,Prentice Hall,1981 New Jercy
4. Structure Soil Interaction - State of Art Report,Institution of Structural Engineers, New Delhi 1978.
5. ACI 336, Suggested Analysis and Design Procedures for combined footings and Mats, American Concrete Institute, Delhi,1988

**MCE13SE08** **DISASTER RESISTANT STRUCTURES** **3 1 0 4**

**OBJECTIVE**

- To study about the structural design to resist different natural calamities Rehabilitation and retrofitting of disastered structures.

**UNIT I : BEHAVIOUR OF LIFE-LINE STRUCTURES** **12 Hrs**

Philosophy for design to resist earthquake, cyclone and flood - National and International codes of practice - By-Law of urban and semi-urban areas - Traditional and modern structures.

**UNIT II: COMMUNITY STRUCTURES** **12 Hrs**

Response of dams, bridges, buildings - Strengthening measures - Safety analysis and rating – Reliability assessment.

**UNIT III: REHABILITATION AND RETROFITTING** **12 Hrs**

Testing and evaluation - Classification of structures for safety point of view - methods of strengthening for different disasters - qualification test.

**UNIT IV: DETAILING OF STRUCTURES AND COMPONENTS** **12 Hrs**

Use of modern materials and their impact on disaster reduction - Use of modern analysis, design and construction techniques optimization for performance.

**UNIT V: DAMAGE ASSESSMENT OF STRUCTURES** **12 Hrs**

Damage surveys - Maintenance and modifications to improve hazard resistance - Different types of foundation and its impact on safety - Ground improvement techniques.

**Total No of Hours: 60**

**TEXT BOOKS**

1. V.Moskvin , et.all Concrete and Reinforced Concrete - Deterioration and Protection - Mir Publishers - Moscow 1980.

2. R.T. Allen and S.C. Edwards, Repair of Concrete Structures, Blakie and Sons, U.K 1987.

**REFERENCES**

**1.** Proceedings IABSE 14th Congress "Civilisation through Civil Engineering" New Delhi, 1992.
2. Raiker R.N.Learning from failures Deficiencies in Design, Construction and Service ,
3. R & D Center (SDCPL) Raiker Bhavan, Bombay , 1987.

**MCE13SE09** **DESIGN OF BRIDGES** **3 1 0 4**

**OBJECTIVE**

- To study the loads, forces on bridges and design of several types of bridges.

**UNIT I: INTRODUCTION** **9 Hrs**

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** **12 Hrs**

Load distribution theories, analysis and design of slab culverts, tee beam and slab bridges.

**UNIT III: LONG SPAN GIRDER BRIDGES** **15 Hrs**

Design principles of continuous bridges, box girder bridges, balanced cantilever bridges.

**UNIT IV: DESIGN OF PRESTRESSED CONCRETE BBRIDGES** **8 Hrs**

**UNIT V: DESIGN OF PLATE GRIDER BRIDGES** **16 Hrs**

(for Including bearings, substructures and footings bridges )

**Total No of Hours: 60**

**REFERENCES**

1. Raina V.K. "Concrete Bridge Practice" , Tata McGraw Hill Publishing Company, New Delhi, 1991.
2. Krishnaraju, N., "Design of Bridges" Oxford and IBH Publishing Co., Bombay, Calcutta, New Delhi, 1988
3. Bakht, B. and Jaegar, L.G., "Bridge Analysis simplified", McGraw Hill, 1985.
4. Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill, 1989
5. Derrick Beckett, "An introduction to Structural Design of Concrete Bridges", Surrey University Press, Henley Thomes, Oxford Shire, 1973.
6. Taylor, F.W., Thomson, S.E., and Smulski E., "Reinforced Concrete Bridges", John Wiley and Sons, New York, 1955.

**MCE13SE10 ENVIRONMENTAL ENGINEERING STRUCTURES 3 1 0 4**

**OBJECTIVES**

- To develop a basic knowledge about the environmental engineering structures and apply the same in the field application.
- At the end of the subject the students will able to design environmental engineering structures such as pipes, water tanks, special structures, repair and rehabilitation of structures and maintenance.

**UNIT I: DESIGN OF PIPES 8 Hrs**

Structural design of a) Concrete b) Prestressed Concrete c) Steel and d) Cast-iron piping mains, sewerage tanks design - anchorage for pipes - massive outfalls - structural design and laying - hydrodynamic considerations. Advances in the manufacture of pipes.

**UNIT II: ANALYSIS AND DESIGN OF WATER TANKS 15 Hrs**

Design of concrete roofing systems a) Cylindrical b) Spherical and c) Conical shapes using membrane theory and design of various types of folded plates for roofing with concrete. IS Codes for the design of water retaining Structures. Design of circular, rectangular, spherical and Intel type of tanks using concrete. Design of prestressed concrete cylindrical tanks - Economic analysis - introduction to computer aided design and packages.

**UNIT III: DESIGN OF SPECIAL PURPOSE STRUCTURES 15 Hrs**

Underground reservoirs and swimming pools, Intake towers, Structural design including foundation of water retaining structures such as settling tanks, clarifloculators, aeration tanks etc. - effect of earth pressure and uplift considerations - selection of materials of construction**.**

**UNIT IV: REPAIR AND REHABILITATION OF STRUCTURES 15 Hrs**

Underground reservoirs and swimming pools, Intake towers, Structural design including foundation of water retaining structures such as settling tanks, clarifloculators, aeration tanks etc. - effect of earth pressure and uplift considerations - selection of materials of construction. Diagnosing the cause and damage, identification of different types of structural and non-structural cracks – repair and rehabilitation methods for Masonry, Concrete and Steel Structures.

**UNIT V: EXPOSURE ON STEEL, LATTICE STRUCTURES USED IN WATER AND SEWERAGE WORKS 7 Hrs**

Diagnosing the cause and damage, identification of different types of structural and non-structural cracks – repair and rehabilitation methods for Masonry, Concrete and Steel Structures.

**Total No of Hours: 60**

**TEXT BOOKS**

1. Reinforced Concrete by P.Dayaratnam . S.Chand and Co.New Delhi 1985
2. Prestressed Concrete by Krishna Raju, Tata McGraw Hill Publishing Co. 2nd Edition New Delhi, 1988.
3. Reinforced Concrete by N.C.Sinha & S.K.Roy - S.Chand and Co.New Delhi 1985.

**REFERENCES**

1. Hulse R., and Mosley, W.H., “Reinforced Concrete Design by Computer ",
2. Macmillan Education Ltd., UK 1986.
3. Ramaswamy, G.S., “Design and Construction of Concrete shell roofs ",
4. CBS Publishers, India, 1986.
5. Green, J.K. and Perkins, P.H., “Concrete liquid retaining structures ",
6. Applied Science Publishers, India 1981.

**MCE13SE11 EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION 3 0 1 4**

**OBJECTIVE**

- To study different Measurements & non destructive testing methods.

**UNIT I : FORCES AND STRAIN MEASUREMENT 9 Hrs**

Strain gauge, Principle, types, performance and uses. Photo elasticity- principle and application-Moire fringe-Hydraulic jacks and pressure gauges- Electronic load cells-proving rings – Calibration of Testing Machines.

**UNIT II: VIBRATION MEASURME 9 Hrs**

Characteristics of Structural Vibrations-Linear Variable Differential Transformer (LVDT)-Transducers for velocity and acceleration measurement. Vibration Meter-Seismographs-Vibration Analyzer-Display and Recording of signals-Cathode Ray Oscilloscope-XY Plotter-Digital Data Acquisition System.

**UNIT III: ACOUSTICS AND WIND FLOW MEASURES 9 Hrs**

Principles of Pressure and flow measurements-Pressure transducers- sound level meter- venturimeter and flow meters- wind tunnel and its use in structural analysis- structural analysis- structural modeling- direct and indirect model analysis

**UNIT IV: DISTRESS MEASUREMENTS AND CONTROL 9 Hrs**

Diagnosis of distress in structures- crack observation and measurements- corrosion of reinforcement in concrete-Half cell, construction and use- damage assessment- controlled blasting for demolition

**UNIT V: NON DESTRUCTIVE TESTING METHODS 9 Hrs**

Load testing on structures, buildings, bridges and towers- Rebound hammer- acoustic emission- ultrasonic testing principles and application- Holography- use of laser for structural testing- Brittle coating.

**Total No. of Hours: 45**
**Tutorials Hours : 15**

**REFERENCES**

1. Sadhu singh- Experimental stress Analysis, Khanna Publishers, New Delhi, 1996
2. JW dalley and WF Riley, Experimental Stress Analysis,Mc Graw Hill Book Company, N.Y.1991
3. L.S.Srinath et.al, experimental stress Analysis, Tata Mc Graw Hill Company, New Delhi 1984
4. R.S.Sirohi, HC Radhakrishna, Mechanical Measurements, NewAge International(P) Ltd 1997
5. F.K.Garas, J.L.Clarke and GST Armer,Structural assessment, Butterworths.London,1987
6. D.E.Bray & R.K.Stanley, Non- destructive Evaluation, Mc. Graw Hill Publishing Company,N.Y.1989
7. John Tuner and Martyn Hill, Instrumentation for engineers and scientists, Oxford University Press, 1999.

**MCE13CE08** **DISASTER MANAGEMENT** **3 1 0 4**

**OBJECTIVE**

- To study about Disaster Risk Management & development.

**UNIT I: INTRODUCTION TO DISASTERS** **9 Hrs**

Concepts, and definitions-Disaster, Hazard, Vulnerability, Resilience, Risks Disasters: Classification, Causes, Impacts -including social, economic, political, environmental, health, psychosocial, etc. )

**UNIT II: RISK MANAGEMENT** **9 Hrs**

Goals and objectives of ISDR Programme- Riskidentification – Risk sharing – Disaster and development: Development plans and disaster management –Alternative to dominant approach –disaster-development linkages - Principle of risk partnership.

**UNIT III: RISK REDUCTION** **9 Hrs**

Trigger mechanism – constitution of trigger mechanism – risk reduction by education – disaster information network – risk reduction by public awareness Application of various technologies: Data bases – RDBMS – Management Information systems – Decision support system and other systems – Geographic information systems Remote sensing-an insight – contribution of remote sensing and GIS - Case study.

**UNIT IV: INTER-RELATIONSHIPS BETWEEN DISASTERS AND DEVELOPMENT**: **9 Hrs**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation. Relevance of indigenous knowledge, appropriate technology and local resources financial arrangements – areas of improvement –disaster preparedness — emergencyresponse.

**UNIT V: DISASTER RISK MANAGEMENT IN INDIA** **9 Hrs**

Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, DM Act and Policy, Other related policies, plans, programmes and legislation)

**Total No. of Hours: 45**
**Tutorials Hours : 15**

**TEXT BOOKS**

1. Pardeep Sahni, Madhavi Malalgoda and Ariyabandu, “Disaster risk reduction in South Asia”, PHI
2. Amita Sinvhal, “Understanding earthquake disasters” TMH, 2010.

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