

**CE-7001 Advance Structural Design –I (RCC) For credits & marks refer scheme**

**Unit - I**

Design of Multistory Buildings - Sway and non-sway buildings, shear walls and other bracing elements.

**Unit - II**

Earth Retaining Structures: Cantilever and counter fort type retaining walls.

**Unit - III**

Water Tanks: Tanks on ground and underground tanks: square, rectangular, circular tanks, overhead tanks: circular and intze tanks.

**Unit - IV**

Silos and Bunkers: Introduction, design of rectangular, square and circular bunkers, design of silos by Airy's theory and Janssen's theory.

**Unit - V**

T-beam & Slab bridges- for highway loading (IRC Loads). Prestressing concepts materials, systems of prestressing & losses. Introduction to working and limit state design.

**Reference books :**

1. R.C.C. by O.P. Jain Vol. II
2. R.C.C. by B.C. Punmia
3. Essentials of Bridge Engineering – D.J. Victor
4. Bridge Engineering - Ponnuswamy
5. Advanced R.C.C. Design by N.K. RAJU
6. N.Krishna Raju, Prestressed Concrete, Tata McGraw Hill, New Delhi.
7. Pre stresses concrete – T.Y. Lin Relevant IS codes

**Practical work:**

The detailed design and drawing of various structural components given below as per the syllabus:

1. Design of multistory buildings (sway and non-sway buildings), shear walls and other bracing elements.
2. Cantilever and counter fort type of retaining walls
3. Water tanks: underground and on ground tanks (square, rectangular, circular), overhead tanks and intze tanks
4. Silos (rectangular, square and circular)
5. Bunkers (rectangular, square and circular)
6. T-beam
7. Slab bridges for highway as per IRC loading
8. Prestressed concrete members

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Credit Based Grading System

**Civil Engineering, VII-Semester**

**CE-7002 Structural Design & Drawing –II (Steel)**

**Unit – I**

Plate girder bridges (Riveted and welded)

**Unit – II**

Trussed girder bridges for railways and highways (IRC & IRS holding).Bearings for bridges.

**Unit – III**

Water tanks: Pressed steel tanks, tanks with ordinary plates, square, rectangular, circular with hemispherical bottom and conical bottom.

**Unit - IV**

Chimneys: Guyed and self-supporting steel stacks.

**Unit – V**

Bunkers, Silos & Towers

**Reference books:**

1. Design of Steel Structures -Ramammutham
2. Design of Steel Structures -Punia
3. Steel structures -RamchandraVol II
4. Steel structures - Arya and Ajmani
5. Design of steel structures - L.S. Negi
6. Design of steel structures –N. Subramanian Relevant IS codes

**Practical work:**

1. The detailed design and drawing of various structural components given below as per the syllabus:
2. Plate girder bridges (riveted and welded)
3. Trussed girder bridges for railways and highways (IRC & IRS holding).
4. Bearings for bridges.
5. Circular (with hemispherical and conical bottom), square and rectangular water tanks
6. Chimney (guyed and self-supporting steel stacks)
7. Bunkers
8. Silos
9. Towers

**CE-7003 Modern Construction Technique & Equipment**

**Unit I Modern Construction Materials:** Study of advance building materials like, aluminum, glass, fabric, various types of finishes & treatments, construction chemicals – sealants, engineering grouts, mortars , admixtures and adhesives

**Unit II Polymers** in civil engineering-structural plastics and composites- polymer membranes coatings-adhesives, non - weathering materials-flooring and facade materials- glazed brick, photo catalytic cement, acid etched copper and composite fiber metals-metals and special alloys of steel - water jet cut stainless steel, mill slab steel, tension rods assemblies and cast iron, heat treatment in steels, tendons.

**Unit III Construction methods:** precast flat panel system, 3d volumetric construction, tunnel boring methods, slip form work, precast foundations .fabrication of pre cast and pre stressed components, reinforcing steel: types, bending, placing, splicing and spacing, tendons- soil improvement - mechanical, thermal and chemical.

**Unit IV Construction Equipment's:** equipment for excavating, 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 , forklifts and related equipment-portable material -conveyors-hauling equipment.

**Unit V Smart Materials:** concept and types, sensing technology-types of sensors -physical measurement using piezoelectric strain measurement, piezoelectric and electrostrictive material - magneto structure material, shape memory alloys, electro rheological fluids

**References Books:**

1. Shan Somayaji, Civil Engineering Materials 2nd Edition, Prentice Hall Inc., 2001.
2. Mamlouk M.S. and Zaniewski J.P., Materials for Civil and Construction Engineers, Prentice Hall Inc., 1999.
3. Derucher K., Korfiatis G. and Ezeldin S., Materials for Civil and Highway Engineers ", Prentice Hall Inc., 1999. 4th Edition
4. Peurifoy R.L., Ledbetter W. B.and Schexnayder C.,Construction Planning, Equipment and Methods ", 5th Edition, McGraw Hill, Singapore, 1995.
5. Sharma S.C. Construction Equipment and Management, Khanna Publishers New Delhi, 1988.
6. Deodhar S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 1988.
7. Mahesh Varma, Construction Equipment and its Planning and Application, Metro-politan Book Company, New Delhi-, 1983
8. Srinivasan A.V and Michael McFarland. D, Smart Structures - Analysis and Design, Cambridge University Press.
9. Mukesh V. Gandhi, Brian S. Thompson, Smart Materials and Structures, Springer,

**Practical work:**

1. Study of basic properties and tests on modern materials
2. Collect the specification of various modern construction materials and equipment available in market
3. Prepare and give a presentation on any of the topic content in syllabus.

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**Civil Engineering, VII-Semester**

**Elective-III CE-7004 (1) Pavement Design**

**Unit -I.**

Equivalent Single Wheel Load (ESWL): Definition, calculation of ESWL, repetition of loads and their effects on the pavement structures.

**Unit -II.**

Flexible Pavements: Component parts of the pavement structures and their functions, stresses in flexible pavements, Stress distribution through various layers, Boussinesque's theory, Burmister's two layered theory, methods of design, group index method, CBR method, Burmister's method and North Dakota cone method.

**Unit -III.**

Rigid Pavements: Evaluation of subgrade, Modulus-K by plate bearing test and the test details, Westergaard's stress theory stresses in rigid pavements, Temperature stresses, warping stresses, frictional stresses, critical combination of stresses, critical loading positions.

**Unit -IV.**

Rigid pavement design: IRC method, Fatigue analysis, PCA chart method, joints, design and construction & types, AASHTO Method, Reliability analysis.

**Unit -V.**

Evaluation and Strengthening of Existing Pavements: Benkleman beam method, Serviceability Index Method. Rigid and flexible overlays and their design procedures.

**Reference Books:-**

1. Principles of pavement design by E.J. Yoder & M.W. Witczak
2. AASHO, "AASHO Interim Guide for Design of Pavement Structures", Washington, D.C.
3. Portland Cement Association, Guidelines for Design of Rigid Pavements, Washington
4. DSIR, Conc. Roads Design & Construction
5. Srinivasan M. "Modern Permanent Way"

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Credit Based Grading System

**Civil Engineering, VII-Semester**

**Elective-III CE-7004 (4) Cost-Effective & Eco-Friendly Construction**

**UNIT-I**

Concepts of energy efficient & environment friendly materials and techniques:

Cost effective materials: Soil, Fly ash, Ferro-cement, Lime, Fibers, Stone Dust, Red mud, Gypsum, Alternate Wood, Polymer.

Energy Efficient & Environment friendly building material products:

Walls - Stabilized and sun dried, soil blocks & bricks, Solid & Hollow concrete blocks, stone masonry blocks, Ferro cement partitions.

Roofs – Pre-cast R.C. Plank & Joists roof, Pre-cast channel roof, Pre-cast L-panel roof, Pre-cast Funicular shells, Ferro cement shells, Filler Slab, SeasalFibre roof, Improved country tiles, Thatch roof, M.C.R. tile.

Green Materials, Green Buildings – Definition - Features- Necessity – Environmental benefit - Economical benefits - Health and Social benefits - Major Energy efficient areas for buildings – Embodied Energy in Materials.

**UNIT-II**

Cost effective construction techniques and equipments:-

(a) Techniques: Rat trap bond construction, Energy Efficient roofings, Ferro cement technique, Mud Technology.

(b) Equipments: Brick moulding machine, Stabilized soil block making machine and plants for the manufacturing of concrete blocks, M.C.R. tile making machine, Ferro cement wall panel & Roofing channel making machine, R.C.C. Chaukhat making m/c.

**UNIT-III**

Cost effective sanitation:

(a) Waste water disposal system

(b) Cost effective sanitation for rural and urban areas (c) Ferrocement Drains

**UNIT-IV**

Low Cost Road Construction:

Cost effective road materials, stabilization, construction techniques tests, equipment used for construction, drainage, maintenance.

**UNIT-V**

Cost analysis and comparison: (a) All experimental materials (b) All experimental techniques Green Building rating systems

**Reference books:**

1. Alternative Building Materials and Technologies – K S Jagadeesh, B V Venkatta Rama Reddy & K S Nanjunda Rao – New Age International Publishers
2. Integrated Life Cycle Design of Structures – Asko Sarja – CRC Press
3. Non-conventional Energy Resources – D S Chauhan and S K Sreevastava – New Age International Publishers
4. Buildings How to Reduce Cost – Laurie Backer - Cost Ford
5. Lynne Elizabeth, Cassandra Adams Alternative Construction : Contemporary Natural Building Methods”, Softcover, Wiley & Sons Australia, Limited, John, 2005
6. Givoni, “Man, Climate, Architecture, Van Nostrand, New York, 1976.
7. Charles J. Kibert, Sustainable Construction: Green Building Design and Delivery, John Wiley & Sons, 2005.
8. Eugene Eccli- Low Cost, Energy efficient shelter for owner & builder, Rodale Press, 1976

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Credit Based Grading System

**Civil Engineering, VII-Semester**

**Elective-IV CE-7005 (1) Infrastructure Engineering**

**Unit I**

Infrastructure: Definitions of infrastructure, Governing Features, Historical overview of Infrastructure development in India, Infrastructure Organizations & Systems.

**Unit II**

Infrastructure Planning: Typical infrastructure planning steps, Planning and appraisal of major infrastructure projects, Screening of project ideas, Life cycle analysis, Multi-criteria analysis for comparison of infrastructure alternatives, Procurement strategies, Scheduling and management of planning activities, Infrastructure Project Budgeting and Funding, Regulatory Framework, Sources of Funding.

**Unit III**

Project Management in Construction: Introduction to project management processes -Initiating, Planning, Executing, Controlling, and Closing processes; Project Integration Management - Project plan development, Project plan execution, and Overall change control; Project Scope Management - Initiation, Scope planning, Scope definition, Scope verification, and Scope change control.

**Unit IV**

Contracts and Management of Contracts: Engineering contracts and its formulation, Definition and essentials of a contract, Indian Contract Act 1872, types of contracts and clauses for contracts, Preparation of tender documents, Issues related to tendering process, Awarding contract.

**Reference books:**

1. A. S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill, New York, 2006.
1. J. Parkin and D. Sharma, Infrastructure planning, Thomas Telford, London, 1999.
2. P. Chandra, Projects: Planning, analysis, selection, financing, implementation, and review, Tata McGraw-Hill, New Delhi, 2009.
3. S. M. Levy, Project management in construction, 5th ed., McGraw Hill, New York, 2007.
4. PMI, A guide to the project management body of knowledge, 3rd ed., Project Management Institute, Pennsylvania, 1996.
5. M. Mawdesley, W. Askew and M. O'Reilly, Planning and controlling construction projects, Addison Wesley Longman Limited, Essex, 1997.
6. Vasant Desai, "Project Management", Himalaya Publishing, 1st Edition, 2010
7. Ronald W Hudson, "Infrastructure Management: integrating design, Construction, maintenance, rehabilitation and renovation", MGH, 1st Edition, 1997
8. Codes of Practice and Standard Specifications" of AP PWD, CPWD, MES etc.
9. Grig N. S., "Infrastructure Engineering and Management", Wiley-Interseience.

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

Credit Based Grading System

**Civil Engineering, VII-Semester Elective-IV**

**CE-7005 (2) Earthquake Resistant Design**

## **Unit 1 Engineering Seismology**

Introduction to engineering seismology, Geological and tectonic features of India, Origin and propagation of seismic waves, Earthquake measurement parameters, Characteristics of earthquake and its quantification- Magnitude and Intensity scales, Seismic instruments. Seismic zoning map of India.

## **Unit 2 Response Spectrum**

Response history and strong motion characteristics. Response Spectrum- elastic and inelastic response spectra, tripartite (D-V-A) response spectrum, use of response spectrum in earthquake resistant design. Computation of seismic forces in multi-storeyed buildings - using procedures as per codal provisions.

## **Unit 3 Aseismic Structural Modelling**

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

## **Unit 4 Design of structure for earthquake resistance**

Seismic design philosophy, Load combinations, Ductility and energy absorption in buildings. Confinement of concrete for ductility, design of columns and beams for ductility, ductile detailing provisions as per IS-1893. Lateral load resisting structural systems.

## **Unit 5 Seismic control of structures**

Introduction, concept and types of seismic control systems as active, passive and semi-active systems. Requirements of efficient earthquake resistant structural system, damping devices, base isolation systems. Retrofitting of structures.

## **Reference Books:**

1. Chopra Anil Kumar, Dynamics of Structures- Theory and Application to Earthquake Engineering, Pearson Education.
2. Hosur Vinod, Earthquake Resistant Design of Building Structures, Wiley (India).
3. Duggal, S. K., Earthquake Resistant Design of Structures, Oxford University Press.
4. Agarwal Pankaj, Shrikande Manish, Earthquake resistant design of structures, Prentice Hall of India, New Delhi India.
5. Pauley & Priestly, Seismic design of reinforced concrete and masonry buildings, John Wiley & Sons.
6. Stratta.J. L, Manual of Seismic Design, Prentice-Hall India Pvt Ltd.
7. Kramer.S. L., Geotechnical Earthquake Engineering, Prentice-Hall India Pvt Ltd.
8. All relevant IS codes.