

**DR. A.P.J ABDUL KALAM TECHNICAL  
UNIVERSITY, LUCKNOW**



**EVALUATION SCHEME & SYLLABUS**

**FOR**

**B. TECH. FOURTH YEAR**

**(CIVIL ENGINEERING)**

**On**

**Choice Based Credit System**

**(Effective from session 2019-20)**



## **RCE701 Design of Structure-III**

**(L-T-P 3-1-0)**

**Credit – 4**

**NOTE: All design are to be carried as per IS:800-2007**

**UNIT - I** Introduction to steel structures. Advantages and Disadvantages of Steel as a Structural Material. Stress-Strain Curve for Mild Steel, Rolled Steel Sections, Convention for Member Axes, Loads, Dead Load, Live Loads, Environmental Loads, Seismic Forces, Snow and Rain Loads, Erection Loads, Basis for Design, Design Philosophies, Local Buckling of Plate Elements. Introduction to Limit State Design Limit States of Strength, Limit States of Serviceability, Actions (Loads), Probabilistic Basis for Design. **[8]**

**UNIT - II** Introduction to Riveted, Bolted and Pinned Connections, Riveted Connections, Patterns of Riveted Joints, Bolted Connections, Types of Bolts, Types of Bolted Joints, Load Transfer Mechanism, Failure of Bolted Joints, Specification for Bolted Joints, Bearing-Type Connections, Prying Action, Tensile Strength of Plate, Efficiency of the Joint, Combined Shear and Tension, Slip-Critical Connections, Combined Shear and Tension for Slip-Critical Connections, Working Load Design, Design of eccentric bolted connections . Simple Welded Connections, Types, Symbols, Welding Process, Weld Defects, Inspection of Welds, Assumptions in the Analysis of Welded Joints, Design of Groove Welds, Design of Fillet Welds, Fillet Weld Applied to the Edge of A Plate Or Section, Fillet Weld for Truss Members, Design of Intermittent Fillet Welds, Plug and Slot Welds, Stresses Due To Individual Forces, Combination of Stresses, Failure of Welds, Distortion of Welded Parts, Fillet Weld Vs Butt Weld, Welded Jointed Vs Bolted and Riveted Joints, Design of eccentric welded connections. **[8]**

**UNIT – III** Introduction to Tension Members, Types of Tension Members, Net Sectional Area, Effective Net Area, Types of Failure, Design Strength of Tension Members, Slenderness Ratio ( $\lambda$ ), Displacement, Design of Tension Member, Lug Angles, Splices, Gusset Plate. **[8]**

**UNIT – IV** Introduction to Compression Members, Effective Length, Slenderness Ratio ( $\lambda$ ), Types of Sections, Types of Buckling, Classification of Cross Sections, Column Formula, Design Strength, Design of Axially Loaded Compression Members, Built-Up Columns (Latticed Columns), Lacing, Batten, Compression Member Composed of Two Components Back-to-Back, Splices, Design of Column Bases. **[8]**

**UNIT – V** Introduction to Beams, Types of Sections, Behaviour of Beam in Flexure, Section Classification, Lateral Stability of Beams, Lateral-Torsional Buckling, Bending Strength of Beams, Laterally Supported Beams, Laterally Unsupported Beams, Shear Strength of Beams, Web Buckling, Bearing Strength, Web Crippling, Deflection, Design Procedure of Rolled Beams, Built-Up Beams (Plated Beams), Purlins, Beam Bearing Plates, Effect of Holes in Beam, Introduction to Plate Girder , Introduction to Gantry Girder. **[8]**

**Text Books**

1. Design of Steel Structures by N. Subramanian, Oxford University Press
2. Limit State Design of Steel Structures by S. K. Duggal, Tata Mcgraw Hill.
3. Design of Steel Structures by K S Sairam, Pearson Education
4. Design of Steel Structures by S Ramamurtham, DhanpatRai Publishing Company.

Reference Books

1. Steel Structures by Robert Englekirk. Hohn Wiley & sons inc.
2. Structural Steel Design by Lambert tall (Ronald Press Comp. Newyork.
3. Design of steel structures by Willam T Segui , CENGAGE Learning
4. Structural Steel Design By D MacLaughlin, CENGAGE Learning

## **RCE702 Water Resources**

**(L-T-P 3-0-0) Credit - 3**

**UNIT – I** Hydrology: Hydrological Cycle and its components; Water Budget Equation, Precipitation: Types, measurements and analysis, Evaporation and consumptive use: estimation and measurement techniques.

Irrigation: Necessity and types, Advantages & disadvantages of irrigation; Functions of water in plant growth, Methods of Irrigation, Water requirement of crops, Duty and Delta relationship; Irrigation frequency; Irrigation efficiencies; Principal crops and crop season, crop rotation.

Canal irrigation: Classes and alignment, Parts of a canal system, Command area, curves in channels, channel losses.

Introduction to Sediment Transportation: Suspended and Bed load and its estimation **[8]**

**UNIT – II** Irrigation channels and Design: Types: lined and unlined, silt theories: Kennedy's and Lacey's Design procedure for irrigation channels, longitudinal cross section, Schedule of area statistics and channel dimensions, cross sections of an Irrigation channel,

Lining of Irrigation Canals: Advantages and types; factors for selection of a particular type, design of lined channels, cross section of lined channels, Economics of canal lining. Water Logging and Drainage Design: effects, causes and anti-water logging measures, Drainage of water logged land. **[8]**

**UNIT – III** Regulation and control of canal system: Purpose, Types of canal regulation works and their functional aspects

Irrigation Outlets: Requirements, types, non-modular, semi-module and rigid module, selection criterion

River Training: Objective and need, classification of rivers, and river training works, meandering, stages, methods of river training, bank protection, Methods for measurement of discharge.

Types of Head works: Component parts of a diversion headwork, Failure of hydraulic structures founded on permeable foundations, Principles of design, Bligh's theory, Khosla's theory for determination of pressure and exit gradient.

Regulation Works: Falls, Classification; Introduction to design principle of falls, Design of Sarda type and straight glacis fall.

Principle and design of Distributory head regulator and cross regulator, canal escape, Bed bars [8]

**UNIT – IV** Canal head works: Functions, Location, Layout of head works. Weir and Barrage, Canal head Regulator, Introduction to the design principles of Weirs on permeable foundations, Design of vertical drop and sloping glacis weir.

Cross drainage works: Necessity and types; Aqueduct, Siphon Aqueduct, super passage, canal siphon, level crossing, Introduction to design principles of cross drainage works. Investigation and planning of dams and Reservoirs: Zones of storage, Estimation of storage capacity, Reservoir losses, Reservoir sedimentation and its control, life of a reservoir. [8]

**UNIT – V** Dams: classification and selection criteria.

Earth Dams: Classification, causes of failure, Phreatic line, and its determination Introduction to stability analysis

Gravity dams: Forces method of analysis, modes of failure and factor of safety, Elementary profile, stability analysis, galleries, joints, control of cracks.

Spillways: Spillway capacity, types of spillways, Design of ogee spillway, Energy dissipation below spillway, Design criteria for Hydraulic Jump type stilling basins with horizontal and sloping aprons, spillway gates.

Hydro-Electric Power: assessment of potential in reference to India, classification of power plants, important terms, types of turbines and their suitability; Power House layout and important structures of a powerhouse. [8]

### **Text Books**

1. Water Resources Engg. By Larry W Mays, John Wiley India
2. Water resources Engg. By Wurbs and James, John wiley India
3. Water Resources Engg. By R.K. Linsley, McGraw Hill
4. Irrigation and Water Resources Engg. By G L Asawa, New age International Publishers
5. Irrigation Engg. and Hydraulic Structures by S.K. Garg, Khanna Publishers.

### **References**

1. Fundamental of Hydraulic Engineering System by Houghalen, Pearson Publication.
2. Irrigation and water Power engineering by B.C. Punmia, Laxmi Publications.
3. Engineering Hydrology by K. Subramanya, TMH.
4. Irrigation Water Power and Water Resource Engg. by K.R. Arrora.
5. Water resource engineering by Ralph A. Wurbs & Wesley P. James, Pearson Publication.

## **RCE071 Geology and Soil Mechanics**

**(L-T-P 3-0-0) Credit - 3**

**UNIT- I** Minerals : Their physical and detailed study of certain rock forming minerals.

Rocks structure of earth and formation of rocks. Texture and classification of rocks. Engineering properties, weathering and suitability of rocks as Engg. materials. **[8]**

**UNIT- II** Stratification and Lamination bedding of rocks. Dip and strike of bed.

Rock deformation : Folds, Faults, joints unconformity and their classification, causes and relation to engg. behaviour of rock masses. **[8]**

**UNIT- III** Earthquake, its causes, classification, seismic zones of India and geological consideration for construction of building, projects in seismic areas.

Landslides: Causes, classification and preventive measures. **[8]**

**UNIT –IV** Geological investigations for site selection of dams, reservoirs tunnels, bridges and highways.

Principles of geophysical explorations methods for subsurface structures. **[8]**

**UNIT- V** Clay Mineralogy, index properties of soil, IS classification of soil, shear strength of soil, Effective stresses in soil, stress in soil (Boussiensq, Westergaard theories) & Earth pressure theories and their application. **[8]**

### **REFERENCES:**

1. V.N.S. Murthy – Soil Mechanics and Foundation Engineering (Fifth Edition)
2. K.R. Arora – Soil Mechanics and Foundation Engineering
3. Narasinga Rao, B.N.D, “Soil Mechanics & Foundation Engineering”, John Wiley & Sons, Wiley India Pvt. Ltd., Daryaganj, New Delhi – 110 002.
4. Varghese, P.C., Engineering Geology for Civil Engineering Prentice Hall of India Learning Private Limited, New Delhi, 2012.
5. Venkat Reddy. D. Engineering Geology, Vikas Publishing House Pvt. Lt, 2010.
6. Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics.
7. J.M. Treteth : Geology of Engineers, Princeton, Von. Nostrand.
8. Prabin Singh : Engg. and General Geology, Katson Publishing House
9. F G Bell : Funamentals of Engineering Geology , B S Publication
10. P.K. Mukerjee : A text Book of Geology, Calcutta Word Publishers.

## **RCE072 Rural Development Engineering**

**(L-T-P 3-0-0) Credit - 3**

**UNIT- I** Rural Development Planning and Concept of Appropriate Technology: Scope; development plans; various approaches to rural development planning; concept of appropriate technology. Rural development programme/ projects. **[8]**

**UNIT- II** Rural Housing: Low cost construction materials for housing; Architectural considerations for individual and group housing; Composite material - ferro-cement & fly ash, autoclaved calcium silicate bricks and soil-stabilized un-burnt brick; Plinth protection of mud walls; design consideration and construction of: non-erodable mud plaster, Water-proof and fire-retardant roof treatment for thatch roofs. Pre-cast stone masonry; rat-trap bond for walls; Panels for roof, ferro-cement flooring / roofing units, Earthquake resistant measures for low cost houses. **[8]**

**UNIT- III** Water Supply and Rural Sanitation: Sources of water. BIS & WHO water standards. Quality, Storage and distribution for rural water supply works; basic design principles of treatment-low cost water treatment technologies; conservation of water; rainwater harvesting; drainage in rural areas, low cost waste disposal systems; septic tank ; Biogas technology; low cost community & individual Garbage disposal systems, Ferro-cement water storage tanks. **[8]**

**UNIT- IV** Low Cost Roads and Transport: Broad categories of Pavement Layers, types of Granular Sub-Bases and Bases, Bituminous Construction, Surface Treatments for roads in rural areas. Soil Stabilization, Lime, Lime Flyash and Cement Treated Course. Crusher-run-Macadam. Use of local materials. Flexible Pavement: Design factors, Basic Principles, Guidelines for Surfacing for Rural Road. **[8]**

**UNIT- V** Low Cost Irrigation: Consideration of low cost irrigation techniques , drip & sprinkler irrigation systems. Watershed and catchments area development - problems and features of watershed management, watershed structures **[8]**

### **Reference Books:**

1. A.G.Madhov Rao, D.S.Ramachandra Murthy, Appropriate Technologies for low cost Housing Oxfordand IBH Publishing Co. Pvt .Ltd.
2. CBRI, Roorkee, Advances in Building Mat erials and Construction.
3. C. Satyanarayana Murthy, Design of Minor Irrigation and Canal Structures. Wiley Eastern Ltd.,
4. Document on Rural Road Development in India Volume1& 2; Central Road Research Institute, New Delhi.
5. Water supply and sanitary engineering by Rangwala, .Charotar publication
6. Rural Infrastructure by P.Nair, SBS Publication
7. Rural Infrastructure by Samalia Bihari Verma, Gyaneshwar Prasad & Sahib Kumari Singh, Sarup & Sons.
8. Rural Development by Katar Singh, SAGE Publication

9. Information and Communication Technology for Agriculture and rural development by R. Saravanan, New India Publishing agency

### **RCE073 Structural Health Monitoring & Rehabilitation (L-T-P 3-0-0) Credit - 3**

**UNIT - I Maintenance:** Repair and rehabilitation, facts of maintenance, importance of maintenance various aspects of inspection, assessment procedure for evaluating damaged structure, causes of deterioration.

**Repair Strategies:** Causes of distress in concrete structures, construction and design failures, condition assessment and distress-diagnostic techniques, assessment procedure for inspection and evaluating a damaged structure. [8]

**UNIT - II Serviceability and Durability of Concrete:** Quality assurance for concrete construction, concrete properties – strength, permeability, thermal properties and cracking. effects due to climate, temperature, chemicals, corrosion. [8]

**UNIT - III Materials and Techniques for Repair:** Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, fibre reinforced concrete, bacterial concrete, rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, gunite and shotcrete, epoxy injection, mortar repair for cracks, shoring and underpinning. [8]

**UNIT - IV Repair, Rehabilitation and Retrofitting Techniques:** Repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.

**Repair of structure:** Common types of repairs, repair in concrete structures, repairs in under water structures.

**Strengthening of Structures:** Strengthening Methods, retrofitting, jacketing. [8]

**UNIT – V Health Monitoring and Demolition Techniques:** Long term health monitoring techniques, engineered demolition techniques for dilapidated structures, use of sensors for building instrumentation. [8]

#### **Suggested Reading:**

1. Concrete Technology by A.R. Santakumar, Oxford University press
2. Defects and Deterioration in Buildings, E F & N Spon, London
3. Non-Destructive Evaluation of Concrete Structures by Bungey - Surrey University
4. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.

5. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ranso, (1981)
6. Building Failures : Diagnosis and Avoidance, EF & N Spon, London, B .
- 7 .Mehta, P.K and Montevic. P.J., Concrete- Microstructure, Properties and Materials, ICI, 1997.,
8. Jackson, N., Civil Engineering Materials, ELBS, 1983.

## **RCE074 RIVER ENGINEERING**

**(L-T-P 3-0-0) Credit - 3**

**UNIT– I** Introduction, classification of Rivers, Mechanics of alluvial rivers including channel and flood plain features, Sediment transport and budgets, River morphology and various classification schemes. **[8]**

**UNIT –II** Behaviour of Rivers: Introduction, River Channel patterns, Straight river channels, causes, characteristics and shapes of meanders and control, cutoff, Braided Rivers, Bed forms, Instability of rivers, Hydraulic geometry, Delta formation and control. **[8]**

**UNIT-III** Mechanics of Alluvial Rivers, Rivers and restoration structures, Socio-cultural influences and ethics of stream restoration. **[8]**

**UNIT-IV** Bio-engineering Techniques, Classification review, Natural Channel Design Analysis, Time Series, Analysis of flow, Sediment and channel geometry data. **[8]**

**UNIT-V** River Training and Protection Works: Introduction, Classification of River Training, Types of training works, Protection for Bridges with reduced waterway, Design of Guide Band, embankment and spurs/dampners and other river/ flood protection works. **[8]**

### **Text book:**

1. River Behaviour Management and Training (Vol. I & II), CBI&P, New Delhi.
2. Irrigation & Water Power Engineering- B. C. Punmia and Pande B. B. Lal.
3. River Engineering by Margeret Peterson
4. Principles of River Engineering by ( the non tidel alluvial) PH Jameen

## **RCE075 Computational Fluid Dynamics**

**(L-T-P 3-1-0) Credit - 4**

**UNIT-I** Introduction to Computational Fluid Dynamics, Basic concepts of CFD: Finite difference approximations, Consistency, stability and convergence. **[8]**

**UNIT-II** Derivation of equations governing fluid flow, Equations for incompressible flow and boundary conditions. **[8]**

**UNIT - III** Fundamentals of discretization, finite Volume approach and discretization of unsteady-state problems. Classification calculation of flow in a rectangular duct ,Calculation of fully developed flow in a triangular duct. **[8]**

**UNIT- IV** Solution of Navier Stokes equations for compressible flows and incompressible flows, solution of linear algebraic equations: basic methods and advanced methods. **[8]**

**UNIT-V** Basics of finite volume method including grid generation, Turbulent flows and turbulence modelling. **[8]**

**REFERENCES:**

- 1.Ferziger J.H. & Peric M. (1999) Computational Methods for Fluid Dynamics, Springer, Berlin, Germany.
- 2.Hirsch C. (1988) Numerical Computation of Internal and External Flows, John Wiley & Sons, New York, USA.
- 3.Patankar S.V. (1980) Numerical Heat Transfer and Fluid Flow, Hemisphere, Washington D.C., USA.
- 4.Versteeg H.K. & Malalsekera W. (1995) An Introduction to Computational Fluid Dynamics: The Finite Volume Method, Longman Scientific & Technical, Harlow, Essex, UK.
- 5.Anderson J.D. (1995) Computational Fluid Dynamics: The Basics with Applications,McGraw-Hill, Inc.
- 6.John C. Tannehill, Dale A. Anderson and Richard H. Pletcher, Computational Fluid Mechanics and Heat Transfer, Taylor &Francis.
7. T. J. Chung, Computational Fluid Dynamics, Cambridge University Press.

**RCE076 Railways, Airport & Water Ways**

**(L-T-P 3-1-0) Credit - 4**

**UNIT –I** Introduction to Permanent Way and its Components: History and administrative setup of Indian Railways; Rails, Type of rails, rail gauges, permanent way formation,– functions, requirements, sections in embankment and cutting (single/double track), electrified tracks, locomotives, wheel and axle arrangement, coning of wheels, defect in rails, rail fastenings, Fish plates, spikes, chairs, keys, bearing plates. sleepers, Timber, steel, cast iron, concrete and prestressed concrete sleepers, sleeper density, ballast: material, specifications. **[8]**

**UNIT-II** Track Geometrics, Turnouts and Crossings, Stations and Yards: Railway alignment, vertical alignment – gradients and grade effects, horizontal alignment – horizontal curves, super-elevation, concepts of cant excess and deficiency, safe permissible speed, transition curves, widening of gauges and track clearances, points and crossings – terminologies, types of turnouts, design of turnouts, types of crossings, design of crossings. Different types of stations and Yards: classification and functioning.

**[8]**

**UNIT –III** Signalling and Interlocking, Urban Railways: Classification of Signals, method of train working, absolute block system, Centralized train control system, ATS, interlocking of track, principle of interlocking, types of interlocking, high speed track – track requirement, speed limitations, high speed technologies, Urban railway- railway system in urban areas. **[8]**

**UNIT – IV** Introduction to Airport Engineering Air craft characteristics affecting airport planning & design, selection of site for an airport. Airports - layout and orientation, Runway and taxiway design consideration and geometric design. Airport drainage management, Zoning laws, Visual aids and air traffic control, Runway lighting, Runway operation Helipads, hangers, service equipment. **[8]**

**UNIT – V** Water Transport Harbours and ports, Types of Harbours; Harbours - layouts, shipping lanes, anchoring, location identification; Littoral transport with erosion and deposition; sounding methods; Dry and Wet docks, components and operational Tidal data and analyses. Inland waterways: advantages and disadvantages; Development in India. Inland water operation. **[8]**

#### **Text Books**

1. A Text Book of Railway Engineering by S. P. Arora & S. C. Saxena
2. Railway Engineering by M. M. Aggrawal.

#### **References**

1. Railway Engineering by Rangwala (Charotar Publishing House).
2. Airport Engineering by Rangwala (Charotar Publishing House).
3. Airport Planning & Design by Khanna , Arora & Jain Nem Chand & Brothers).
4. Docs & Harbour Engineering by Bindra (Dhanpat Rai Publishing Company).
5. Docs & Harbour Engineering by Rangwala (Charotar Publishing House).
6. Docs & Harbour Engineering by Oza (Charotar Publishing House).

### **RCE077 Air & Noise Pollution Control**

**(L-T-P 3-1-0) Credit - 4**

**UNIT- I** Air pollution: composition and structure of atmosphere, global implications of air pollution. classification of air pollutants: particulates, hydrocarbon, carbon monoxide, oxides of sulphur, oxides of nitrogen and photochemical oxidants. Indoor air pollution. Effects of air pollutants on humans, animals, property and plants. **[8]**

**UNIT - II** Air pollution chemistry, meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion. **[8]**

**UNIT - III** Ambient air quality and standards, air sampling and measurements. Control of particulate air pollutants using gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP). **[8]**

**UNIT - IV** Control of gaseous contaminants: Absorption, Adsorption, Condensation and Combustion, Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons. Automotive emission control, catalytic convertor, Euro-I, Euro-II and Euro-III specifications, Indian specifications. [8]

**UNIT - V** Noise pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psychoacoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infrasound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices. Noise control methods. [8]

**References:**

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2. Martin Crawford: Air Pollution Control Theory.
3. Wark and Warner: Air Pollution: Its Origin and Control.
4. Rao and Rao: Air Pollution Control Engineering.
5. Nevers: Air Pollution Control Engineering.
6. Mycock, McKenna and Theodore: Handbook of Air Pollution Control Engineering and Technology.
- Suess and Craxford: W.H.O. Manual on Urban Air Quality Management
7. C.S. Rao, Air pollution and control
8. Advanced Air and Noise Pollution Control by Lawrence K. Wang, Norman C. Pereira & Yung Ise Hung.
9. Noise Pollution and Control by S. P.Singhal , Narosa Pub House
10. Textbook of Noise Pollution and Its Control by S. C. Bhatia, Atlantic; Edition

**RCE078 Ground Improvement Techniques**

**(L-T-P 3-1-0) Credit - 4**

**UNIT -I** Introduction, Review of compaction theory, effect of compaction on surface behaviour, Field methods of compaction, Quality Control, Design of soil-lime, soil-cement, soil-bitumen and soil-lime-flyash mixes. [8]

**UNIT -II** In-situ densification methods in granular soils, Deep compaction: Introduction, Terra-Probe, Vibroflotation techniques, Ground Suitability for Vibroflotation, Advantages, Mueller Resonance Compaction, Dynamic Compaction, Depth of Improvement.

[8]

**UNIT -III** In-situ densification methods in cohesive soil: Introduction, Pre-loading and de-watering, Vertical drains, Electrical method, Thermal method. [8]

**UNIT – IV** Grouting: introduction, suspension grout, solution grout, grouting equipments and methods, Grouting design and layout Granular Piles: Ultimate bearing capacity and settlement, method of construction, load test. **[8]**

**UNIT -V** Underpinning of foundations: importance and situations for underpinning, methodology, typical examples. Geotextiles: types, functions, specifications, precautions in transportation and storage. **[8]**

**Recommended:**

1. S. K. Garg – Soil Mechanics & Foundation Engineering.
2. Purshotham Raju – Ground Improvement.
3. Gopal Ranjan and A. S. R. Rao – Basic and Applied Soil Mechanics
4. J. N. Mandal – Geosynthetics World
5. Bergado et. al. – Soft Ground Improvement
6. Koerner, R. M. - Designing with geosynthetics
7. Ground Improvement Techniques by Dr. P Purushothama Raj

**RCE751 Non Destructive Testing Laboratory**

**(L-T-P 0-0-2) Credit - 1**

**NOTE: Student will have to perform minimum 3 test on concrete & two test on structural steel**

1. Non Destructive Testing of reinforced cement concrete
  - (a) Strength assessment using rebound hammer
  - (b) Quality assessment using ultrasonic puls velocity test
  - (c) Strength assessment using pull out method
  - (d) Assessment of corrosion of reinforcing bars using half cell potentiometer
  - (e) To determine thickness of concrete cover, diameter & spacing of reinforcing bars using rebar scanner.
2. Testing of structural steel
  - (a) Testing for corrosion of structural steel
  - (b) Assessment of thickness of pipes/tubes/structural steel
  - (c) Test for welding performance with Di-penetration test, ultrasonic test & magnetic particle test

## **RCE752 Mini Project**

**(L-T-P 0-0-2) Credit - 1**

- **Students will be asked to work upon minimum four of the following topics during the semester.**
  - **They will submit the report of each topic containing following information (as per need of topic) like: introduction, general information, usage/application (if any) detailed description of work/process, relevant diagrams, drawings & tabulation (if any), observation and results (as applicable) or any other relevant information as per topic.**
1. Work related to preparation of bill of quantity & tender document.
  2. Work related to design & drawing of flat slab using IS code method.
  3. Work related to cost estimation of (including market survey of rates by students) building/earth work for a highway.
  4. Work related to scheduling of activities of a project using relevant software
  5. Work related to preparation of layout plan of a building and its marking on ground.
  6. Design & analysis of a G+5 residential building using structural design and analysis software like STAAD Pro/STRUDS/SAP/ETAB/STRAP.
  7. Work related to design of a small sewage treatment plant (STP) unit for a residential society.
  8. Work related to computation of surface runoff & design of rain water harvesting system for given area (relevant software may be used for runoff computation).

## EIGHTH SEMESTER

## CIVIL ENGINEERING

## SESSION 2019-20

S No.	Subject Code	Subject Name	Teaching Deptt.	L-T-P	Th/Lab Marks	Sessional		Total	Credit
					ESE	CT	TA		
1		Open Elective Course -2	Other Deptt.	3---0---0	70	20	10	100	3
2	RCE081 RCE082 RCE083 RCE084	<b>Elective -5</b> Finite Element Method Structural Dynamics Advanced Concrete Design Solid Waste Management	Core Deptt.	3---1---0	70	20	10	100	4
3	RCE085 RCE086 RCE087 RCE088	<b>Elective -6</b> Engineering Hydrology and Ground Water Management Urban Transportation System & Planning Probability Methods in Civil Engineering Earthquake Resistant Design of Structure	Core Deptt.	3---0---0	70	20	10	100	3
4	RCE851	Seminar	Core Deptt.	0 ---0---3			100	100	2
5	RCE852	Project-2	Core Deptt.	0---0---12	350		250	600	12
	<b>TOTAL</b>				<b>560</b>	<b>60</b>	<b>380</b>	<b>1000</b>	<b>24</b>

The required identification and distribution of electives through NPTEL has been made as given below.

Sem	Departmental Elective	Name of Elective through NPTEL
VIII	5	RCE082 Structural Dynamics
	6	RCE087 Probability Methods in Civil Engineering

## **RCE081 Finite Element Methods**

**(L-T-P 3-1-0) Credit – 4**

**UNIT - I** Calculus of variation, Introduction to calculus of variations, Introduction to equilibrium equations in elasticity, Euler's Lagrange's equations, Principle of virtual work, virtual displacements, Principles of minimum potential energy, boundary value, initial value problems, Flexibility approach, Displacement approach, Different problems in structural analysis. **[8]**

**UNIT - II** FEM Procedure, Derivation of FEM equations by variation principle polynomials, Concept of shape functions, Derivation for linear simplex element, Need for integral forms, Interpolation polynomials in global and local coordinates. Weighted residual Methods: Concept of weighted residual method, Derivation of FEM equations by Galerkin's method, Solving cantilever beam problem by Galerkin's approach, Derivation of shape functions for CST triangular elements, Shape functions for rectangular elements, Shape functions for quadrilateral elements. **[8]**

**UNIT - III** Higher order Elements: Concept of iso-parametric elements, Concept of sub-parametric and super - parametric elements, Concept of Jacobin matrix. Numerical Integration: Numerical Integration, one point formula and two point formula for 2D formula, Different problems of numerical integration evaluation of element stiffness matrix, Automatic mesh generation schemes, **[8]**

**UNIT - IV** Pascal's triangle law for 2D shape functions polynomial, Pascal's triangle law for 3D shape function polynomials, Shape function for beam elements, Hermitian shape functions. Convergence: Convergence criteria, Compatibility requirements, Geometric isotropy invariance, Shape functions for iso-parametric elements, Special characteristics of stiffness matrix, Direct method for deriving shape functions using Lagrange's formula, Plane stress problems. **[8]**

**UNIT - V** Analysis of structures: Truss elements, Analysis of truss problems by direct stiffness method. Analysis of frames and different problems, Different axi-symmetric truss problems. **[8]**

### **Text Book:**

1. The Finite Element method -ZIENKIEWICZ.O.C.Tata McGraw Hill Pub. New Delhi, 2000
2. Finite Element Methods by C R Alaval , PHI
3. Finite Elements in Engineering:- Chandrupatta, et. Al. Prentice Hall of India Pvt. Ltd.,
4. Finite element method with application in engineering by Chandrupatla & Belegundu, Pearson Publication.
5. Finite Element Method Basics concept & Applications by Alawala
6. Fundamental of Finite element Analysis by Devid V. hutton
7. Finite element Methods is fundamentals an application in engineering by Chen Z

### **Reference:**

1. Concepts and Applications of Finite Element Analysis: COOK. D. Robert. Malus.S.David, Plesha E. Michel, John wiley & sons 3rd Edn. New York, 2000

2. Finite Element Analysis -C.S. Krishnanmoorthy, Tata McGraw Hill Publishing Co. Ltd, New Delhi,
3. Introduction to the Finite Element method -Desai / ABEL-C.B.S. Publishers & Distributors, New Delhi.

## **RCE082 Structural Dynamics**

**(L-T-P 3-1-0) Credit - 4**

**UNIT- I** Introduction of Structural Dynamics, differential equations in civil engineering, types of analysis/static and dynamic load, degree of freedom ,generation of stiffness matrix), dynamic equilibrium equation, solution of equilibrium equation, Undamped free vibration solution, natural period/frequency ,energy in free vibration, damped free vibration, types of damping, logarithmic decrement equation. **[8]**

**UNIT - II** Undamped forced vibration , amplitude & phase angle , dynamic amplification factor for deflection( $R_d$ ), damped forced vibration, relationship between  $R_d$ ,  $R_v$ , &  $R_a$  , Resonant frequency and half power band width, force transmission and Isolation, Introduction of vibration measuring Instruments. **[8]**

**UNIT – III** Response to Unit Impulse , response to arbitrary force ( duhamel's Integral), response to step and ramp forces, response to rectangular pulse, half sinusoidal wave, time stepping methods, central difference method, Newmark's Method , Concept of response spectrum, uses of response spectrum, response of structure in frequency domain. **[8]**

**UNIT – IV** Equation of Motion for MDOF System , Solution of equation, natural frequencies and mode shapes, modal orthogonality, approximate method for finding natural frequency , Time History Analysis, Response spectrum Analysis, 3 D dynamic Analysis , Vibration of continuous systems, shear behavior and bending behavior, generalized SDOF. **[8]**

**UNIT – V** Dynamics of rigid blocks, Non structural elements, floor response spectrum, Introduction to vibration control, active control, passive control, design of tuned mass damper by displacement and energy perspectives. **[8]**

### **References Books:**

1. “Dynamics of structures” by Anil K Chopra, Pearson Education Limited.
2. “Structural Dynamics” by Clough & Penzin, McGraw-Hill Education .
3. “Theory of Vibrations” by Thompson, Pearson Education Limited.

4. "Elements of vibration analysis" by Leonard Mirovitch , McGraw-Hill Education .
5. "Structural dynamics" by Madhujit Mukhopadyay ,Ane Books India.

## **RCE083 Advanced Concrete Design**

**(L-T-P 3-1-0) Credit - 4**

**UNIT - I** Introduction to liquid retaining structures, design criteria, material specifications and permissible stresses for tanks, design concept of circular and rectangular tanks situated on the ground and underground. **[8]**

**UNIT - II** Design of over-head tanks: design of RC domes and beams curved in plan, design of cylindrical and rectangular tanks with different end conditions using IS: 3370 tables, Intze tank design based on membrane analysis with mention of continuity effects. **[8]**

**UNIT - III** Introduction to prestressing, assumptions, general principles ,advantages of prestressing, Axially placed tendons, bent tendons, parabolic tendons, load balancing concept, pressure line , systems of prestressing, pretensioning and post tensioning, Hoyer system, Freyssinet system ,Le-Mccall system, Magnel-Blaton system, Gifford-Udall system, C.C.L standard system. **[8]**

**UNIT - IV** Losses in prestress, IS 1343 recommendations for prestressed concrete, stages of loading to be considered in design, handling and transportation of precast prestressed concrete beams , analysis and design of simple prestressed beams, Lever arm conception, kern distance. **[8]**

**UNIT - V** Introduction to deep beams, minimum thickness, design of deep beams by IS 456, check for local failures, detailing of deep beams, Introduction to Corbels, Shear friction, Corbel dimensions, design of a corbel. **[8]**

### **Text Books & References**

- 1)IS : 456 – 2000, “ Code of Practice for Plain and Reinforced Concrete”, Bureau of Indian Standards, New Delhi.
- 2)IS 3370-2009, “Indian Standard concrete structures for storage of liquids - code of practice”, Bureau of Indian Standards, New Delhi
- 3)IS 1343-2012, “Indian Standard prestressed concrete - code of practice”, Bureau of Indian Standards, New Delhi
- 4)Shah. H.J., “Reinforced Concrete Vol : 2”, Charotar publishing house pvt. Ltd.
- 5)Varghese P.C. “ Advanced Reinforced concrete design”, PHI learning pvt. Ltd.
- 6)Ramamrutham S. and Narayan R. ,”Design of Reinforced Concrete Structures”, Dhanpat Rai Publishing company pvt. Ltd.
- 7)Jain, A.K., “Reinforced Concrete: Limit State Design”, Nem Chand & Bros., Roorkee.
- 8)Punmia B.C. ,Jain A.K.,” Limit State Design of Reinforced Concrete”, Laxmi Publications pvt. Ltd.

## **RCE 084 Solid Waste Management**

**(L-T-P 3-1-0) Credit - 4**

**UNIT-I** Solid waste: Public health and ecological impacts, Sources and types of solid wastes, material flow and waste generation, Functional elements: Waste generation, storage, collection, Transfer and transport, processing and recovery, disposal. Physical and chemical composition of municipal solid waste, integrated solid waste management, hierarchy of waste management options, different methods for generation rates. Storage: movable bins, fixed bins. Collection: home to home collection, community bin system. Theory and design of hauled container system, stationary container system. **[8]**

**UNIT-II** Transportation: handcart, tri-cycle, animal cart, tripper truck, dumper placer, bulk refuse carrier, railroad transport, water transport, conveyors, layout of routes. Engineering system for on-site handling and processing of solid waste: separators, size reduction equipments, screening equipments, densification, baling, cubing, pelleting equipments. **[8]**

**UNIT-III** Landfilling: Site selection criteria, landfill layout, landfill sections, Occurrence of gases and leachate in landfills: composition and characteristics, generation factors, initial adjustment phase, transition phase, acid formation phase, methane formation phase, maturation phase of gases and leachate, Introduction to engineered landfills. **[8]**

**UNIT-IV** Composting, types of composting, process description, design and operational consideration of aerobic composting, process description, design and operational consideration of anaerobic composting. Thermal conversion technologies: incineration and pyrolysis system, energy recovery, system. Overview of solid waste management practices in India. **[8]**

**UNIT-V** Introduction to Hazardous wastes, Definition of Hazardous waste, The magnitude of the problem; Hazardous waste: Risk assessment, Environmental legislation, Characterization and site assessment, Waste minimization and resource recovery, Transportation of hazardous waste, Disposal of hazardous waste.

Introduction to Electronic waste and Biomedical waste and their disposal. **[8]**

### **References:**

1. Tchobanoglous, G., Theisen, H., & Vigil, S.A; Integrated Solid Waste Management: McGraw Hill, New York
2. Solid Waste Engineering, Principle & Management issues by Ven Te Chow
3. Bhide, A.D., B.B. Sundaresan, Solid Waste Management in developing countries.
4. Manual on Municipal solid Waste Management, CPHEEO, Govt. of India.
5. Guidelines for Management and Handling of Hazardous wastes MOEF (1991), Govt. of India.
6. Datta, M; Waste Disposal in Engineered Land fills, Narosa Publishers, Delhi.
7. Waste Management “Asian and Pacific Center for Transfer of Technology (N.D.) India”, September 1993.

8. Solid and Hazardous Waste Management: Science and Engineering by M.N. Rao, Razia Sultana & Sri Harsha Kota
9. E-Waste Management: From Waste to Resource by Ramzy Kahhat, Klaus Hieronymi, Eric Williams.
10. Biomedical Waste Management by R. Radhakrishan
11. Electronic Waste Management (Issues in Environmental Science and Technology) by R. E. Hester , R. M. Harrison & Martin T. Goosey

## **RCE085 Engineering Hydrology & Groundwater Management**

**(L-T-P 3-0-0) Credit - 3**

**UNIT – I** Introduction: hydrologic cycle, water budget equations, world water balance, Precipitation: Forms of precipitation, measurement. Introduction to characteristics of storm. Abstraction from Precipitation: Evaporation – process, measurement and estimation; Evapotranspiration-measurement and estimation; Initial Losses- Interception & Depression storage; Infiltration- process, capacities indices, measurement & estimation. **[8]**

**UNIT – II** Runoff and Hydrographs: Runoff characteristics of stream, mass curve. Hydrograph, Factors affecting flood hydrographs, unit hydrograph and its analysis, s-curve hydrograph, synthetic and instantaneous unit hydrographs. **[8]**

**UNIT – III** Flood: Rational method, empirical formulae, flood frequency studies, statistical analysis, regional flood frequency analysis, design storm & design flood, risk/reliability and safety factor; Flood Routing: Basic equation, hydrologic storage routing & attenuation, hydrologic channel routing, flood forecasting & control, hydraulic method of flood routing. **[8]**

**UNIT – IV** Groundwater: Introduction, forms of subsurface water, aquifers & its properties, Occurrence of ground water, hydro-geology & aquifers, Ground water movement. Steady and unsteady flow through confined and unconfined aquifers. Well Hydraulics: Single & Multiple well system, partially penetrating wells, Image wells, Mutual interference of wells, well losses, specific capacity. **[8]**

**UNIT – V** Water Wells: Introduction to Well construction, completion and Development. Pumping equipment for water wells, maintenance of wells. Ground Water quality, Contamination of groundwater and its Control, Ground Water Modelling Techniques and exploration, Artificial discharge and Recharge of Ground Water, Roof-top rainwater harvesting and recharge. **[8]**

### **Text Books:**

- ‘Groundwater Hydrology’ by Todd D. K., Wiley
- ‘Groundwater Resource Evaluation’ by Walton W. C. , McGraw Hill
- ‘Groundwater’ by Raghunath H. M., New Age Publisher
- ‘Engineering Hydrology’ by K. Subramanya, Mc Graw Hill Education
- ‘Hydrology: Principles. Analysis. Design’ by Raghunath H. M., New Age Publisher
- ‘Handbook of Applied Hydrology’ by Chow V. T. , Mc Graw Hill Education

**Reference:**

- ‘Irrigation: Theory & Practice’ by Michael A. M., Vikas Publication House
- ‘Groundwater’ by S.Ramakrishnan, Scitech Publications
- ‘Irrigation: Theory & Practice’ by Michael A. M., Vikas Publication House
- ‘Engineering Hydrology’ by Ojha, Oxford University Press.
- ‘Introduction to Hydrology’ by Viessman & Lewis by Pearson Publication.
- ‘Applied Hydrology’ by Fetter, by Pearson Publication

**RCE086 Urban Transportation System & Planning (L-T-P 3-0-0) Credit - 3**

**UNIT-I** Introduction to transportation planning, the planning concept, Goals, objective and Importance of transportation planning. Nature of traffic problems in cities. Present Scenario of road transport and rail transport assets. Role of transportation: Social, Political, Environmental. Transport and Socioeconomic Activities, Historical Development of Transport, Transportation in the Cities, Freight Transportation, Future Developments. **[8]**

**UNIT- II** Urban form and Transport patterns, land use – transport cycle, concept of accessibility. Types of transport systems, evolution of transport modes, transport problems and mobility issues. Public Transport: Intermediate Public Transport (IPT) Rapid and mass transport system like MRTS & bus rapid transit. Transport Planning Process, Problem Definition, Solution Generation. **[8]**

**UNIT- III** Travel demand: Estimation and fore casting, trip classification, trip generation: factor and methods, multiple regression analysis. Trip distribution methods, modal split, trip assignment. **[8]**

**UNIT- IV** Studying travel behavior. Analyzing urban travel markets. Traffic and transportation surveys and studies, traffic and travel characteristics, urban transport planning process – stages, study area, zoning, database, **[8]**

**UNIT-V** Evaluation of transport planning proposals: Land Use Transport Planning, Economic Evaluation methods like Net present Value methods, Benefit Cost method. Transport system management: Long term and short term planning. **[8]**

**Text Book:**

1. Khanna S. K., Justo C.E.G, & Veeraragavan, A. “Highway Engineering”, Nem Chand and Bros., Roorkee- 247 667.
2. Kadiyali L. R., & Lal, N.B. “Principles and Practices of Highway Engineering (including Expressways and Airport Engineering)”, Khanna Publications, Delhi – 110 006

**References:**

1. Introduction to Transportation Engineering: William W. Hay.
2. Introduction to Transportation Engineering planning- E.K.Mortak.
3. Metropolitan Transportation planning-J.W.Dickey.
4. Traffic Engineering, L.R. Kadiyali
5. Hutchinson,B.G.(1974).Principles of Urban Transport Systems Planning. Mc Graw Hill Book Company, New York.
6. John W.Dickey.(1975). Metropolitan Transportation Planning. Mc Graw Hill Book Company, New York.

**RCE087 Probability Methods in Civil Engineering (L-T-P 3-0-0) Credit - 3**

**UNIT -I** Introduction: Role of Probability in Civil Engineering Problems, Random Events: Definition of basic random events; Application of set theory in definition of composite event operations; Probability of events and definition of probability axioms; Solution of real life examples from civil engineering. **[8]**

**UNIT- II** Random Variables: Definition of random variables – discrete and continuous; Probability definitions – PMF, PDF, CDF; Moments and expectations.  
Functions of Random Variables: Definition of probability distributions of functions of single random variables – exact methods and approximate methods; Moments and expectations of functions – direct and indirect methods. **[8]**

**UNIT- III** Multiple Random Variables: Definition of joint, marginal, and conditional probability distributions; Definitions of moments and expectations, including the definition of correlation coefficient; Functions of multiple random variables. **[8]**

**UNIT -IV** Common Probability Models: Discrete random variables – binomial distribution, Poisson’s distribution; Continuous random variables – exponential distribution, gamma distribution; Central limit theorem; Normal and lognormal distributions **[8]**

**UNIT -V** Statistics and sampling: Goodness of fit tests; regression and correlation analyses; estimation of distribution parameters from statistics; hypothesis testing and significance; Bayesian updating of distributions. **[8]**

**References:**

1. Papoulis, A, and S. U. Pillai (2002), Probability, Random Variables and Stochastic Processes, McGraw-Hill, New York.
2. Richard A. Jonson and C. B. Gupta (2005), Miller and Freund's Probability and Statistics for Engineers, Pearson Education, Inc., United States.
3. West M. and J. Harrison (1997), Bayesian Forecasting and Dynamic Models, Springer-Verlag, New York.
4. Ang, A. H-S., and Tang, W., H. "Probability concepts in engineering: Emphasis on applications in civil and environmental engineering." Wiley.
5. Kottegoda, N. T., and Rosso, R. "Applied Statistics for Civil and Environmental Engineers." Wiley.
6. Ross, S. "A first course on probability." Prentice Hall.

**RCE088 Earthquake Resistant Design of Structure (L-T-P 3-0-0) Credit – 3**

**UNIT-I** Internal structure of earth, Causes of earthquakes, Seismic waves, Magnitude, Intensity and Energy released, Characteristics of Earthquakes, **[8]**

**UNIT-II** Response of Structure to Earthquake motion, Modeling of structures, Dynamics of single degree of freedom system, **[8]**

**UNIT-III** Dynamics of multi degree of freedom system, Idealization of structures, seismic response, **[8]**

**UNIT-IV** Introduction to earthquake resistant design, Equivalent lateral force method, Response spectrum method, Time history method, Introduction to earthquake resistant brick and masonry buildings. **[8]**

**UNIT-V** Reinforced Concrete framed buildings, Code provisions. Introduction to machine foundation & its design. Degrees of freedom of a block foundation. **[8]**

**References:**

1. Introduction to Structural Dynamics - J.M. Biggs
2. Elements of Earthquake Engineering - Jai Krishna an A.R. Chandrasekaran
3. IS: 1983 - 1984 Criterion for Earthquake Resistant Design.
4. Structural Dynamics - Theory & computation - Mario Paz.
5. Dynamics of Structures Theory and Applications to Earthquake Engineering - Anil K. Chopra.
6. Earthquake Resistant of Design of structures, Agarwal and Srikhande.
7. Earthquake Resistant of Design of structures, S.K.Duggal