

**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]

## COURSE OUTCOMES

Course Name: RCE-701: Design of Structure-III

Year of study: 2019-

20

On completion of this course, the students will be able to	
RCE 701.1	learn the design philosophies of steel structures
RCE 701.2	design riveted, bolted and pinned connections for steel structures.
RCE 701.3	design welded connections for steel structures.
RCE 701.4	design of tension steel members.
RCE 701.5	design of compression steel members.
RCE 701.6	design of various types of steel beams and plate girders.

### Mapping of Course Outcome and Program Outcome

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
RCE 701.1		2	2	-	-	-	2	-	-	-	-	-	2
RCE 701.2		3	3	-	-	-	2	-	2	-	-	-	2
RCE 701.3		3	3	-	-	-	2	-	2	-	-	-	2
RCE 701.4		3	3	-	-	-	2	-	2	-	-	-	2
RCE 701.5		3	3	1	1	-	2	-	1	-	-	-	2
RCE 701.6		3	2	-	-	-	2	-	2	-	-	-	2
Average		2.83	2.67	1.00	1.00	-	2.00	-	1.80	-	-	-	2.00

### Mapping of Course Outcome and Program Specific Outcome

CO	PSO	PSO 1	PSO 2
RCE 701.1		2	2
RCE 701.2		3	3
RCE 701.3		3	2
RCE 701.4		3	3
RCE 701.5		3	3
RCE 701.6		3	3
Average		2.83	2.67

## **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]

## COURSE OUTCOMES

Course Name: RCE-702: Water Resources

Year of study: 2019-20

On completion of this course, the students will be able to	
RCE 702.1	analyse the hydrologic cycle, learn the irrigation systems and sediment transport theories
RCE 702.2	design of irrigation channels, canal lining and drainage design
RCE 702.3	design of the regulation and control systems of canal and types of canal irrigation works
RCE 702.4	Learn river training works
RCE 702.5	Design of canal head works and cross drainage works
RCE 702.6	Analyse earth and gravity dams and hydroelectric power plant in India

### Mapping of Course Outcome and Program Outcome

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
RCE 702.1	2	-	-	-	-	1	-	-	-	-	-	2
RCE 702.2	3	-	-	-	-	2	1	-	-	-	-	2
RCE 702.3	3	-	-	-	-	2	1	-	-	-	-	1
RCE 702.4	3	-	-	-	-	3	1	-	-	-	-	2
RCE 702.5	3	1	2	1	-	2	1	-	-	-	-	2
RCE 702.6	3	-	-	-	-	2	1	-	-	-	-	2
Average	2.83	1.00	2.00	1.00	-	2.00	1.00	-	-	-	-	1.83

### Mapping of Course Outcome and Program Specific Outcome

CO	PSO	PSO 1	PSO 2
RCE 702.1		2	2
RCE 702.2		2	2
RCE 702.3		3	2
RCE 702.4		3	3
RCE 702.5		3	3
RCE 702.6		3	3
Average		2.67	2.50

## **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]

## COURSE OUTCOMES

Course Name: RCE071: Geology and Soil Mechanics

Year of study: 2019-20

<b>On completion of this course, the students will be able to</b>	
<b>RCE 071.1</b>	Understand about minerals, rocks and engg. properties
<b>RCE 071.2</b>	Learn Stratification and Lamination bedding of rocks, Dip and strike of bed and Rock deformation
<b>RCE 071.3</b>	Understand about Earthquake, geological consideration for construction of building and Landslide
<b>RCE 071.4</b>	Learn site selection of dams geologically and geophysical explorations.
<b>RCE 071.5</b>	learn Clay Mineralogy, index properties of soil, IS classification of soil and shear strength of soil
<b>RCE 071.6</b>	understand the Effective stresses in soil & Earth pressure theories and their applications.

### Mapping of Course Outcome and Program Outcome

CO	PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
<b>RCE 071.1</b>		3	2	-	-	-	2	-	-	-	-	2	3
<b>RCE 071.2</b>		2	2	-	-	-	3	-	-	-	-	2	3
<b>RCE 071.3</b>		3	2	1	1	-	3	-	-	-	-	3	3
<b>RCE 071.4</b>		3	2	-	-	-	3	1	-	-	-	3	3
<b>RCE 071.5</b>		3	2	-	-	-	2	-	-	-	-	3	2
<b>RCE 071.6</b>		3	2	-	-	-	2	-	-	-	-	3	2
<b>Average</b>		<b>2.83</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>-</b>	<b>2.50</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2.67</b>	<b>2.67</b>

### Mapping of Course Outcome and Program Specific Outcome

PSO CO	PSO 1	PSO 2
<b>RCE 071.1</b>	3	3
<b>RCE 071.2</b>	3	3
<b>RCE 071.3</b>	3	3
<b>RCE 071.4</b>	3	3
<b>RCE 071.5</b>	3	3
<b>RCE 071.6</b>	3	3
<b>Average</b>	<b>3</b>	<b>3</b>

**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]

## COURSE OUTCOMES

Course Name: RCE-076: Railways, Airport & Water Ways

Year of study: 2019-

20

On completion of this course, the students will be able to	
RCE 076.1	understand the various aspects of permanent way and component of Indian Railways.
RCE 076.2	design track geometrics, turnouts, crossings, stations and yards.
RCE 076.3	understand the signalling and interlocking systems of Indian Railways and their applications.
RCE 076.4	understand the urban Railways and their planning.
RCE 076.5	learn the applicability aspects of various components of Airport, runway designs and design parameters of various components of Airport.
RCE 076.6	learn the concept of the harbours and ports for their detailed design.

### Mapping of Course Outcome and Program Outcome

CO	PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
RCE 076.1		2	2	-	-	-	1	-	-	-	-	-	2
RCE 076.2		3	3	-	-	-	2	-	-	-	-	-	2
RCE 076.3		3	2	1	-	-	2	-	-	-	-	-	2
RCE 076.4		2	2	-	-	-	2	-	-	-	-	-	1
RCE 076.5		3	2	-	-	-	2	-	-	-	-	-	1
RCE 076.6		2	2	-	-	-	2	2	-	-	-	-	1
Average		2.50	2.17	1.00	-	-	1.83	2.00	-	-	-	-	1.50

### Mapping of Course Outcome and Program Specific Outcome

CO	PSO	PSO 1	PSO 2
RCE 076.1		2	2
RCE 076.2		3	3
RCE 076.3		3	2
RCE 076.4		2	2
RCE 076.5		3	3
RCE 076.6		3	3
Average		2.67	2.50

## **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

## COURSE OUTCOMES

**Course Name: RCE-751: Non Destructive Testing Laboratory**

**Year of study: 2019-20**

<b>On completion of this course, the students will be able to</b>	
<b>RCE 751.1</b>	determine the compressive strength of the concrete by using rebound hammer, ultrasonic puls velocity test and pull out method
<b>RCE 751.2</b>	assess the corrosion in the reinforcement bar and determine thickness of concrete cover, diameter & spacing of reinforcing bars
<b>RCE 751.3</b>	analyse the characteristic of structural steel by using various laboratory test such as corrosion and welding performance.

Mapping of Course Outcome and Program Outcome

<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>
<b>RCE 751.1</b>	3	-	-	-	2	3	2	1	2	-	-	1
<b>RCE 751.2</b>	3	-	-	-	2	3	2	1	2	-	-	1
<b>RCE 751.3</b>	3	-	-	-	2	3	3	1	2	-	-	1
<b>Average</b>	<b>3</b>	-	-	-	<b>2</b>	<b>3</b>	<b>2.33</b>	<b>1</b>	<b>2</b>	-	-	<b>1</b>

Mapping of Course Outcome and Program Specific Outcome

<b>CO</b>	<b>PSO 1</b>	<b>PSO 2</b>
<b>RCE 751.1</b>	2	2
<b>RCE 751.2</b>	2	2
<b>RCE 751.3</b>	2	2
<b>Average</b>	<b>2</b>	<b>2</b>