

**Course structure**  
**B. Tech. Third year (Civil Engineering)**  
**Year III, Semester - V**

S. No	Course Code	NAME OF THE SUBJECT	PERIODS			Credit
			L	T	P	
1	THU-501	Engineering Economics & Principles of Management	2	1	-	2
2	TCE-501	Structural Analysis – II	3	1	-	4
3	TCE-502	Concrete Structure – I	3	1	-	4
4	TCE-503	Transportation Engineering – I	3	1	-	4
5	TCE-504	Water Resource Engineering – I	3	1	-	4
6	TCE-505	Estimation & Construction Management	3	1	-	4
7	TCE-551	Structural Analysis Lab– II	-	-	3	1
8	TCE-552	Concrete Lab	-	-	3	1
9	TCE-553	Transportation Engineering Lab	-	-	3	1
10	TCE-554	Survey Camp	-	-	-	1
11	GP-501	General Proficiency	-	-	-	0
		Total	17	6	9	26

**Semester - VI**

S. No	Course Code	NAME OF THE SUBJECT	PERIODS			Credit
			L	T	P	
1	TCE-601	Environmental Engineering – I	3	1	-	4
2	TCE-602	Concrete Structure – II	3	1	-	4
3	TCE-603	Geotechnical Engineering- I	3	1	-	4
4	TCE-604	Water Resource Engineering – II	3	1	-	4
5	TCE-605	Transportation Engineering – II	3	1	-	4
6	TCE-651	Environmental Engineering Lab - I	-	-	3	1
7	TCE-652	Structural Detailing Lab - I	-	-	3	1
8	TCE-653	Geotechnical Engineering Lab	-	-	3	1
9	TCE-654	Colloquium	-	-	3	1
11	GP-601	General Proficiency	-	-	-	0
		Total	15	5	12	24

**ENGINEERING ECONOMICS AND PRINCIPLES OF  
MANAGEMENT**

**Industrial Economics:**

**Unit –1.Introduction:** Nature and significance of Economics. Meaning of Science, Engineering and Technology and their relationship with economic development.

**Unit –2. Basic Concept:** The concept of demand and supply. Elasticity of Demand and Supply. Indifference Curve Analysis, Price Effect, Income Effect and Substitution Effect, **Theory of Cost-Long run, Short run.**

**Unit –3. Money and Banking:** Functions of Money, Value of Money, Inflation and measures to control it. Brief idea of functions of banking system, viz., Commercial and central banking, Business fluctuations.

**Management:**

**Unit –4. Introduction:** Definition, Nature and Significance of Management,. Evaluation of Management thought, Contributions of Max Weber, Taylor and Fayol.

**Unit –5. Human Behaviour:** Factors of Individual Behaviour, Perception, Learning and Personality Development, Interpersonal Relationship and Group Behaviour.

**References:**

1. Dewett, K.K. / Modern Economic Theory/S.Chand& Co.
2. Luthers Fred/ Organizational Behaviour.
3. Prasad L.M./ Principles of Management.
4. A.W. Stonier & D.C. Horgne / ATextBook of Economic Theory/ Oxford Publishing House Pvt. Ltd.
5. M.K Agarwal/ Engineering Economics, New Age Pub.co.ltd, New Delhi

**TCE - 501**  
**STRUCTURAL ANALYSIS II**

**UNIT – 1**

Analysis of fixed beams, Continuous beams and simple frames with and without translation of joint, Method of Consistent Deformation, Slope-Deflection method, Moment Distribution method, Strain Energy method

**UNIT – 2**

Muller-Breslau's Principle and its applications for drawing influence lines for indeterminate beams, Analysis of two hinged arches, Influence line diagrams for maximum bending moment, Shear force and thrust

**UNIT – 3**

Suspension Bridges, Analysis of cables with concentrated and continuous loadings, Basics of two and three hinged stiffening girders, Influence line diagrams for maximum bending moment and shear force for stiffening girders

**UNIT – 4**

Basics of Force and Displacement Matrix methods for beams and trusses.

**UNIT – 5**

Basics of Plastic Analysis, Applications of Static and Kinematic theorem for Plastic Analysis of Beams and Frames

**Text Books**

1. Advanced Structural Analysis by A. K. Jain, Nem Chand & Bros., Roorkee.
2. Structural Analysis by C. S. Reddy, Tata McGraw Hill Publishing Company Limited, New Delhi.

**References**

1. Theory and Analysis of Structures, Vol. I & II by O. P. Jain & B. K. Jain, Nem Chand & Bros., Roorkee.
2. Theory of Structures by S. P. Timoshenko and D. Young, Mc-Graw Hill Book Publishing Company Ltd., New Delhi.
3. Analysis of Statically Indeterminate Structures by P. Dayaratnam, Affiliated East-West Press.
4. Indeterminate Structural Analysis by C. K. Wang.
5. Introduction to Matrix Methods of Structural Analysis by H. C. Martin, Mc-Graw Hill Book Publishing Company Ltd.
6. Matrix Analysis of Framed Structures by Weaver and Gere.

7. Theory of Structures Vol. II by Vazirani&Ratwani.
8. Influence Line Diagrams by Dhavilkar.

## **TCE - 502**

### **CONCRETE STRUCTURE I**

#### **UNIT – 1**

Introduction to Various Design Philosophies, Design of Rectangular Singly and Doubly Reinforced Sections by Working Stress Method.

#### **UNIT – 2**

Assumptions in Limit State Design Method, Design of Rectangular Singly and Doubly Reinforced beams, T-beams, L-beams by Limit State Design Method.

#### **UNIT – 3**

Behaviour of RC beam in Shear, Shear Strength of beams with and without shear reinforcement, Minimum and Maximum shear reinforcement, design of beam in shear, Introduction to development length, Anchorage bond, flexural bond. (Detailed Examples by Limit State Design Method), Failure of beam under shear, Concept of Equivalent Shear and Moments.

#### **UNIT – 4**

Design of one way and two way solid slabs by Limit State Design Method, Serviceability Limit States, Control of deflection, cracking and vibrations.

#### **UNIT – 5**

Design of Columns by Limit State Design Method- Effective height of columns, Assumptions, Minimum eccentricity, Short column under axial compression, requirements for reinforcement, Column with helical reinforcement, Short column under axial load and uni-axial bending, Design of columns under bi-axial loading by Design Charts.

**Note :**All designs shall be conforming to IS : 456 – 2000.

#### **Text Books**

1. IS : 456 – 2000.
2. Reinforced Concrete – Limit State Design by A. K. Jain, Nem Chand & Bros., Roorkee.
3. Reinforced Concrete Design by P. Dayaratnam.

#### **References**

1. Plain and Reinforced Concrete Vol. I & II by O. P. Jain & Jai Krishna, Nem Chand & Bros.

2. Reinforced Concrete Structures by R. Park and Pauley.
3. Reinforced Concrete Design by S. Unnikrishna Pillai & D. Menon, Tata Mc-Graw Hill Book Publishing Company Limited, New Delhi.

## **TCE - 503**

### **TRANSPORTATION ENGINEERING I**

#### **UNIT – 1**

Introduction : Role of Transportation, Modes of Transportation, History of road development, Nagpur road plan, Bombay road plan & 3<sup>rd</sup> 20 Year Road Plan, Road types and pattern.

Geometric Design : Cross sectional elements, camber, shoulder, sight distance, horizontal curves, super elevation, extra widening, transition curves and gradient, vertical curves, summit and valley curves.

#### **UNIT – 2**

Traffic Engineering : Traffic characteristic, volume studies, speed study, capacity, density, traffic control devices, signs, signals, design of signals, Island, Intersection at grade and grade separated intersections, design of rotary intersection.

#### **UNIT – 3**

Design of Highway Pavement : Types of Pavements, Design factors, Design of Flexible Pavement by CBR method (IRC : 37-2001), Design of rigid pavement, Westergaard theory, load and temperature stresses, joints, IRC method of rigid pavement design. (IRC : 58 – 2002).

#### **UNIT – 4**

Road Construction Methods : WBM, Surface dressing, bituminous carpeting, Bituminous Bound Macadam and Asphaltic Concrete, Cement Concrete road construction.

#### **UNIT – 5**

Airport Engineering : Air craft characteristics, types of airports, layout of airports, airport planning & design, runway orientation, wind-rose diagram, estimation of runway length & correction.

#### **Text Books**

1. Highway Engineering by S. K. Khanna & C.E.G. Justo.
2. Airport Planning & Design by S. K. Khanna, M. G. Arora & S. S. Jain.

#### **References**

1. Transportation Engineering by L. R. Kadiyali.

2. Highway Engineering by S. K. Sharma
3. Principles of Transportation Engineering by P. Chakraborty & A. Das.

## **TCE - 504**

### **WATER RESOURCES ENGINEERING I**

#### **UNIT – I**

Water Resources planning and management: Objectives, constraints and criteria based on technical, economical, social and political factors. Assessment of surface water resources of India, Intra and inter basin development concepts. Single and multipurpose projects.

**Hydrology** : Hydrologic Cycle. Water Budget Equation, Hydrologic system, **Precipitation** : Types, measurements and analysis, error in estimation, missing data, consistency of rainfall records, Intensity duration frequency (IDF) and probable maximum Precipitation (PMP) curves.

Evaporation and consumptive use: Process affecting factors, estimation and measurement techniques.

**Infiltration** : Process affecting factors, measurement and estimation, Infiltration, Indices.

#### **UNIT – II**

Surface Runoff: Components and factors affecting runoff, methods of estimation of runoff volume and peak runoff, rating curve, Rainfall – runoff relationships

Hydrograph analysis: components, factors affecting hydrographs, base flow separation, Direct Runoff Hydrograph, Unit Hydrograph: Theory and assumptions. Derivation of Unit Hydrograph, Synthetic Unit Hydrograph Introduction to computer models for rainfall runoff analysis.

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

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

#### **UNIT – III**

Sediment Transportation: Suspended and Bed load and its estimation

Irrigation channels: 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, use of Garret's Diagrams in channel design, cross sections of an Irrigation channel, Computer programmes for design of channels, 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: Definition, effects, causes and anti-water logging measures, Drainage of water logged land, Types of drains open and closed, spacing of closed drains.

#### **UNIT – IV**

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.

#### **UNIT – V**

Ground Water Hydrology: Zones of underground water, Aquifers and their types, important terms, Determination of discharge through unconfined and confined aquifers with steady flow conditions, Interference among wells, determination of aquifer constants, Well loss and specific capacity, efficiency of a well, types of water wells, bored and open wells, specific yield of a well, Relative merits of well and canal irrigation, type of tube wells, well surrounding and well development, Suitable site selection for a tube well, Types of open wells, Methods of lifting water. Infiltration galleries.

#### **Text Book**

1. Irrigation Engg. and Hydraulic Structures by S.K. Garg, Khanna Publishers.
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.

#### **References**

5. Water Resources Engg. By Larry W. Mays, John Wiley India
6. Water resources Engg. By Wurbs and James, John wiley India
7. Water Resources Engg. By R. K. Linsley, McGraw Hill
8. Irrigation and water Resources Engg. By G L Asawa, New age International Publishers
9. Irrigation Theory and practices by A.M. Michel.

### **TCE - 505**

## **ESTIMATION & CONSTRUCTION MANAGEMENT**

#### **UNIT – 1**

Importance of estimation, different types of estimates, specifications :

general and detailed. Methods of estimation, Estimates of RC works, Estimates of Buildings.

### **UNIT – 2**

Analysis of rates, Prime cost, Work charge establishment, Quantity of materials per unit of work for major Civil Engineering items, Resource planning through analysis of rates, market rates, P.W.D. schedule of rates and cost indices for building material and labour.

Introduction to Valuation.

### **UNIT – 3**

Project cycle, Organisation, Planning, Scheduling, Monitoring, Updating and Management System in Construction. Bar Chart, Milestone charts, Work down structure and preparation of networks. Application of network, Techniques like PERT, GERT,

CPM, AON and AOA techniques.

### **UNIT – 4**

Project monitoring, cost planning, resources allocation through network techniques. Time value of money, Present economy studies, Equivalence concept, financing of projects, economic comparison, present worth method, equivalent annual cost method, discounted cash flow method, Depreciation and break even cost analysis.

### **UNIT – 5**

Legal aspects of contracts, their relative advantages and disadvantages, Different types of contracts, their relative advantages and disadvantages, Elements of tender preparation, process of tendering, pre-qualification of contracts, Evaluation of tender preparation, process of tendering, Evaluation of tender, Contract negotiation and award of work.

### **Text Books**

1. Estimating and Costing by B. N. Dutta.
2. PERT and CPM Principles and Application by L. S. Shrinath.

### **References**

1. Estimating, Costing and Valuation in Civil Engineering by M. Chakraborty.
2. Construction, Planning, Equipment and Methods by R. L. Peurify
3. Network Analysis Techniques by S. K. Bhatnagar.
4. Construction Planning and Management by U. K. Srivastava.



**TCE – 551**  
**Structural Analysis Lab -II**

1. To find carry over factor for the beam with far end fixed.
2. To find forced in elastically coupled beams.
3. Preparation of working drawings for beams
4. Preparation of working drawings for columns
5. Preparation of working drawings for the slab

**TCE – 552**  
**CONCRETE LAB.**

1. Compressive Strength of Concrete.
2. Workability by Compaction Factor, Slump Test.
3. Determination of Constituents of Hardened Mortar.
4. Mix Design by IS Code Method.

**TCE – 553**  
**TRANSPORTATION ENGINEERING LAB.**

1. Crushing Value Test of Aggregate
2. Impact Value Test of Aggregate
3. Los Angeles Abrasion Value of Aggregate
4. Shape Test (Flakiness Index, Elongation Index) of Aggregate
5. Penetration Test of Bituminous Sample
6. Softening Point Test of Bituminous Sample
7. Stripping Test of Bituminous Sample
8. Ductility Test of Bituminous Sample
9. Flash & Fire Point Test of Bituminous Sample
10. Classified both directional Traffic Volume Study
11. Traffic Speed Study ( Using Radar Speedometer or Enoscope)

**References**

1. Highway Material Testing by S. K. Khanna & C. E. G. Justo
2. Highway Material Testing by A. K. Duggal

**TCE – 601**  
**ENVIRONMENTAL ENGINEERING – I**

## **UNIT-1**

Water supply: Water demands and domestic use, variation in demands; population forecasting by various methods using logistic curve method; per capita supply, basic needs and factors affecting consumption; design period.

Sources of water: Kinds of water sources and their characteristics, collection of surface and ground water; quality of surface and ground waters; factors governing the selection of a source of water supply; intakes and their design for lakes, streams and rivers, impounding reservoir and canal; determination of the capacity of impounding reservoir. 8

## **UNIT-2**

Transmission of water: Various types of conduits, capacity and sizes including economical sizes of rising main, structural requirements; laying and testing of water supply pipelines; pipe materials, joints, appurtenances and valves; leakages and control; water hammer and its control measures.

## **UNIT-3**

Storage and distribution of water: Methods of distribution, pressure and gravity distribution systems, concept of service and balancing reservoirs, capacity of distribution reservoirs; general design guidelines for distribution system, Hardy - Cross method, Newton - Raphson method and equivalent pipe method of pipe network analysis; rural water supply distribution system.

Water supply, plumbing systems in buildings and houses: water connections, different cocks and pipe fittings, hot water installation. Institutional and industrial water supply. 8

## **UNIT-4**

Wastewater collection: Systems of sanitation and wastewater collection, estimation of wastewater flows and variations in wastewater flows.

Storm water: Collection and estimation of storm water by different formulae.

Flow in sewers: Flow in full and partially full sewers and design of sewers; types of sewers, materials and construction of sewers, joints and sewer appurtenances, layout and construction of sewer lines; small bore sewer systems. Planning of sewerage systems.

Institutional and industrial wastewater management.

## **UNIT-5**

Air pollution: Composition and structure of atmosphere; units of measurement, sources of pollutants, classification of pollutants and their effects, air quality monitoring and standards.

Brief introduction to Control devices for particulate contaminants – gravitational settling chambers, centrifugal collectors, wet collectors, fabric filters and electrostatic precipitators; control devices for gaseous contaminants; automotive emission control, concept of clean and biofuels.

Noise pollution: Definition of decibel, sound power level, sound intensity level and sound pressure level; measurement of noise level; basic concept of community noise, transportation noise and industrial noise; acceptable outdoor and indoor noise levels; effects of noise and control measures.

Introduction to Solid waste management and environmental impact assessment.

**Text books:**

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering
2. Metcalf and Eddy Inc.: Wastewater Engineering
3. Garg: Water Supply Engineering (Environmental Engineering Vol. – I)
4. Garg: Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. – II).

**References:**

1. Manual on Water Supply and Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi
2. Manual on Sewerage and Sewage Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi
3. Steel and McGhee: Water Supply and Sewerage
4. Fair and Geyer: Water Supply and Wastewater Disposal
5. Arceivala: Wastewater Treatment for Pollution Control
6. Hammer and Hammer Jr.: Water and Wastewater Technology
7. Raju: Water Supply and Wastewater Engineering
8. Sincero and Sincero: Environmental Engineering: A Design Approach
9. Pandey and Carney: Environmental Engineering
10. Rao: Textbook of Environmental Engineering
11. Davis and Cornwell: Introduction to Environmental Engineering
12. Kshirsagar: Water Supply and Treatment and Sewage Treatment Vol. I and II
13. Punmia: Water Supply and Wastewater Engineering Vol. I and II
14. Birdie: Water Supply and Sanitary Engineering
15. Ramalho: Introduction to Wastewater Treatment Processes
16. Parker: Wastewater Systems Engineering
17. Nevers: Air Pollution Control Engineering
18. Mycock, McKenna and Theodore: Handbook of Air Pollution Control Engineering and Technology
19. Suess and Craxford: W. H. O. Manual on Urban air Quality Management
20. W. H. O.: Selected Methods of Measuring Air Pollutants
21. Cunniff: Environmental Noise Pollution

22. Kreith: Handbook of Solid Waste Management
23. Vesilind, Worrell and Reinhart: Solid Waste Engineering
24. Canter: Environmental Impact Assessment
25. Cheremisinoff and Morresi: Environmental Assessment and Impact Assessment Handbook.

## **TCE - 602**

### **CONCRETE STRUCTURE II**

#### **UNIT - 1**

Nature of Stresses in flat slabs with and without drops, coefficient for design of flat slabs, reinforcement in flat slabs. (IS Code Method).

#### **UNIT - 2**

Analysis and design of beam curved in plan. Structural behaviour of footings, design of footing for a wall and a single column, combined rectangular and trapezoidal footings, Design of strap footing.

#### **UNIT - 3**

Structural behaviour of retaining wall, stability of retaining wall against overturning and sliding, Design of T-shaped retaining wall, Concept of Counter fort retaining wall.

Loads, forces and I.R.C. bridge loadings, Design of R.C. slab culvert.

#### **UNIT - 4**

Design criteria, material specifications and permissible stresses for tanks, design concept of circular and rectangular tanks situated on the ground / underground, design of overhead tanks.

#### **UNIT - 5**

Advantages of prestressing, methods of prestressing, losses in prestress, analysis of simple prestressed rectangular and T-section.

#### **Text Books**

1. IS : 456 – 2000.
2. Reinforced Concrete – Limit State Design by A. K. Jain, Nem Chand & Bros., Roorkee.

#### **References**

1. Plain and Reinforced Concrete Vol. I & II by O. P. Jain & Jai Krishna, Nem Chand & Bros.
2. Reinforced Concrete Structures by R. Park and Pauley.

3. Reinforced Concrete Design by P. dayaratnam.

## **TCE – 603 GEOTECHNICAL ENGINEERING – I**

### **UNIT – 1**

Preview of Geotechnical field problems in Civil Engineering, Soil formation, transport and deposit, Soil composition, Basic definitions, Clay minerals, Index properties, Particle size analysis, Soil classification.

### **UNIT – 2**

Soil-water systems, capillarity-flow, Darcy's law, permeability, field and lab tests, piping, quick sand condition, seepage, flow nets, flow through dams, filters. Soil compaction, water content – dry unit weight relationships, OMC, field compaction control, Proctor needle method.

### **UNIT – 3**

Effective stress principle, Stresses due to applied loads, Boussinesq and Westergaard equations.

Compressibility and consolidation characteristics, Rate of consolidation, Terzaghi's one dimensional theory of consolidation and its applications, Over Consolidation Ratio, determination of coefficient of consolidation and secondary consolidation (creep), consolidation under construction loading.

### **UNIT – 4**

Shear strength - direct & triaxial shear tests, Mohr – Coulomb strength criterion, drained, consolidated, undrained and unconsolidated tests, strength of loose and dense sands, Normally Consolidated and Over Consolidated soils, dilation, pore pressure, Skempton's coefficient.

### **UNIT – 5**

Stability of slopes with or without pore pressure, limit equilibrium methods, methods of slices and simplified Bishop method, factor of safety. Soil stabilization, Introduction to geosynthetics, classification, functions and its field application.

### **Text Books**

1. V.N.S. Murthy – Soil Mechanics and Foundation Engineering (Fifth Edition)
2. K.R. Arora – Soil Mechanics and Foundation Engineering
- References 1. Alam Singh – Modern Geotechnical Engineering 2. Brij Mohan Das – Geotechnical Engineering 3. I.H. Khan – Text Book of Geotechnical Engineering 4. C.

Venkataramaiah – geotechnical Engineering 5. GopalRanjan and A.S.R. Rao – Basic and Applied Soil Mechanics 6. G.V. Rao& G.V.S.S. Raju – Engineering with Geosynthetics

## **TCE - 605**

### **TRANSPORTATION ENGINEERING II**

#### **UNIT – 1**

Indian railways: Development and organization of Indian Railways.

Permanent way : Sub-grade, formation, embankment and cutting, track drainage. Rails : Rail gauges, types of rails, defects in rails, rail failure, creep of rail. Rail Fastenings : Fish plates, spikes, chairs, keys, bearing plates.

Sleepers : Timber, steel, cast iron, concrete and prestressed concrete sleepers, manufacturing of concrete sleepers, sleeper density.

Ballast : Ballast materials, size of ballast, screening of ballast, specification of ballast, tests on ballast

#### **UNIT – 2**

Railway Track Geometry : Gradients, horizontal curves, super-elevation, safe speed on curves, cant deficiency, negative super elevation, compensation for curvature on gradients, track resistance and tractive power.

Points & Crossings : Elements of a simple turn-out, details of switch, details of crossings, number & angle of crossings, design of turn-out.

#### **UNIT – 3**

Stations & Yards : Site selection for a railway station, layout of different types of stations, classification of stations, types of railway yard, functions of Marshalling yards. Signalling & Interlocking : Classification of signals, method of train working, absolute block system, mechanical interlocking of a two line railway station.

#### **UNIT – 4**

Introduction to Steel Bridges, Types of Steel Bridges, Economical Span, Loads, Permissible Stresses, Fluctuation of Stresses, Secondary stresses in trusses, Design of Plate Girder Bridges

#### **UNIT-5**

Design of Truss Bridges, General Arrangements, Economic Proportions

Types of bridge trusses, Wind Forces on, Lattice Girder Bridge Top lateral bracing Bottom lateral Brief introduction to Bearing.

### **Text Books**

1. A Text Book of Railway Engineering by S. P. Arora & S. C. Saxena
2. IS : 800 – 1984.
3. Design of Steel Structures by A. S. Arya & J. L. Ajmani, Nem Chand & Bros., Roorkee.

### **References**

1. Railway Engineering by M. M. Aggrawal.
2. Railway Engineering by Vasvani
3. Bridge Engineering by Algia
4. Railway Engineering by B. L. Gupta & Amit Gupta
5. Roads, Railway, Bridge & Tunnel Engineering by B. L. Gupta
6. Essentials of Bridge Engineering by D. J. Victor
7. Design of Steel Structures by S. K. Duggal, Tata Mc-Graw-Hill Publishing Company.
8. Design of Steel Structures by Gaylord & Gaylord.

## **TCE - 604**

### **WATER RESOURCES ENGINEERING II**

#### **UNIT – I**

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 Bed bars.

#### **UNIT – II**

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. 8

#### **UNIT – III**

Flood routing: Types, methods of reservoir routing, channel routing by Muskingham Method. 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. Dams:



classification and selection criteria. Earth Dams: Classification, causes of failure Pheratic line, and its determination Introduction to statisly analysis.

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#### **UNIT – IV:**

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

#### **UNIT – V**

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 specially 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.

#### **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 Theory and Practices by A M Michel
6. Irrigation Engineering,

#### **References**

1. Irrigation Engg. And Hydraulic Structures by S. K. Garg, Khanna Publishers
  2. Irrigation and Water Power Engineering by B. C. Punimia&Pande B.B. LalLaxmi Publications
  3. Engineering Hydrology by K Subramanya, TMH
- Irrigation, Water Power and Wate Resources Engg. By K. R. Arora

### **TCE-651**

#### **ENVIRONMENTAL ENGINEERING LAB. – I**

1. Determination of turbidity, colour, and conductivity.
2. Determination of pH, alkalinity and acidity.
3. Determination of hardness and chlorides.
4. Determination of residual chlorine and chlorine demand.
5. Determination of dissolved oxygen.

6. Determination of most probable number of coliforms.
7. Measurement of air pollutants with high volume sampler.
8. Measurement of sound level with sound level meter.

### **Text Books**

1. Sawyer, McCarty and Parkin: Chemistry for Environmental Engineering
2. Mathur: Water and Wastewater Testing.

### **References**

1. Standard Methods for the Examination of Water and Wastewater, A. P. H. A., New York
2. W. H. O.: Selected Methods of Measuring Air Pollutants
3. Cunniff: Environmental Noise Pollution.

## **TCE – 652 Structural Detailing Lab. I**

Preparation of working drawings for the following \_

1. RC Beams- Simply supported, Continuous, Cantilever
2. T – beam / L-beam floor
3. Slabs – Simply supported, Continuous, One way and two way slabs.
4. Columns – Tied Columns and Spirally reinforced columns.
5. Isolated footings for RC Columns.
6. Combined rectangular and trapezoidal footings.
7. Detailing of Buildings with respect to Earthquake Resistant Design.

## **TCE – 653 Geotechnical Engineering Lab.**

Preparation of working drawings for the following \_

1. Sieve Analysis
2. Hydrometer Analysis
3. Liquid & Plastic Limit Tests
4. Shrinkage Limit Test
5. Proctor Compaction Test
6. Relative Density
7. In Situ Density – Core cutter & Sand Replacement

8. Permeability Test
9. Direct Shear Test
10. Auger Boring
11. Static Cone Penetration Test
12. Standard / Dynamic Cone Penetration Test