

**T.Y. B. Tech.**  
**(Civil & Water Management Engineering)**

**SYLLABUS**

**Teaching & Examination Scheme**

**(From Academic Year 2011-12 Onwards)**



**Department of Civil & Water Management Engineering**  
Shri Guru Gobind Singhji Institute of Engineering & Technology,  
Nanded – 431 606

**T.Y. B. Tech. (Civil & Water Management Engineering)**  
**Teaching & Examination Scheme**  
**(For Academic Year 2011-12 Onwards)**

**Semester-I**

Course Code	Name of the Course	Lectures/ week	Tutorials/ week	Practical/ week	Total Credits
CW301	Geotechnical Engineering	04	--	02	05
CW302	Engineering Geology	04	--	02 (Audit)	04
CW303	Design of Structures–I (Steel)	04	--	02	05
CW304	Irrigation Water Management Engineering–I	03	01	--	04
CW305	Engineering Hydrology	03	01	--	04
Sub Total		<b>18</b>	<b>02</b>	<b>06</b>	<b>22</b>

**Semester-II**

Course Code	Name of the Course	Lectures/ week	Tutorials/ week	Practical/ week	Total Credits
CW306	Design of Structures–II (RCC)	04	--	02	05
CW307	Theory of Structures-II	04	--	--	04
CW308	Design of hydraulic Structures–I	04	--	02	05
CW309	Transportation Engineering	04	--	02	05
CW310	Environmental Engineering	04	--	02	05
CW311	Field Training	--	--	--	Audit Course
Sub Total		<b>20</b>	--	<b>08</b>	<b>24</b>
<b>Grand Total</b>		<b>40</b>	<b>02</b>	<b>14</b>	<b>46</b>

**First Semester:**

**CW 301 GEOTECHNICAL ENGINEERING**

(Lectures/Week: 04, Practicals/Week: 02 and Total Credits: 05)

- 1. Introduction:** Definition, scope, Historical survey, nature of problems, soil formation (02)
- 2. Index properties of Soils:** soil as phase system, Definitions: specific gravity, different densities, voids ratio, porosity, degree of saturation, moisture content, density Index, volume weight relationship, Determination of specific gravity, Determination of field density, grain size analysis; mechanical and sedimentation analysis, Particle size distribution curve, use of particle size distribution curve, consistency limits, determination of consistency limit, Use of consistency limit, Soil texture and structure (05)
- 3. Classification of Soil:** Particle size classification, Unified soil classification and ISI classification, soil Identification (02)
- 4. Permeability of Soil:** Introduction, Darcy's law, Validity of Darcy's Law, Discharge and seepage velocity, factors affecting permeability, Laboratory methods for determination of coefficient of permeability, Determination of average permeability of stratified soil mass, critical hydraulic gradient (05)
- 5. Compaction:** Introduction, standard and modified Proctor Test, factors affecting compaction, Air void line, zero air void line, field compaction (03)
- 6. Effective stress Principle:** Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuation of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition (05)
- 7. Consolidation:** Introduction, consolidation indices, relation between pressure and void ratio, Laboratory consolidation test. Terzaghi's one-dimensional consolidation theory, square root of time fitting method and logarithm of time fitting method, secondary consolidation, final settlement of soil deposit. (05)
- 8. Shear Strength:** Concept of shear strength, Different theories, Mohr's envelopes for cohesive, non cohesive and composite soils. Type of shear test: Direct shear test, Unconfined compression test, Triaxial shear test (UU, CU and CD), relation between major and minor principle stresses, and vane shear tests. (06)
- 9. Earth Pressure:** Earth pressure at rest, Active and passive conditions, Rankin's earth pressure theory, determination of earth pressure for cohesionless and cohesive soil, Coulombs earth pressure theories, graphical methods for active pressure (06)
- 10. Stability of Slopes:** Factors contributing to slope failures, classification of slope failures, Infinite and finite slopes, The Swedish method and its application to dry cohesive soils and composite soils, Friction circle method, Stability number and chart. (05)

**11. Soil Exploration:** Importance of sub surface investigations Auger and wash borings sampling tool for exploration undisturbed and disturbed sample, Sub surface soundings, Drilling, spacing and depth of exploratory borings, Preparation of soil profiles (03)

### **TERM WORK**

The term work shall consist of a record of laboratory experiments as mentioned below

1. Determination of specific gravity
2. Field density test (Core cutter method and sand replacement method)
3. Determination of particle size distribution of soil: a) Sieve analysis; b) Sedimentation analysis
4. Determination of Consistency Limits.
5. Permeability test variable and constant head
6. Standard proctor compaction test
7. Direct shear test
8. Unconfined compression test
9. Triaxial compression test
10. Consolidation test
11. Static cone penetration test

(Note: - Experiment No.9-11 only demonstration)

### **REFERENCE BOOKS**

1. Soil Mechanics and foundation Engineering by B.C. Punamia.
2. Modern Geotechnical Engineering by Alam Singh.
3. Geotechnical Engineering by P. Purshothamaraj
4. Soil mechanical and foundation Engg. by Arora.
5. Relevant Indian Standard Specification & Codes.
6. Soil Mechanics by Craig R. F. Chapman and Hall
7. Theoretical Soil Mechanics by Terzaghi.
8. Soil Mechanics by Lambe T. W. & Whitman R. V.

### **CW 302 ENGINEERING GEOLOGY**

(Lectures/Week: 04, Practicals/Week: 02(Audit) and Total Credits: 04)

**1. General Geology:** Scope of geology in engineering, Age and interior of earth, Volcanism, Mountains, Origin of continents and oceans, Continental drift and plate tectonics. (04)

**2. Physical Geology:** River, River valley development, Geological work, Rejuvenation, Erosional and depositional landforms, Glaciers, Erosional and depositional landforms, Wind, Sand dunes and bars. (03)

**3. Mineralogy:** Mineral, Types, Physical properties and Occurrence of minerals. (03)

**4. Petrology:** Igneous rocks: forms and structures classification (based on mode of occurrence, mineral and SiO<sub>2</sub>% (Tabular classification) and Common rocks.

Secondary Rocks: Weathering, Transportation and deposition of sediments, Classification - textures and structures of secondary rocks, Characteristics of shallow water deposits and Common rocks.

Metamorphic Rock: Metamorphism, Agents and engineering properties of igneous, sedimentary and kinds of metamorphism, Minerals and structures, Common rocks. Engineering properties of igneous, sedimentary and metamorphic rocks (with reference to exploration, targets and problems, hazards in natural and artificial slopes, escalation at surface, foundation, under ground work and groundwater) (06)

**5. Structural Geology:** Strike and dip, Fold and its various types, Faults and its various types, Identification of folds and faults in the field, Unconformity and its various types. Inliers and Outliers, Overlaps and Joints and their types. (05)

**6. Topography and Landforms:** Surface features of earth, Land scope, Landforms (Hill, Basin, Plateau valley etc.) to understand construction material, rock types, soil conditions etc. (02)

**7. Stratigraphy:** Geological Time Scale, Physiographic divisions of India and their characteristics, Engineering significance of structural characteristics of Dharwar, Cuddapah, Vindhyan, Gondwana and Deccan formations, Deccan and Traps and Engineering projects (Dams, Tunnels, Roads). (03)

**8. Engineering geology:** Preliminary geological investigations, Use of geological map, Aerial photo interpretation and remote sensing. Sources of information (NRSA, GSI, GSDA, CGWB), Types of geological maps, Agricultural soil maps, Drainage and Erosional patterns in aerial photos, Core borings, Drill holes and Test pits, Core and logging of drill core, Limitations of drilling, Engineering significance of geological structures such as stratification, Dip and strike, Faults, Folds, Joints, Dykes, Crush zones etc. Engineering properties of rocks, Porosity, Permeability, Compressive strength, Tensile strength Mechanics of shear in rocks and Modulus of elasticity for rock. (06)

**9. Engineering projects:** DAMS- Types of dams, Geological investigations of dam sites and their influence on type and design of dams. Case histories. Tunnels-Geological investigations for tunneling, Influence of geological conditions for tunneling, Roads and Bridges- Geological investigations for road and bridge constructions. (04)

**10. Groundwater:** Source and types, Water table types and its fluctuations, Types of aquifers, Springs and its types, artesian well and artesian conditions. Engineering problems and groundwater. Scope of groundwater investigations in Civil engineering: Groundwater survey, Direction of groundwater flow, Pumping test, Groundwater recharge and conservation. (03)

**11. Natural hazards:** Earthquakes- Seismic waves and its recordings, Earthquake prone belts/areas, Engineering significance of earthquakes, Landslides- Causes and types, Influence of dip and strike, Safe and unsafe slopes, Soil creep, Precautions to be taken while making cuts in hill sides, Rock fall, Floods, Food control and disaster management. (02)

**12. Rock as construction material:** Requirements as good construction material, Suitability of common rocks as construction material and building stones. (02)

**TERM WORK**

### **1. Identification of Minerals:**

Quartz and its varieties, Orthoclase, Plagioclase, Microcline, Zeolites, Muscovite, Biotite, Hornblende, Garnet, Asbestos, Actinolite, Chlorite, Olivine, Serpentine, Tourmaline, Kaoline, Calcite, Corundum, Apatite, Magnetite, Limonite, Chromite, Pyrite, Malachite, Chalcopynite, Pyralusite, Graphite, Native copper Galena and Baryte.

### **2. Identification of Rocks:**

Granites, Syenites, Diorites, Gabbro, Rhyolite, Trachite, Pumice, Pegmatite, Dolerite, Basalt and its varieties, Volcanic breccia. Shales, Sandstones, Conglomerate, Breccia, Grit, Arkose, Organic and chemical limestones, Laterite, Ballxite and Kankar. Slate, phyllite, schists, Gneisses, Marbles and Quartzites.

### **3. Geological Maps and Problems:**

Contour map, Geological map and its reading, Identification of land form in contour maps, Construction of sections of simple geological maps, Selection of engineering sites from geological maps, Merits and demerits of sites, Core logging types and its significance.

### **REFERENCE BOOKS:**

- |                                      |                     |
|--------------------------------------|---------------------|
| 1. Principles of Engineering Geology | - R.B. Gupte        |
| 2. Engineering Geology               | - Richard E. Godman |
| 3. A Text Book of Geology            | - P.K. Mukherjee    |
| 4. Geology of India                  | - D.N. Wadia        |
| 5. Principles of Physical Geology    | - A. Holmes         |
| 6. Groundwater                       | - H.M. Raghunath    |

### **CW 303 DESIGN OF STRUCTURES – I (STEEL)**

(Lectures/Week: 04, Practicals/Week: 02 and Total Credits: 05)

**1. General Considerations:** Advantages and disadvantages of steel structures, rolled steel sections, types of loads, design methods (04)

**2. Connections:** Riveted, Welded connections, design of concentric and eccentrically loaded riveted and welded connection (08)

**3. Tension Members:** Introduction, types, permissible stresses, net sectional area, design of tension members (04)

**4. Beams:** Introduction, Types of sections, design of simple and built-up beams (06)

**5. Compression Members:** Introduction, slenderness ratio, types of sections, design of angle continuous and discontinuous struts, design of axially and eccentrically loaded compression members, built up column, lacing, battening. (10)

**6. Column Bases:** Introduction, types of column bases, design of bases: Slab base and Gusseted base, Moment resistant bases. (04)

**7. Roof Trusses:** Types of trusses, loading on trusses, design of tubular and angular roof truss with connection, design of purlin. (06)

**8. Plate Girder:** Introduction of plate girder, Proportioning and design of section and connections, curtailment of flange plates, design of web splices, design of stiffeners (06)

### **TERM WORK:**

It shall consist of design and drawing of various elements as detailed below.

1. Design and drawing of industrial building:

It shall consist of design and drawing for various structural elements as detailed below.

a) Design and drawing of simple beam, Built up beam, Beam to beam connection, Beam to column connection.

b) Design and drawing of compound columns, lacing, battening with bases

2. Design and drawing of roof truss.

3. Design and drawing of plate Girder.

### **REFERENCES BOOKS**

1. Design of steel structures by A.S. Arya and J.L. Ajmani, Nemichand and Bros., Roorkee.
2. Design of steel structures by S.K. Duggal, Tata-McGraw Hill Co.
3. Design of steel structures by I.S. Negi, Tata-McGraw Hill Co.
4. Design of Steel Structures by Vol. I & II, Ramchandran, Standard book house.
6. IS 800 and IS 875 Part I, Part II & Part III

### **CW 304 IRRIGATION WATER MANAGEMENT ENGINEERING-I**

(Lectures/Week: 03, Tutorials/Week: 01 and Total Credits: 04)

**1. Soil Science:** Physical and chemical properties of soil, Statics and dynamics of soil moisture, Soil irrigability classification, Saline and alkaline soils, Soil survey techniques for irrigation purposes (08)

**2. Soil-Water-Plant Relationship:** Soil as a medium for plant growth, Soil– water–plant relationship, Soil productivity-crop rotation and tillage, Soil nutrients and their role in crop production, Optimal crop planning (07)

**3. Soil Fertility:** Manures and fertilizers, macro and micronutrients – their role in crop production, crop rotation (04)

**4. Agro Technology:** Factors in crop production, tillage – purpose and practices, implements used for tillage operation (03)

**5. Crop Water Requirement:** Infiltration rate of soil, Crop water requirement (Blaney–Cridle and Modified Penman method), Effective rainfall, Leaching requirement, Intensity and Frequency of Irrigation, Irrigation Efficiencies (08)

**6. Gravity Irrigation Methods:** Phases of water profile development, Different flood irrigation methods, Hydraulic Design of Check Basin, Border and Furrow (10)

**7. Land Grading & Drainage for Irrigation:** Necessity of land grading, Land grading design, Necessity of land drainage, Design of surface and subsurface drainage systems of irrigated land (08)

### **TERM WORK**

Exercise 1. Determination of infiltration rate of soil

Exercise 2. Determination of soil moisture content

Exercise 3. Determination of evaporation rate of soil

Exercise 4. Determination of pH of soil

Exercise 5. Determination of EC of soil

Exercise 6. Design of flood irrigation method

Exercise 7. Design of intensity, frequency and efficiency of flood irrigation

Exercise 8. Design of land grading system

Exercise 9. Design of land drainage system

### **REFERENCE BOOKS:**

1. WALMI Publication No. 15 - WALMI, Aurangabad (M.S.).

2. Irrigation Theory and Practice-A.M. Michael, Vikas Publishing House Pvt. Ltd., New Delhi.

3. Irrigation Engineering- R.K. Sharma and T.K. Sharma, S.Chand & Company Ltd., New Delhi.

### **CW 305 ENGINEERING HYDROLOGY**

(Lectures/Week: 03, Tutorials/Week: 01 and Total Credits: 04)

**1. Introduction:** Definition, scope, Applications of Hydrology, Hydrologic Cycle and its representations; Water Budget Equation, Atmospheric processes. Hydrologic data (04)

**2. Precipitation:** Definition, conditions for occurrence of precipitation, forms of precipitation, Characteristics of monsoon over India, Measurement of precipitation, missing precipitation data, consistency of data, Presentation of data, Mean depth of rainfall over an area, Rainfall characteristics and their relations. Depth Area Duration Curves Maximum intensity-duration analysis (06)

**3. Infiltration:** Definition, factors affecting, infiltration indices, measurement of average infiltration rate, Horton's infiltration equation (04)

**4. Evaporation and Transpiration:** Definition, factors affecting evaporation rate, measurement of evaporation rate, Transpiration, evapotranspiration, PET, AET. Methods of estimation of evaporation and evapotranspiration rate, Reservoir evaporation and its reduction. (06)

**5. Runoff:** Definition, types of runoff, annual yield and its estimation, dependability of annual yield, factors affecting runoff, flow duration curve and flow mass curve and their application (05)

**6. Hydrographs:** Streamflow hydrograph, factors affecting shape of hydrograph, methods of base flow separation, Unit hydrograph theory, applications of UH, S-Curve, Instantaneous Unit hydrograph, Frequency analysis of rainfall and runoff, Measurement of runoff. (06)

**7. Groundwater Hydrology:** Definition, importance of groundwater, Advantage of groundwater, types of aquifer, properties of aquifer general flow equation for groundwater and its applications, safe yield for aquifer, steady, unsteady, radial flow to wells, Thiem's equation for well flow, saltwater intrusion. (07)

**8. Hydropower Engineering:** Definition, basic principles, estimation of hydropower potential, load curve, flow duration curve. Types of hydropower plants- typical layouts. (05)

#### **REFERENCE BOOKS:**

- |                                  |   |                   |
|----------------------------------|---|-------------------|
| 1. Engineering Hydrology         | - | K. Subramanya     |
| 2. Hydrology and Water Resources | - | S. K. Garg        |
| 3. Applied Hydrology             | - | R.S. Linsley      |
| 4. Ground Water Hydrology        | - | H.M. Raghunath    |
| 5. A text book of hydrology      | - | P. Jayarami Reddy |
| 6. Hydropower Engineering        | - | Dandekar          |

#### **Second Semester:**

##### **CW 306 DESIGN OF STRUCTURES – II (RCC)**

(Lectures/Week: 04, Practical/Week: 02 and Total Credits: 05)

**1. Design Philosophies:** Introduction, Introduction to working stress method, ultimate load method, detailed philosophy of limit state method. Types & classification of Limits states, Stress – strain relationship for concrete and steel. Characteristic strength, characteristic load, partial factor of safety (08)

**2. Beams:** Introduction, Assumptions, modes of failure, moment of resistance; Flexural shear; Diagonal tension, Design for shear reinforcement in beams, Concept of development length & bond, Design of beams: singly, doubly reinforced Rectangular beams and flanged beams for flexure, shear, bond and torsion: Simply supported, continuous, cantilever. (20)

**3. Slabs:** Introduction, Design of one way, two way, cantilever and continuous slabs (10)

**4. Columns:** Axial compression, design of short columns under axial load, uniaxial and biaxial bending (10)

**5. Footings:** Design of Isolated footings, design of eccentric footing. (04)

**6. Staircases:** Design of staircase: Dog legged and Open well stair case. (02)

(Note: All designs are by limit state method)

### **TERM WORK:**

Design and drawing of RC building up to 12 m height above ground level for gravity loads only, covering all types of structural elements of building. Detailed structural drawings for designed building with reinforcement detailing and bar bending schedule.

It shall consist of design and drawing for various structural elements as detailed below.

1. Design and drawing of beams.
2. Design and drawing of slabs
3. Design and drawing of column and footings
4. Design and drawing of staircase

### **TEXT BOOK /REFERENCES:**

1. Reinforced Concrete Design by S.N. Sinha, Tata McGraw Hill, 2<sup>nd</sup> Edition.
2. Plain and reinforced concrete by Jain and Jaikrishna
3. Reinforced Cement Concrete by S. Unnikrishna Pillai and D. Menon TMH Pub. Co.Ltd.
- 4) Design of R.C. Structures by D.S. Prakashrao
- 5) Limit State Analysis and Design by P. Dayaratnam - Wheeler Publishing company
- 6) IS 456-2000; IS 875; SP-16, SP – 34

### **CW 307 THEORY OF STRUCTURES – II**

(Lectures/Week: 04; Total Credits: 05)

**1. Basic Theorems of Structural Mechanics:** Maxwell's reciprocal theorems, Muller Breslau's principle, Application of these theorems (06)

**2. Two Hinged Arches:** Reaction, Horizontal thrust, effect of support yielding rib shortening and Temperature changes, influence line for Horizontal thrust, bending moment, radial shear and normal thrust (06)

**3. Slope Deflection Method:** Introduction, development of slope deflection equations, application to Beams (06)

**4. Moment Distribution Methods:** Introduction, concept of moment distribution, Application to beams, frames and frames with and without side sway. (08)

**5. Kani's Methods:** Introduction, Basic concepts, application to beams and frames, with and without side sway (10)

**6. Matrix Methods:** Fundamental concepts of flexibility and stiffness method of analysis, Formulation of flexibility matrix and stiffness matrix, Application to simple structures. (12)

**REFERENCES BOOK:**

- |  |   |
|--|---|
| 1. Basic Structural Analysis SI Units  | by C.S. Reddy, TMH Publishing Co. New Delhi |
| 2. Theory of Structures                | by Gupta and Pandit, Tata Mcgraw hill Pub.  |
| 3. Structural Mechanics Vol. II,       | by Junnarkar S.B; Charotar Publishers.      |
| 4. Analysis of structures, Vol. II     | by Vazrani and Ratwani, Khanna Publishers   |
| 5. Theory of Structures                | by Timosheko and Young.                     |
| 6. Statically Indeterminate Structures | by C.K. Wang.                               |
| 7. Basic Structural Analysis           | by Wilbur and Norris                        |

**CW 308 DESIGN OF HYDRAULIC STRUCTURES – I**

(Lectures/Week: 04, Practical/Week: 02 and Total Credits: 05)

**1. Reservoir:** Site selection, classification, water availability studies, demand analysis, estimation of storage capacity from mass curve, area–elevation curve, reservoir sedimentation, causes, problems and remedial measures, life of reservoir, reservoir losses, operation of multipurpose reservoir, and reservoir economics (07)

**2. Arch Dams:** Suitability, types, design methods, cylinder theory, elastic theory. (03)

**3. Buttress Dams:** Types and selection, design principles, miscellaneous types of dams steel dams, timber dams etc. (05)

**4. Gravity Dams:** Suitability, forces acting on it, modes of failure and factor of safety, elementary and practical profile, Principle and shear stress, stability analysis by gravity method, galleries in dams, joints in dams, treatment of dam foundation, grouting, control of cracking (08)

**5. Earth Dams:** Types, suitability, construction methods, criteria for safe design, phreatic line, types of filters, slope protection works, seepage control, stability of slope, rock fill dams. (06)

**6. Spillways:** Necessity, types, factors affecting design, ogee spillway - profile and its computation, chute spillway, side channel, shaft, siphon spillways etc. spillway gates, operation and control (06)

**7. Energy Dissipators:** Types and selection, IS and USBR basins, bucket type stilling basins (06)

**8. Dam Instrumentation:** Precautions for dam safety, equipments used during construction and monitoring. (04)

**TERM WORK:** Term work shall consist of following exercises on

1. Reservoir capacity estimation from mass curve
2. Calculation of life of reservoir
3. Types and design principles of buttress dam
4. Stability analysis of gravity dam with and without earthquake force
5. Plotting of phreatic line in an earth dam

6. Swedish slip circle method of stability analysis.
7. Design of ogee spillway

**TEXT BOOKS:**

- |   |                         |
|---|-------------------------|
| 1. Irrigation Engineering                                 | - B.C. Punmia and Pande |
| 2. Irrigation Engineering and Hydraulic structures        | - S.K. Garg             |
| 3. Irrigation Water Resources and Water Power Engineering | - Dr. P.N. Modi         |
| 4. Irrigation Engineering                                 | - Bharat Sing.          |

**REFERENCE BOOKS:**

- |   |                           |
|---|---------------------------|
| 1. Irrigation Practice and Design (Vol. I, II, and III) | - Khushalani G. B.        |
| 2. Theory and Design of Irrigation Structures           | - R.S. Varabeny and Gupta |
| 3. Engineering for Large Dam; (Vol. I, II)              | - Thomas                  |
| 4. Concrete Dams  | - H.D. Sharma             |

**CW 309 TRANSPORTATION ENGINEERING**

(Lectures/Week: 04, Practical/Week: 02 and Total Credits: 05)

**1. Introduction:** Highway planning, Surveys, Historical Development, Components of Transportation systems, Road development and alignment (03)

**2. Highway Geometrics:** Cross sectional elements, Design steps, Sight distance, Passing and Non passing distance, horizontal alignment, super – elevation, set back transition curves and vertical Alignment, Geometrics of hill road (10)

**3. Traffic Engineering:** Traffic characteristics, Traffic survey's origin and destination studies, spot speed studies conflicts, 3–5 of traffic engineering. Intersection at grade, grade separations. Traffic control devices, parking and lighting. (06)

**4. Highway Materials Characterization:** Soil classifications for road materials. Tests on bitumen, Bituminous mix design, Soil stabilization, geotextiles (02)

**5. Highway Pavement and Construction:** Introduction of G.I. and C.B.R. method of design for flexible pavements and construction basics of rigid pavement design and construction, highway maintenance and drainage (03)

**Railway Engineering:**

**1. Introduction:** Role of Railway in Transportation, Historical development and modernization of railway in India, classification of Indian railways, metro and suburban railways (02)

**2. Railway Track:** Permanent way, requirement of ideal permanent way, capacity of railway track, Types and selection of gauges, Coning of wheels, Function of rails, Selection and Types of rails, Rail failures, wear on rails; Creep of rails. Theories of creep, Measurement and Prevention of Creep Functions of sleepers, Types, Requirement of Sleepers: Functions of ballast, Different fixtures and their purposes, Railway track cross sections (08)

**3. Railway Geometrics:** Track alignment, Gradient and grade compensation, Speed of train, Cant and negative cant, Curves, Points and crossing Track junctions, Stations and yards, track drainage and maintenance (05)

**TERM WORK:** Term work shall consist of following Sketches

1. C/S of pavement.
2. C/S of Railway track.
3. Three sketches on Railway fixtures.
4. Detailed sketch of Turnout.
5. Two sketches on Track junctions.
6. Two sketches on Stations and yards

**TESTS ON:**

1. **Road Materials:** Specific gravity, Crushing, Impact, Abrasion and Shape.
2. **Bitumen:** Specific gravity, Viscosity, Flash point, Softening point and ductility.

**REFERENCE BOOKS:**

1. Highway Engineering by Justo and Khanna.
2. Principles of Transportation engineering by B.V.Rao.
3. Principles of railway engineering by S.C.Rangawala
4. A Textbook of Railway Engineering by S.C. Saxena and S.P. Arora, Dhanpat Rai & Pub., New Delhi
5. A Course in Highway Engineering by S.P. Bindra, Dhanpat Rai & Pub., New Delhi
6. Railway Engineering by Satish Chandra and M.M. Agrawal

### **CW310 ENVIRONMENTAL ENGINEERING**

(Lectures/Week: 04, Practical/Week: 02 and Total Credits: 05)

1. **Introduction to Water Supply:** Various components of environment, Necessity and importance of water works, components of water supply scheme
2. **Quantity of Water:** Daily rate of water consumption for various purposes, factors affecting consumption, fire allowance, Variation in the demand of water and its effect on the design of water supply units, population forecast, Design capacity of scheme.
3. **Sources of Water:** Comparative study of various sources with respect to quality and quantity, Selection of source from view point of service provider, Economics of scheme
4. **Raw water conveyance:** Intake structures, various conveyance systems, Pressure pipes, Different types of valves, pressure regulating valves, Fire hydrants, services, Testing of pipes and pipe fittings.
5. **Treatment of water:** Quality standards, physical, chemical and bacteriological aspects of water, typical layout of water purification plant for domestic and industrial supply, details and design of various treatment units:
  - a) Screens
  - b) Plain sedimentation – Principle and types
  - c) Mechanical sedimentation – Principle, coagulant, dosing and mixing, coagulation, flocculation, clarification, sludge removal.

- d) Filtration – Theory, working, trouble shooting and design of rapid sand gravity filters, pressure filters, portable filters.
  - e) Disinfection – Different methods, pre, post and super chlorination, break point chlorination, chlorine demand, residual chlorine, Dechlorination.
  - f) Miscellaneous methods – Aeration, activated carbon, hardness removal, fluoride removal, reverse osmosis.
- 6. Distribution of water:** Objectives of distribution, Zoning of areas, service reservoirs – their purpose and capacity determination, systems of distribution, pressure in distribution system, determination of diameter of mains.
- 7. Quantity of sewage:** Definitions of terms, sources of sewage, domestic and industrial water, D.W.F., storm water runoff, ground water infiltration. Systems of sewerage, design discharge.
- 8. Sewer Design:** Common materials and shapes, Hydraulic design of sanitary sewers, storm sewers, Laying and jointing of sewers, testing of sewer pipes.
- 9. Plumbing and sanitation system:** Pipe line and fixtures for bathroom and W.C., House drainage, rain water collection system, Manholes, street inlets, flushing devices, domestic sewers – one pipe and two pipe systems, traps, I.C. and other special structures.
- 10. Sewage Pumping:** Types of pumps pump selection, sludge pumping.
- 11. Wastewater Characteristics:** Sampling procedure, Wastewater analysis, Determination and application of physical, chemical and biological characteristics.
- 12. Effluent disposal:** Various methods and their suitability, Treatment in receiving environment, Effects on biology.
- 13. Sewage Treatment:** Flow chart, various units incorporated, conventional and non-conventional methods:
- a) Primary Treatment – Principles and design of facilities
  - b) Secondary Treatment – Importance of micro organisms, aerobic and anaerobic process
    - i) Trickling filters, Activated sludge process, Lagoons, Oxidation ponds and ditches, Constructed wetlands, RBC, Membrane bioreactors.
    - ii) Sludge digestion – Sludge digestion, acid and methane fermentation in anaerobic treatment, factors affecting high rate digesters, sludge concentration mixing, input output balance, digester capacity, gas production.
  - c) Tertiary treatment-Filtration, Nutrient removal
- 14. Approach to treatment:** End of pipe approach, Innovative approach. Reuse of wastewater
- 15. Industrial Waste:** Elementary knowledge about types and nature.

**TERM WORK:**

List of practicals:

(Any four from group (A), any two from group (B) and two activities in group C)

### **Group 'A'**

1. Conductivity
2. Chlorine demand and Residual chlorine.
3. Study of Chlorinator.
4. Study of Backwashing of filter
5. Study of flame photometer
6. Turbidity

### **Group 'B'**

1. Sampling- Representative sample
2. Solids: Total, Dissolved, and volatile
2. B.O.D.
4. Bacteriological test - Study of slides showing pathogens and micro organisms in water

### **Group 'C'**

1. Visit to water treatment plant (Report to be submitted)
2. Study of software of water distribution system/ water treatment plant
3. Visit to river pollution abatement program
4. Design problem on wastewater treatment.

### **REFERENCE BOOKS:**

1. Water Supply and Sanitary Engineering by Birdie
2. Water and wastewater technology by Hammer, John Wiley and Sons
3. IWWA Technical Data book
4. MetCalf and Eddy: Wastewater Engineering: Treatment, Disposal and Reuse 3<sup>rd</sup> Ed., TMH New Delhi.

### **CW 311 FIELD TRAINING (Audit)**

(Three Weeks duration in the winter vacations term work contains training, Report writing and delivery of seminar)

The practical training program between T.Y. first and second semester is aimed at imparting practical knowledge to support theoretical concepts and principles of Engineering. It is expected that the student should work at construction sites/projects/ design organizations, to acquire the knowledge of practical aspects of various engineering works ( i.e. road works, Construction of pavements, culverts, bridges, irrigation works, building works, dams tunnels water supply, watershed management schemes etc.) for THREE WEEKS duration in the winter vacations. A detailed report of the training, comprising of the out line of the work, technical details, construction techniques, machinery used, its make, capacity, operations, consumption of fuel etc, Construction materials used, its rates, source, suppliers, technical specifications etc, Quality and quantity of labour force, its task work, source, wages, working hours residential arrangements , work sequence etc. should be submitted to the **faculty in charge** in the department. Assessment for term work and viva voce at the end of T.Y. second semester shall be based on training report submitted and seminar delivered, by the student. The size of the group working together on the project / site shall be depending on the size of the project, however it should not be greater than five. In one institute the repetition of the similar site should be avoided. The faculty in charge shall personally visit the site at least once during the training period. Faculty in charge should have a load of two hrs/week, during the entire second semester, who will guide the students in report writing. The faculty in charge will conduct the seminar of the students on the training received.