



TEACHING AND EXAMINATION SCHEME

Final Year B.Tech. (Civil & Water Management Engineering)

Course Code.	Name of the Course	Total No. Credits	Lectures Hrs/week	Tutorial Hrs/week	Practical Hrs/week
WM401	Environmental Engineering.	4+1	4	--	2
WM402	Project Planning and Management	4+Audit	4	--	2
WM403	Design of Hydraulic Structures-II	4+1	4	--	2
WM404	Design of Structures – III	4+1	4	--	2
WM405	Elective-I (offered only 2 at a time)	4+Audit	4	--	2
WM406	Seminar	1	--	--	2
WM407	Project –Part A	1	--	--	2
Total		25	20		14
WM408	Water Resource Systems Engineering	4 + Audit	4	--	2
WM409	Professional Practice	5	4	--	2
WM410	Foundation Engineering	4	4	--	2
WM411	Open Channel Hydraulics	5	4	--	2
WM412	Elective – II (only 2 at a time)	5	4	--	2
WM413	Project – Part B	2	--	--	4
Total		25	20		14

	ELECTIVE – I		ELECTIVE - II
WM405A	Soil and Water Conservation Engineering	WM412A	Flood Control and Drought Management
WM405B	Ground Water Engineering	WM412B	Solid Waste Management
WM405C	Bridge and Tunnel Engineering	WM412C	Finite Element Analysis
WM405D	Hydropower Engineering	WM412D	Hydro informatics

Note: Batch of 15 students for Practicals and 05 students for Project-A and Project-B.
Two Electives may be offered at a time

EXAMINATION

1. There would be two minor examinations during the semester each of 20 marks (1 hour duration).
2. The first minor examination would be at the end of 5th week and the second would be at the end of 10th week
3. At the end of the semester there would be a major examination of 60 marks (2 hours or 2.5 hours duration).
4. The distribution of weightage for each component shall be decided and announced by the course coordinator at the beginning of the course, subject to such stipulations as or given in the scheme of teaching and examination for a given programme with prior approval of PGPC.
5. Those courses which have practical component (Term work / Sessional) or which are completely practical (Term work / Sessional) in nature will be evaluated regularly during the regular schedule (50%). It also has mid-term evaluation (25%) and the end term evaluation (25%) will be done. The practical grades shall appear separately on the grade card.

SEMINAR (1 Credit)

The seminar should be done on any topic with focus on real life problems in Civil Engineering to be decided by students and the teachers concerned. Seminar work shall be in the form of report submitted by the student at the end of the semester. The candidate will make a presentation before departmental faculty and the assessment will be made by two internal examiners appointed by the DPGPC, one of them will be the supervisor.

PROJECT – A AND B: (1 + 2 = 3 Credits)

PROJECT-A:

There shall be a batch of five students for undertaking a project work in Civil and Water Management Engineering on any of the following topics.

1. Irrigation scheme including storage and distribution works
2. A major lift irrigation scheme (from a river source)
3. Water supply scheme for a township
4. Sewerage and sewage disposal scheme for a township
5. Water supply and drainage scheme for a village or group of villages
6. Watershed development and management
7. Modern irrigation methods
8. Hydrological analysis and Design
9. Hydraulic structures
10. Prestressed Concrete
11. Concrete technology
12. Analysis and Design of Structures
13. Transportation
14. Project Management
15. Public Health Systems
16. Hydroinformatics

The scope of Project-A shall be:

1. Finalization of the Topic and scope of the project in consultation with the Guide

2. Completion of Literature Survey
3. Data Collection
4. Design of Experimental set-up if required
5. Project feasibility and methodology

Presentation of the above work carried out by the batch of students in the first semester in respect of the project assigned.

PROJECT-B:

The students are expected to undertake the main component of the project work (experimental/analytical), in continuation of the Project-A carried out in Semester-I, and complete the entire work to the level of satisfaction of the respective guide.

The term work for Project-B shall consist of submission of three copies of typed and bound project report, on the work carried out by the batch of students in respect of the project assigned. There would be Viva-voce based on the project report submitted by the students.

Final Year B.Tech. (Civil & Water Management Engineering)

Semester-I

WM401 ENVIRONMENTAL ENGINEERING (L-4, T-0, P-1) 5 Credits

1. **Introduction to Water Supply:** various components of environment, Necessity and importance of water works, components in 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.
4. **Sources of Water:** Comparative study of various sources with respect to quality and quantity, Selection of source.
5. **Raw water conveyance:** Intake structures, various conveyance systems, Pressure pipes, design of pipes and pipe joints, pipe specials, different types of valves, pressure regulating valves, break pressure tanks, fire hydrants, services, testing of pipes and pipe fittings.
6. **Treatment of water:** Quality standards, physical, chemical and bacteriological aspect 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, details 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.
7. **Distribution of water:** Aim of distribution, Zoning of areas, service reservoirs – ground and elevated, their purpose and capacity determination, systems of distribution, pressure in distribution system, determination of diameter of mains.
8. **Sewage and Sewerage:** Sewage and sullage – sources of sewage, domestic and industrial water, D.W.F., storm water runoff, ground water infiltration. Systems of sewerage – separate, combine and partially combine systems, design discharge.
9. **Sewer Design:** Common materials and shapes, Hydraulic design of sanitary sewers, storm sewers, velocity in sewers, size and gradient of sewers, Laying and jointing of sewers, testing of sewer pipes.
10. **Sewer Appurtenances:** Manholes, street inlets, flushing devices, domestic sewers – one pipe and two pipe systems, traps, I.C. and other special structures.
11. **Sewage Pumping:** Types of pumps, pump selection, pumping station design, sludge pumping.
12. **Waste Water Characteristics:** Waste water analysis, determination and application of physical, chemical and biological characteristics.
13. **Sewage Treatment:** Flow chart, various units incorporated, conventional and non-conventional methods:
 - b) Primary Treatment – Principles and design units separating non degradable constituents of sewage principle, working and design, plain and chemical sedimentation tanks, proportional weirs.

- c) Secondary Treatment – Importance of micro organisms, aerobic and anaerobic process
 - i) Trickling filters: principle, working, constructional details and design, B.O.D., operational problems and remedial measures.
 - ii) Activated sludge process – Principal, working and design.
 - iii) 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.

14. Non-conventional methods of treatment: Principal and working of Lagoons, oxidation ponds, oxidation ditch.

15. Effluent disposal: Various methods and their suitability.

16. 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. Solids: Total, Dissolved, and volatile
- 2. B.O.D.
- 3. 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.

TEXT BOOKS:

- 1. Water Supply and Sanitary Engineering by Birdie
- 2. Water Supply and Waste Water Engineering by B. S. N. Raju, Tata Mc-Graw Hill Publishing house New Delhi.

Reference Books:

- 1. IWWA Technical Data book
- 2. MetCalf and Eddy: Waste Water Engineering Treatment, Disposal and Reuse 3rd Edition, Tata Mc-Graw Hill New Delhi.
- 3. Handbook and Water Supply and Drainage B.I.S. New Delhi.

WM402 PROJECT PLANNING AND MANAGEMENT (L-4, T-0, P-Audit) 4 Credits

1. **Introduction:** Project, Project life cycle, System approach to project management & Guidelines for project management system design.

(05 hrs.)

2. **Project appraisal techniques:** Appraisal criteria: (Net present value, Benefit cost ratio, Internal rate of return, Pay back period), Types and measures of project risk & Capital budgeting.

(07 hrs.)

3. **Network techniques for project management:** Development of project network, Activity, Event, Activity and event times, Float: (Start, Finish, Total, Free and Independent), Critical path analysis, CPM and PERT model & Precedence network, Resource allocation, crashing and leveling, Computer applications in project management. (09 hrs.)
4. **Project implementation:** Forms of project organization, Matrix organization, Project planning, Project control & Pre-requisite for successful project implementation. (06 hrs.)
5. **Project cost management:** Types of project cost (Direct and Indirect Cost), Cost duration curve, Basic principles for measuring project cash flows & Breakdown cost. (06 hrs.)
6. **Project quality management:** Quality control & Quality control charts. (04 hrs.)
7. **Human resources management:** Recruitment, Training, Motivation and Team work. (04 hrs.)
8. **Principles of engineering economics:** Time value of money, Design period, Elasticity of demand and Demand and supply curves. (02 hrs.)

Term Work:

1. Project network for the given activities with tabular calculation of floats.
2. Case study of a construction project involving the list of activities and location of critical path.
3. An exercise on compression and decompression of project network.
4. An exercise on plotting the cost- duration curves and measuring project cash flows.
5. Study of project management software packages.

Text Books:

1. Project Management by B.M. Naik, Vani Publishers, New Delhi.
2. Project Planning and Control with PERT and CPM by Dr. B. C. Punmia.

Reference Books:

- 1 CPM and PERT by Srinath.
- 2 Principles of Cost Management by Roy Pchery.

WM403 DESIGN OF HYDRAULIC STRUCTURES – II (L-4, T-0, P-1) 5 Credits

1. **Components of Canal and Distribution Network:** Components up to field head, rotation period and flow period of channels, water distribution policies rotation (Shejpali, Warabandi) and on demand, Chak its definition and design, Estimating capacity of channels based on water distribution policy (04 hrs)
2. **Hydraulic Design of Channels:** Cross section of channels use of Manning's equation, Kennedy's silt theory, and Lacey's silt theory, causes of silting, design of non-silting, non scouring channels, silt distribution over a channel cross section, land width and beams,

balancing depth concept and I.S. requirements of canals

(04 hrs)

3. **Construction of Channels and Lining:** Layout, equipment and quality control, lining of irrigation channels, its justification over existing and new canal systems, advantages of lining and types of linings. Concrete, shot Crete, bricks, stones, asphalt, soil cement lining, buried membrane lining, construction and maintenance of lining

(04 hrs)

4. **Hydraulic Jump:** Its use fullness in the design of irrigation structures, definition, types of jump, momentum formula, loss of energy, location and profile of jump on a sloping glaxis, profiles before the jump and after the jump hydraulic jump as a energy dissipater

(03 hrs)

5. **Theories of Seepage:** Failures of weirs and barrages, caused of failure by piping and by uplift, Bligh's creep theory for seepage flow, safety against piping and against uplift, Khosla's theory and concept of independent variables, Khosla's simple standard profile, and various types of corrections

(04 hrs)

6. **Silt Ejectors and Silt Excluders**

(03 hrs)

7. **Canal Regulatory Works:** Regulation, discharge measurements, head regulators, cross regulators, falls, escapes their types, location and design

(12 hrs)

8. **Cross Drainage Works:** Necessity different types of C.D. works i.e. aqueducts, siphons, super passage, inlets and outlets, their location, hydraulic design and maintenance

(04 hrs)

9. **Irrigation Outlets:** Classes, non-modular, semi modular and rigid module outlets, their location, design and selection of outlets

(04 hrs)

TERM WORK:

Term work shall consist of following:

- 1 Computer Programs for Canal design, Regulators C.D. Works, Canal flow
- 2 Neat sketches of various C,D, Works Canal falls at least-5

TEXT BOOKS:

- 1 Irrigation Engineering by Punmia and Pande
2. Irrigation Engineering by Garg S.K.

REFERENCE BOOKS:

1. C.B.I.P. Publication No.12 (1982)
- 2.Canal Automation C.B.I.P Publication No. 238,93

WM404 DESIGN OF STRUCTURES – III (L-4, T-0, P-1) 5 Credits

PART – A: REINFORCED CEMENT CONCRETE

1. Working stress method: Introduction, flexure analysis and design of various R.C. sections. (6hrs)

2. Water Tanks: Circular water tanks with flexible & rigid bases resting on ground, rectangular water tanks resting on ground & underground. (10 hrs)

3. Flat Slabs: Design of flat slab with or without drop -direct design method. (06 hrs)

PART – B: PRESTRESSED CONCRETE

4. Fundamentals of pre-stressing- classifications and types of pre-stressing
5. Pretension and post tensioning- losses of prestress
6. Flexure analysis design of PSC sections- cable profile-limiting zone-shear and bond-End block design

TERM WORK:

Term Work shall consist of the following:

1. Design and drawing of circular water tanks.
2. Design and drawing of underground and on ground rectangular water tank
3. Design and drawing of PSC girder with end block design.
4. Computer aided design of PSC beams (min.2)

TEXT BOOKS:

1. RCC designs : Pillai Tata McGraw Hill Pub.
2. Prestressed Concrete by Krishna Raju
3. RCC designs by Umat & Jain

REFERENCE BOOKS:

- 1 IS 456-2000, IS 3370 (part-iv), IS 1343
- 2 Design of Prestressed Concrete Structure by Lin T.Y.
- 3 R.C.C. by Puroshottam
- 4 Reinforced Concrete by Umat and Jain
- 5 Advanced R.C.C. by Krishna Raju

WM405 ELECTIVE – I (L-4, T-0, P-Audit) 4 Credits

A. SOIL & WATER CONSERVATION ENGINEERING

1 Mechanics of Soil Erosion:

Types and estimation of soil erosion, trap efficiency, factors affecting erosion. Wind erosion, Stream bank erosion, Gully erosion, Principles of gullies erosion, classification of gullies, Gully control structure, Stages of development.

(06 hrs.)

2.. **Erosion Control Structures for Agricultural Land:** Mechanical, vegetative and tillage methods of erosion control, Erosion control structures and their design, Contour bunding, Graded bunding, Broad based terraces, Bench terracing, Grassed waterways

(04 hrs)

3. **Erosion Control Structures for Non Agricultural Lands:** Contour and staggered trenching, Forestry, Agro-forestry , Gully erosion-Stages of development, Ravine reclamation,

(03 hrs)

5. **Farm Ponds:** Types, selection of site, survey, design, Estimates and construction, Percolation tanks and their utilization

(03 hrs)

2 Forestry in Soil Conservation

Management of forests, contour trenching, Specifications of different types of trenches, Forest plantation, Ravine reclamation, Shifting cultivation. (05 hrs.)

3 Fields Structure And Practices

To control erosion by water: contour bunding, design and construction of contour bunds evolving design criteria for contour bunds, Design of vegetated waterways. Shape and waterway location, channel grade and dimensions, Grass land management. (06 hrs.)

4 Water Harvesting

Types of storage structures, Ponds and Reservoirs, Components, location and storage capacity, seepage discharge equation, seepage line equation, seepage line as a parabola, seepage analysis by flow nets. (05 hrs)

6 Watershed Management

Aims and objective, criteria for priority watersheds, collection of data, execution, follow-up practice, maintenance, monitoring and evaluation, Format- introduction. (05 hrs)

Term Works:

Term work shall consist of assignment / exercise based on above syllabus and report on field visit.

Reference Book:

1. Principles of agricultural Engineering (Value-II) by Micheal A.M. and Oza
2. Land & Water Management Engineering by Murti V.V.N.
3. Water Shed Management in India by Mutri J.V.S.
4. Manual of soil and water conservation practice by Gurmel Sing
5. Text book of soil conservation by Hudson.

B. GROUND WATER ENGINEERING(L-4, T-0, P-Audit) 4 Credits

1.Introduction

Ground water extent and potential in India Ground water exploitation methods and investigations, hydrology, water bearing properties of rocks, site selection and spacing of wells, infiltration mechanism & curves. Water balance budget and equations (04 hrs)

2. Water storage and rock functions

Porosity, void ratio, water retention properties, Specific retention, Specific yield, Permeability, parameters, constant & variable head analysis and equations (04 hrs)

3. Geological zones of saturation

Aeration zone, soil water belt, saturation zone. Aquifers, storage coefficient water table fluctuation springs (03hrs)

4. Ground water flow

Specific weight, compressibility, head distribution, Laminar and turbulent flow, Reynolds number Darcy's laws and application, three dimensional flow, flow net analysis storage equations boundary conditions steady flow states, radial flow to wells, Deputies equation and application, draw down curves and cone of depression. (05 hrs)

5. Aquifer Properties

Aquifer tests, test measurements confined aquifers discharge analysis (The is' and Jacob's methods), unconfined aquifers and flow properties. (05 hrs)

6. Well Hydraulics

Types of wells and construction, infiltration galleries, tube well design and dimensions, maintenance of wells, performance tests, specific capacity, Revitalization of wells and maintenance. (05 hrs)

7. Ground Water Exploration and Modeling

Geologic and hydrologic methods electrical resistivity methods, Seismic methods, Magnetic methods, Gravity methods, Radio metric methods, Tracer techniques, Physical and mathematical models, Finite element methods and application. (05 hrs)

8. Saline Water Intrusion and Artificial Recharge

Saline water intrusion, salinity influx in estuaries, zone of diffusion and interface parameters, saline zone identification. Prevention and control of saline water intrusion. Artificial recharge and methods, wastewater recharge, detention dams, water shed management techniques, Rain water harvesting. (05 hrs)

9. Pumps and Allied Machinery

Discharge rates, demands, flow charts, heads and loses, power requirements pumps types, suitability, installation and maintenance, power calculations. Flow measurements and metering distribution networks. (04 hrs)

10. Water Quality Pollution And Legislation: Potable water quality parameters sources of pollution and pollutants, hard water and effects, water salinity and logging, water test parameters, leaching and soil reclamation, pollution control norms boards, action plans and legislation (04 hrs)

Term work:

1. Exercise on ground water quality parameters, pollution sources and remedial measures.
2. Exercise on bore well drilling methods (working sketch, parts drilling stage precautions flow measurement and billing).
3. Exercise on pump capacity, selection, cost analysis, installation and maintenance.
4. Exercise on ground water pollution control norms, pollution boards and legislation
5. Exercise as a case study on water shed management scheme.
6. At least ten sketches of basic figures of the course.

Reference Books:

1. Ground Water Engineering (Assessment, development and management)
by K.R. Karanth
2. Ground Water
by H.M. Raghunath
3. Ground Water Hydrology
by D.K. Todal
4. Ground Water and Seepage
by M.E. Harr.
5. Seepage, drainage and flow nets
by H.R. Cedergren
6. Engineering Fluid Mechanics
by C. Jaegar.

C. BRIDGE AND TUNNEL ENGINEERING (L-4, T-0, P-Audit) 4 Credits

1. **Introduction:** History of bridges and development, Definitions and components of bridges, Various ways of classification of bridges, Alignment finalization and economic span (03 hrs)
2. **Investigations:** Need for investigation, Selection of bridge site, Preliminary data to be collected at site of bridge, Determination of flood discharge and waterway calculations, Depth of foundation and clearance, Afflux, Depth of scour (04 hrs)
3. **Loadings I.R.C.:** Recommendations for loading on road and railway bridges, Substructure, general considerations, Types, Design and construction of piers abutments and wing walls, Condition of stability (03 hrs)
4. **Foundations:** Types of foundations, Shallow piles, Wells, Use of coffer dams and caissons, Grip length, Approaches, Influence of conditions on approaches and the selection of the type of bridge, Types of construction of approaches, Culverts slab, Box type and arched types, Causeways, and submersible bridges (03 hrs)
5. **Super Structure:** Different types of road and railway bridges, Arched, Girder and suspension type (02 hrs)
6. **Bridge Details:** Different type of bridge floors for road and railway bridges, Bearings for bridges (02 hrs)
7. **Construction and Maintenance:** Methods of erecting girder, Truss and maintenance of bridges (03 hrs)

TUNNELING

1. **Introduction:** History, Necessity, Detailed classification in accordance with size shape and geological considerations, Open cut tunnel (02 hrs)
2. **Geometric Design:** Different shapes and sizes of tunnels for various works such as railways, Highways, Water carriage, Gas lines, Gradient and curves (04 hrs)
3. **Tunnel Surveys:** Setting out, Modern instruments, Method of transfer of alignment, Accuracy of transfer (01 hrs)
4. **Geological Conditions for Tunnels and Problems:** Problems in tunneling, Tunneling in hard rock, Methods of attack, Equipment, Drilling, Driving, Sequence of aberration, Classification of drill holes, Explosive, Types of explosives, Perfect use of explosives, Types of fitting, Delay technique, Tunnel boring, Boring machines, Mucking and rock bolting (04 hrs)
5. **Tunneling in Soft Strata:** Methods of driving, Different types of boring machines, Mucking and supporting structures, Methods of both ordinary and pneumatic along with procedure, Equipments and accessories, Safety (04 hrs)
6. **Lining:** Necessity and various types of lining, Ventilation, Drainage, Lighting their requirements and various provisions, Maintenance of the tunnels (03 hrs)

TERM WORK:

Term work shall consists the following:

1. Problems on geometric design of tunnel.
2. Detailed sketches of various types of bridge (05)
3. Sketch of various types of girders (05)

TEXT BOOKS:**

1. Bridge Engineering
2. Essentials of Bridge Engineering
3. I.R. C. Code for bridge No. I&II
4. Tunnel Engineering
5. Tunnel Engineering
6. I.S. 4880, I.S. 5878 Parts I to X.

D. HYDROPOWER ENGINEERING (L-4, T-0, P-Audit) 4 Credits

1. Introduction to Hydropower: Sources of energy, status of power, hydropower in India, importance of hydropower, hydropower in multipurpose reservoir system, estimation of water power potential, load curve, load factor capacity factor utilization factor, load duration curve, firm power, secondary power, prediction of load

(06 hrs)

2. Hydroelectric Plants: Classification of hydel plants, run-of river plants, alley dam plants, historical development of pumped storage power plants, types of pump storage plant, advantages of pumped plants, two unit and three unit arrangement relative merits, reversible pump – turbines, problems of operations topography, reservoirs and water conveyance, power house, efficiency of pumped storage plant, Small and micro hydropower.

(07 hrs)

3. Penstocks: Classifications of penstocks, Design criteria for penstocks, Economical diameter of penstocks, blocks, Conduit valves, Bends and manifolds, Water hammer, Resonance in penstock channel, surges, surge tanks,

(07 hrs)

4. Intakes: Intakes, types of intakes, Losses in intakes, Air entrainment at intakes, Inlet aeration, Canals fore bay tunnels

(04 hrs)

5. Turbines: Main types, Arrangements, Suitability and adaptability, Layouts

(05 hrs)

6. Power Channels and Settling basins

(05 hrs)

7. Electrical and Mechanical Equipments: Generators, Excitation, Ventilation, Cooling and fabrication, transformers, Switchgear, Central room equipments, Mechanical equipment, Transmission of electric power

(06 hrs)

8. Power House Planning: Surface power stations, Power house structure, Power house dimensions, Variations in design of power house, Underground (UG) power station, History, Location, Types of UG power house, Components of UG power house, Types of layout, Limitations of UG power house

(05 hrs)

9. Tidal Power: Basic principle, Location of tidal power plant, Difficulties in tidal power generation, Components of tidal power plants, Modes of generation, Single and double basin system, Constructional aspects, Estimate of energy and power, Economic feasibility

(06 hrs)

TERM WORK:

1. Analytical solution for economical diameter of open stocks.
2. Hydraulic design of simple surge tanks.
3. Salient features of an existing H.P.P.

4. Study of Power house complex and components and arrangements.
5. Neat sketches of at least ten basic figures of the course.

TEXT BOOKS:

1. Water power engineering by Dandekar M.M. and Sharma K.N.
2. Water power engineering by Deshmukh

REFERENCE BOOKS:

1. Hydro power structures by Varhney R.S.
2. Hydro electric engineering practice by Brown J.G.
3. Hydro electric practice by Creager and Justin
4. Water power development (Vols. I, II and III) by E. Mosonyi
5. A Hand Book on hydrology by Ven Te Chow

WM406 SEMINAR (L-0, T-0, P-1) 1Credit

Each candidate shall study some special topic under the subjects of Civil (Water Management) branch from current literature or study a project under the subjects of Civil (Water Management) branch and its actual working and design etc. under the guidance of a faculty member. He shall prepare his report together with design, computations, sketches drawings etc. And deliver a talk on the topic before other students in the presence of faculty members

The report, written in a technical reporting manner and the presentation of the talk on the subject will be treated as term work under this head and will be assessed by the two internal examiners appointed by the Head of the department, one of whom will be his guide and the other internal teacher of the concerned subject, or expert from the field

WM407 PROJECT – A (L-0, T-0, P-1) 1 Credit

There shall be a batch of five students for undertaking a project work in Civil and Water Management Engineering on any of the following topics

17. Irrigation scheme including storage and distribution works
18. A major lift irrigation scheme (from a river source)
19. Water supply scheme for a township
20. Sewerage and sewage disposal scheme for a township
21. Water supply and drainage scheme for a village or group of villages
22. Watershed development and management
23. Modern irrigation methods
24. Allied fields of current and future interest

The scope of Project-A shall be:

1. Finalization of the Topic and scope of the project in consultation with the Guide
2. Completion of Literature Survey
3. Data Collection
4. Design of Experimental set-up if required
5. Project feasibility and methodology

Presentation of the above work carried out by the batch of students in the first semester in respect of the project assigned.

Semester-II

WM408 WATER RESOURCE SYSTEMS ENGINEERING(L-4, T-0, P-Audit)

4 Credits

- 1. Nature of Water Resource Systems:** Technological, economical, social, environmental, and political aspects. (02 hrs)
- 2. Systems Engineering:** Need, role and scope of systems engineering, definition. Concept of system, characteristics of system, hierarchy of systems. (03 hrs)
- 3. Systems approach and systems analysis:** Steps in the application of systems approach. Optimal policy analysis - introduction to optimization, overview of operations research techniques. System models and their role in systems engineering. (03 hrs)
- 4. Systems Analysis Techniques:** classical optimization techniques - differential calculus methods, linear and nonlinear optimization, introduction to nonlinear programming methods – Lagrange Multiplier method, Khun Tucker conditions. (03 hrs)
- 5. Linear Programming:** General form of LP problem – terminology and notation, graphical solution, Simplex method of solution, solution to problems, applicability and limitations. Introduction to sensitivity analysis. Introduction to Duality. (12 hrs)
- 6. Dynamic Programming:** Concept, principle of optimality, terminology, recursive relationship, simple applications to resource allocation and network problems. (05 hrs)
- 7. Surface Water Quantity Management:** Objectives of water resource development and management. Objective functions and type of constraints. Description of surface water resource planning problems. Introduction to reservoir planning and management. Solution of simple resource allocation and network problems using Linear programming and Dynamic Programming. (05 hrs)
- 8. Groundwater System:** System configuration, characteristics, manageable resources of ground water, aspects of conjunctive use of surface and ground water. (03 hrs)
- 9. Water quality System:** Water quality standards and objectives, measures for maintaining water quality, regulation and law, economic incentives, low cost treatment. (03 hrs)

TERM WORK:

1. Conceptual understanding of system concepts and role of systems engineering in water resource management – Three assignments.
2. Solution to linear programming problems – Three assignments.
3. Solution to Dynamic programming problems – Two assignments.
4. Reservoir planning problem – One assignment.

TEXT BOOKS

1. Water Resources Systems Engineering by Hall and Dracup ,TMH Pub.
2. Operations Research by S.S.Rao, Tata McGraw Hill Pub.

Reference Books

1. Systems Approach to Water Management by Biswas A.K., McGraw Hill Pub.
2. Operatios Research An Introduction by Hamdy A. Taha, PHI Pub.
3. Introduction to Operations Research by Hiller and Lieberman, McGraw Hill Pub.

WM409 PROFESSIONAL PRACTICE (L-4, T-0, P-1) 5 Credits

INTRODCUTION OF IS-1200

For Modes of Measurements. (02 hrs)

TAKING OUT QUANTITIES

Methods of Taking Out Quantities, PWD Method, English Method, Estimates of Buildings, Slab, Pipe Culvert, Septic Tank, Walls, Roads, Railway Tracks, and Canals. Plumbing Works, RCC Slabs and Framed Structures. Abstracting.

(08 hrs)

ANALYSIS OF RATES

Analysis of Rates for Various Items of Construction. Introduction of District Schedule of Rates.

(04 hrs)

APPROXIMATE ESTIMATES

Methods of Preparing Approximate Estimates For Building, Road, Bridges, Water Supply Schemes, Sewerage Schemes And Irrigation Schemes

(04 Hrs)

SPECIFICATIONS

Detailed specification (Reference to be made to PWD handbook and IS. 1200) for typical Civil Engineering works. Brief specifications. Principles of writing specifications.

(02 Hrs)

CONTRACTS

Various Agencies Involved In Construction Industry. Essentials of Valid Contracts. Contract Documents. Conditions of Contract. Role of Engineer in Govt. Works in Contract. Role of Architect/ Civil Engineer in Semi Govt. and Private Organizations. Performance of Contract. Breach of Contract, Termination of Contract.

(03 Hrs)

TYPES OF CONTRACT

Item Rate, Percentage Rate, Lump Sum, Cost plus Percentage. Cost Plus Fixed Fee, Target, and Piece.

(03 Hrs)

TENDER

Definition, Tender Notice, Earnest Money, Security Deposits, Preparation and Submission of Security and Acceptance of Tenders.

(04 Hrs)

GOVERNMENT PROCEDURE FOR EXECUTION OF WORKS

Classification of Works, Administrative Approval, Technical Sanction, Bills, Measurements Book, Muster Roll, Accounts of Works and Stores, Tools And Plants, Materials at Site Account, Daily Diary.

(04 Hrs)

VALUATION

Definition, Nature of Value Factors Affecting Value of Land And Buildings, Salvage Value, Book Value, Market Value, Prospective Value, Sinking Fund, Depreciation, Methods of Working out Sinking Fund Installation & Depreciation, Methods of Valuation for Buildings.

(03 Hrs)

PROPERTIES

Definition, Mortgage, Amortization, Arbitration, Sale Of Real And Immovable Properties, Registration Sale Dead. Formation of Co-Operative Housing Societies and Related Procedure for Execution and Construction of Apartment, Act. (03 Hrs)

TERM WORK

Term-work shall consist of the following.

1. Estimate of a two storied building
2. Estimate of a culvert or railway track or canal or road
3. Estimate of a simple RCC framed structure/ Industrial steel structures.
4. Analysis of rates for ten items of construction.
5. Specifications for six items of construction.
6. Valuation report for a building.

REFERENCE

1. Civil Engineering Contract and Estimates by B. S. Patil
2. Estimating and Costing in Civil Engineering by B. N. Dutta.
3. Elements of estimating and costing by S. C. Rangwala.

WM410 FOUNDATION ENGINEERING (L-4, T-0, P-0) 4 Credits

1. **Bearing Capacity:** Theories – Terzaghi , Prandl, Balla, Mayer of Ultimate, net and safe bearing capacity, field load test and their limitations, standard penetration test local and general shear failure of long, square and circular footings, factors affecting bearing capacity, methods of improving bearing capacity of foundation beds, effect of water table on shape of footing, width of footing depth of footing and bearing capacity.
2. **Settlement Analysis:** Causes and control fo settlement, immediate settlement, consolidation settlement, differential settlement, prediction of foundation settlement from plate load test, settlement tolerance of superstructures
3. **Footings and Rafts:** Design considerations and construction of different types of footings and farts on sand and clays proportioning of footing for equal settlement, combined footings and cantilever footings.
4. **Pile Foundations:** Types of piles, their use and functions, timber, precast, cast-in-situ sheet piles, method of pile driving, pile driving hammers, effect of pile driving on ground, selection of type of pile, determination of strength, design of pile foundation, determination of bearing capacity from theoretical analysis, point bearing, friction negative skin friction pile capacity by static and dynamic formulae, limitations, group action, number and spacing of pile in group
5. **Coffer Dams:** Types of coffer dams, use and salient features of construction, single wall, double wall cellular, design of braced and cellular coffer dams, circular and of diaphragm type, pumping and sealing of bottom of coffer dam.
6. **Well and Cassions:** Types of wells, components parts, choice of particular type, design loads, scour depth, sinking, frictional resistance for wells, tilting and method of correction of wells, cassion – open, box drilled pneumatic safety problems, working, uses, salient construction features.
7. **Foundations on Black Cotton Soils:** Characteristics of B.C. soil, foundation problems in black cotton soils, foundation design principles, foundation techniques, under reamed piles, dewatering of foundation, special features of foundation for towers and tanks

TEXT BOOKS:

- | | | |
|--|----|-----------------|
| 1. Foundation Engineering | by | Phatak D.R. |
| 2. Foundation Engineering | by | Kasamalkar D.J. |
| 3. Soil Mechanics Foundation Engineering | by | Punamia B.C. |
| 4. Soil Mechanics Foundation Engineering | by | Murthy V.N. S. |
| 5. Foundation Design and construction | by | Wayne C. Teng. |
| 6. Foundation Design | by | Wayne C. Teng. |
| 7. Soil Mechanics Foundation Engineering | by | Bharat Singh |

WM411 OPEN CHANNEL HYDRAULICS (L-4, T-0, P-1) 5 Credits

1. **Basic Principles:** Open channel flow and its classification, energy and momentum principles, critical flow and its computations, transitions. (06 hrs)
2. **Uniform Flow:** Computation of uniform flow, design of channels for uniform flow (Non-erodible, erodible and grassed channels) concept of boundary layer, surface roughness, velocity distribution of instability of uniform flow (08 hrs)
3. **Gradually Varied Flow:** Theory and analysis, methods of computations, flow profiles in non-prismatic channels, spatially varied flow (08 hrs)
4. **Rapidly Varied Flow:** Flow over spillway, hydraulic jump and its use in energy dissipation (05 hrs)
5. **Unsteady Flow:** Equation of continuity and equation of motion, waves and their classification, celerity of wave, surges (08 hrs)
6. **Sediment Transport:** Introduction, basic theories of sediment transportation, dunes and ripples, scour criteria (06 hrs)
7. **Open Channel and River Models:** Principles and interpretations of results (05 hrs)

TERM WORK:

5. Experiments on transitions
6. Computation of α and β for various channel.
7. Term Work shall be consisting of at least 4 problems on each of the listed above.
8. Computation of GVF using computer programs.

TEXT BOOKS:

- | | | |
|----------------------------|----|---|
| 1. Open Channel Hydraulics | by | Ven Te Chow (McGraw Hill Pub. 1959) |
| 2. Flow in open Channel | by | K. Subramanya ((McGraw Hill Pub. 1986.) |
| 3. Open Channel Hydraulics | by | Strum. |

WM412 ELECTIVE – II (L-4, T-0, P-1) 5 Credits**A. FLOOD CONTROL AND DROUGHT MANAGEMENT****1. Introduction**

Hydrologic cycle, various hydrologic processes, network standards and design, radars, satellite data acquisition. (03 hrs)

2. Frequency Analysis

Definitions, assumptions and data requirement, plotting positions, commonly used distributions for frequency analysis, parameter estimation techniques, and goodness of fit test, chi square test, K-S test and D-index test, standard errors. (06 hrs)

3. Hydrologic Time Series Analysis and Modeling

Classification, general statistical properties of hydrologic time series components, over year trends, trends analysis, estimation of parameters, methods of separating periodic and stochastic components, steps in time series modeling, deterministic and stochastic models. (08 hrs)

4. Reservoir Planning

Water availability studies, storage terms (active storage, within year storage, carry over storage, conceptual storage), Reservoir capacity, Yield determination, Ripple's methods, Residual mass curve, Simulation, Methods based on range and low flow sequences, Probability matrix methods, Flow duration curve and energy computations. (08 hrs)

5. Flood Control

Flood forecasting needs and problem, methods of flood control, flood zoning, flood protection structures, levees, channel improvements and channel diversion, soil conservation, flood routing techniques, channel routing and reservoir routing, electrical analogy method, economics of flood control. (06 hrs)

6. Urban Hydrology

Introduction, qualitative descriptions of urban storm water runoff, determination of urban storm water runoff. (03 hrs)

7. Drought

History and nature of drought, impact of drought, definition and classification of drought. Drought relief measures. Drought management, long term strategy of drought mitigation, people's participation in drought management programme, evaluation of drought management programme. Watershed management, Ground water recharging methods, Ground water exploitation, Ground water management, (08 hrs)

TERM WORK

Term work shall consists of assignments based on above syllabus.

TEXT/REFERENCE BOOKS

1. Hydrology - Varshney
2. Hydrology for Engineers - Linsley, Kohlar
3. Handbook of hydrology - V.T. Chow
4. Stochastic hydrology - Dr. P. Jayarami Reddy
5. Watershed hydrology - R. Suresh
6. Engineering hydrology - K. Subramanya
7. Applied hydrology - K.N. Mutreja

B. SOLID WASTE MANAGEMENT

01 Definition of Solid Waste

Domestic garbage, ash, rubbish, dust, debris. Commercial: wastes form offices, shops and markets, Industrial waste, Hazardous waste, Supreme Court directives about solid waste, MSW-2000 rules.

02 Sources of Solid Wastes

Household wastes, waste from commercial establishments, office, vegetable markets, fish and meat markets, stables, solid waste from construction activities, industries, hospital wastes and dead animals.

03 Quantity Composition and Properties of Solid Waste

Per capita municipal solid waste, quantity of industrial solid waste per unit produced, composition: physical, chemical and biological constituents, sampling and characterization of solid wastes. Engineering design principles, materials balance analysis.

04 Effects of Solid Waste on Environment

Effects on air, soil, water (surface and ground), public health hazards.

05 Collection, Segregation, Storage and Transportation of Solid Waste

House to house collection centers: location, sizes, types of containers and maintenance. Transportation methods: manual, mechanical, methods with or without compaction in transportation of waste. Optimization of transportation routes. Modern techniques of analysis.

06 Disposal of solid waste

Various methods of disposal: dumping, land filling, composting, incineration, sea disposal. Innovative approaches: Segregation, reduction at source, recovery and recycle. Role of rag pickers. Disposal methods: sanitary land filling, composting; aerobic and anaerobic, incineration, vermicomposting.

07 Industrial solid waste

Wastes produced during manufacturing process, operation of pollution control facilities, minimization at source, recycling and disposal. Textile, Tanning, Paper, Food processing, Pharmaceutical, Foundry and smelting, Cement, Thermal power etc.

08 Modern Trends

Thermal, biological and chemical conversion technologies, energy conversion, Kyoto protocol, carbon trading.

09 Disposal and treatment of hazardous wastes

Types, generation minimization at source, separate collection, treatment and disposal. Rules for disposal.

10 Legal aspects of solid waste management, incentives to industry for waste management.

TERM WORK:

Each student shall prepare a report on any industrial/hazardous/municipal solid waste comprising source, characterization, transportation, recycle, treatment and disposal.

REFERENCE BOOKS:

- Integrated Solid Waste Management Technologies by Theisen and Vigil, McGraw Hill International.
- Solid Waste Management in Developing Countries by A. D. Bhide, NEERI, Nagpur publication.
- Manual on Solid Waste Management – AILSG, Mumbai publication, 2006

C. ADVANCED STRUCTURAL DESIGN

1. Analysis and design of building frames above two storey and two bay. (10 hrs)
2. Design of overhead rectangular and circular service reservoirs, Design of intz water tanks, membrane analysis, analysis of staging by cantilever method (use of tables from IS 3370) design of foundations (16 hrs)

3. RCC bridges with IRC loading, design of slab bridges, simply supported T beam bridges, a complete design of super structure (14 hrs)

4. Design of RC Bunkers and soils (12 hrs)

TERM WORK:

Term work shall consist of at least two applications with programming based on the syllabus. Computer programming must have flow – chart listing of source programme and computer output.

TEXT BOOKS:

1. Matrix operations on computer by Bhirud L.L., Oxford IBH Pub. Co.
2. Matrix Finite Element, Computer aided structural analysis by Madhujit Mukhapadhaya, Oxford IBH Pub. Co.
3. Numerical Algorithms by Krishnamurthy E.V. and Sen S.K. Affiliated East West Press Pvt. Ltd.
4. Reinforced Concrete – Fundamental Approach by Edward G. Wavy, Prentic Hall Inc.
5. “Essentials of bridge engineering by Victor D. J.
6. IRc Codes. IS. 3370
- 7 RC designs by Punmia B. C.

D. HYDRO INFORMATICS

Mathematical modeling: Mathematical tools and techniques, partial differential equations, Numerical method, Advanced modeling applications to water resources and environmental engineering problems. (10 hrs)

Artificial Intelligence Techniques: Artificial neural networks, Genetic algorithm, Parallel processing, Fuzzy logic, Application in water resources and environmental engineering. (10 hrs)

Computer Modeling: Computational hydraulics, computer modeling in environmental engineering, Introduction to various computer packages for water resources and environmental engineering (10 hrs)

Advanced Information technology application: IT applications in water resources and environmental engineering, Web based modeling, Application of virtually reality, Internet based modeling, Multi media applications, WWW based hydro informatics systems (10 hrs)

Decision Support systems: Knowledge based systems, Computer based decision support systems. (6 hrs)

TERM WORK

Term work shall consists of assignments based on above syllabus.

Text Book

Barr, A; Cohen P. R and Feigenbau, E. A, “ Artificial Intelligence- The Handbook, Vol.5 Addison Wesley, 1989.

Dayoff, J.E., Neural Networks Architecture: An Introduction, Van Nostrand Reinhold, New York, 1990.

Abbot M. B. Hydroinformatics- information Technology and the Aquatic Environment, Avebury Technical, Aldershot, UK., 1991.

WM413 PROJECT PART-B (L-0, T-0, P-2) 2Credits

The students are expected to undertake the main component of the project work (experimental/analytical), in continuation of the Project-A carried out in Semester-I, and complete the entire work to the level of satisfaction of the respective guide.

The term work for Project-B shall consist of submission of three copies of typed and bound project report, on the work carried out by the batch of students in respect of the project assigned. There would be practical examination based on the project report submitted by the students.