

WATER RESOURCES ENGINEERING – II

Lectures / Tutorials : 4 / 1 Periods/Week

Sessional marks : 40

Semester End Exam. : 3 Hours

Semester End Exam. Marks : 60

Credits : 4

Course Objectives:

- To measure stage, velocity and discharge of a stream at a given location.
- To study functions, types and suitable locations for canal outlets, canal falls, canal regulators and canal escapes.
- To discuss different types of cross-drainage works and the criteria for selection of suitable type.
- To discuss the selection criteria for a reservoir and to determine its storage capacity by mass curve method.
- To study about reservoir sedimentation and to estimate the life of reservoir and to discuss the flood routing methods.
- To study forces on gravity dam, modes of failure of gravity dam and to analyse the stability of gravity dam.
- To discuss criteria for high and low gravity dam and to design a gravity dam.
- To study types of earth dams and to discuss causes of failure of earth dams and seepage control measures.
- To explain various types of spillways and their suitability, energy dissipation under spillways and types of spillway gates.
- To study about component parts and their function of hydel project and estimation of load factor, capacity factor, utilization factor etc.

Course Outcomes:

At the end of the course the student will be able to:

- Understand the methods for measuring stage, velocity and discharge of a stream at a given location.
- Understand the functions and suitable locations of canal outlets, canal falls and canal regulators.
- Suggest suitable type of cross drainage work based on existing levels and discharge conditions of canal and drainage.
- Suggest suitable type of aqueducts for the existing condition.
- calculate the storage capacity of a reservoir.
- Estimate the life of a reservoir based on sediment inflow.
- analyse stability of gravity dam under various conditions (including seismic forces).
- Design an earth dam based on the locally available materials and carry out stability analysis of earth dam under various conditions.
- Suggest a suitable spillway at a dam site and understand the criteria for design of stilling basin for energy dissipation under spillway.
- Understand the functions of component parts of a hydro electric power scheme and determine load, capacity, utilization factors for a hydel project.

UNIT – I

Stream Gauging

Necessity; Selection of gauging sites; Discharge measurement- Area-Velocity method; Slope-Area method; Tracer method, Electromagnetic induction method, ultrasonic method; Measurement of depth – Sounding rod, Echo-sounder; Measurement of velocity; Floats – Surface float, Sub-surface float, Velocity rod; Current meter; Measurement of stage – Staff gauge, wire gauge, water stage recorder, bubble gauge recorder; stage-discharge curve.

Canal outlets and regulation works

Types of outlets; Non-modular outlets; Semi-module outlets; Rigid modules; Canal falls; Necessity and location of falls; Development of falls; Types of falls; Canal regulators; Off-take alignment; Head regulators and cross-regulators; Canal escape (Designs not included).

Cross Drainage Works

Introduction; Types of cross - drainage works; Selection of suitable type of cross - drainage work; Classification of Aqueducts and Syphon Aqueducts.

UNIT – II

Reservoir Planning

Introduction; Investigations for reservoir planning; Selection of site for a reservoir; Zones of storage in a reservoir; Storage capacity and yield; Mass inflow curve and demand curve; Calculation of reservoir capacity for a specified yield from the mass inflow curve; Determination of safe yield from a reservoir of a given capacity; Sediment flow in streams; Reservoir sedimentation; Life of reservoir; Reservoir sediment control; Multipurpose reservoir; Flood routing; Methods of flood routing – Inflow - Storage Discharge Curves method and Trial and error method (Description only).

Dams In General

Introduction; Classification; Gravity dams, Arch dams, Buttress dams, Steel dams, Timber dams, Earth dams and rock fill dams; Physical factors governing selection of type of dam and selection of site for a dam.

UNIT – III

Gravity Dams

Introduction; Forces acting on a gravity dam; Combination of loading for design; Modes of failure and criteria for stability requirements; Stability analysis; Elementary profile of a gravity dam; Practical profile of a gravity dam; Limiting height of a gravity dam; High and low gravity dams; Design of gravity dams–single step method; Galleries; Joints; Keys and Water seals; Stability analysis of non-overflow section of gravity dam.

UNIT – IV

Earth Dams

Introduction; Types of earth dams; Causes of failure of earth dams; Criteria for safe design of earth dams; Section of an earth dam; Seepage control measures.

Spillways

Introduction; Types of spillways; Energy dissipation below spillways for relative positions of jump height curve and tail water curve; Stilling basins; Indian standards on criteria for design of hydraulic jump type stilling basins with horizontal and sloping aprons.

Water Power Engineering

Introduction; Hydropower - Advantages and disadvantages; Estimation of hydropower; Flow duration curve; Power duration curve; Load curve; Load factor; Capacity factor; Utilization factor; Diversity factor; Load duration curve; Firm Power; Secondary power; Types of hydel schemes; Forebay; Intake structures; Penstocks; Surge tank; Tail race; Turbines; Selection of suitable type of turbine.

NOTE

Two questions of 12 marks each will be given from each unit out of which one is to be answered. Twelve questions of one mark each will be given from entire syllabus which is a compulsory question.

TEXT BOOKS

1. Irrigation and Water Power Engineering by B.C. Punmia and Pande B.B. Lal; 16th Edition, Laxmi Publications, New Delhi.
2. Irrigation Engineering and Hydraulic Structure by S. K. Garg; Khanna Publishers, Delhi, 2011.

REFERENCE BOOKS

1. Irrigation, Water Resources and Waterpower Engineering by P.N. Modi, 7th Edition, Standard Book House, 2008.
2. Irrigation, Waterpower and Water Resources Engineering by K R Arora, Standard Publishers, 2010.
3. Water Power Engineering by M.M. Dandekar and K. K. Sharma; Vikas Publishing House Pvt. Ltd., 1979.