

# 16CE309 WATER RESOURCES ENGINEERING - II



Hours Per Week :

L	T	P	C
3	1	-	4

Total Hours :

L	T	P	WA/RA	SSH/HSB	CS	SA	S	BS
45	15	-	13	45	5	15	2	-

## Course Description and Objectives:

This course imparts knowledge of various cross drainage works and their design. It also gives knowledge of planning a reservoir and estimation of hydropower. The objective of course is to discuss various types of dams, their stability and design, types of spillways and their suitability.

## Course Outcomes:

The students will be able to:

- gain knowledge on design appropriate cross drainage work.
- analyze gravity and earth dams.
- plan a reservoir
- understand basic concepts of hydropower engineering
- *understand basic equipment and principles use in hydropower generation.*

## SKILLS:

- ✓ *Measure discharge and velocity of flow using various methods.*
- ✓ *Design of cross drainage works.*
- ✓ *Study about various types of dams.*
- ✓ *Perform stability analysis of gravity dams.*
- ✓ *Study about spillways and their design for given conditions.*

**UNIT - 1****L-9, T-3**

**STREAM GAUGING** : Necessity, Selection of gauging sites, Methods of discharge measurement, Area-Velocity method, Measurement of velocity – Floats, Surface floats, Sub-surface float or Double float, Twin float, Velocity rod or Rod float, Pitot tube, Currentmeter; Measurement of area of flow, Measurement of width, Pivot point method, Measurement of depth – Sounding rod, Echo-sounder.

**CROSS DRAINAGE WORKS:** Introduction, Types of cross-drainage works, Selection of suitable type of cross-drainage work, Classification of Aqueducts and Siphon Aqueducts, Selection of a suitable type.

**UNIT - 2****L-9, T-3**

**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, Reservoir sedimentation, Life of reservoir, Reservoir sediment control, Multipurpose reservoir, flood routing, Methods of flood routing -Graphical Method (Inflow – storage discharge curves method), Trial and error method.

**UNIT - 3****L-9, T-3**

**DAMS IN GENERAL:** Introduction, Classification, Gravity dams, Arch dams, Buttress dams, Earth dams and rock fill dams, Physical factors governing selection of type of dam and selection of site for a dam.

**GRAVITY DAMS:** Introduction, Forces acting on a gravity dam, 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.

**UNIT - 4****L-9, T-3**

**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, Design to suit available materials, Seepage control measures, Slope protection.

**SPILLWAYS** : Introduction, Types of spillways, Profile of ogee spillway, 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 slopping aprons, Spillway crest gates-Types and description only.

**UNIT - 5****L-9, T-3**

**WATER POWER ENGINEERING** : Introduction, Hydropower - Advantages & disadvantages, Estimation of hydro-power, 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.

**TEXT BOOKS:**

1. B. C. Punmia and Dr. Pande B.B. Lal, "Irrigation and water power Engineering", 12<sup>th</sup> edition, Laxmi Publications Pvt. Ltd., New Delhi, 1992.
2. S. K. Garg, "Irrigation Engineering and Hydraulic Structures", 23<sup>rd</sup> edition, Khanna Publishers, Delhi, 2009.

**REFERENCE BOOKS:**

1. Dr. P. N. Modi, "Irrigation, Water Resources and Water Power Engineering", 7<sup>th</sup> edition, Standard Book House, New Delhi, 2008.
2. K. Subramanya, "Engineering Hydrology", 3<sup>rd</sup> edition, Tata Mc Graw Hill, New Delhi, 2010.
3. M. M. Dandekar and K. K. Sharma, "Water Power Engineering", 4<sup>th</sup> edition, Vikas Publishing House Pvt. Ltd., New Delhi.

**ACTIVITIES:**

- Prepare a model of any one cross-drainage structure.
- To determine the capacity of a reservoir.
- Prepare a model of a dam.
- Prepare a model of a spillway.
- Prepare a model of dam along with a power house.