WATER RESOURCES ENGINEERING-1

Course Code: 20CE1118

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Pre-requisites: Fluid Mechanics

Course Outcomes:

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

CO1: Describe the various hydrological parameters and interpreted the useful information (L3)
CO2: Apply hydrograph analysis for estimating peak runoff from a catchment (L3)
CO3: Estimate the peak floods and solve hydrologic flood routing models (L3)
CO4: Assess the aquifer properties and compute the yield from a well (L3)
CO5: Compute the quantity of water required for different crops (L3)

UNIT-I **(10 Lectures)**

INTRODUCTION TO HYDROLOGY:

Introduction to Engineering hydrology and its applications, Hydrologic cycle, types and forms of precipitation, rainfall measurement, types of raingauges, optimum number of raingauges - computation of average rainfall over a basin, processing of rainfall data and estimation of missing precipitation data. Abstraction from rainfall-evaporation, factors affecting evaporation, measurement of evaporation – evapo-transpiration - Infiltration, factors affecting infiltration, measurement of infiltration, infiltration indices.

Learning outcomes:

At the end of the unit, the student will be able to

1. explain the various stages of hydrologic cycle and their influencing factors (L2)
2. compute the average precipitation of the river basin (L3)
3. analyse the useful information from the hydrological data (L3)

UNIT-II **(10 Lectures)**

DESCRIPTIVE HYDROLOGY AND HYDROGRAPH ANALYSIS:

Runoff-components of runoff, factors affecting runoff, Stream gauging: Necessity, selection of gauging sites, methods of measurement of discharge, Hydrograph analysis - base flow separation, effective rainfall, Unit Hydrograph- definition, limitations and applications, derivation of Unit Hydrograph, S-hydrograph, IUH, Synthetic Unit Hydrograph.

Learning outcomes:

At the end of the unit, the student will be able to

1. explain the factors affecting runoff (L2)
2. describe the gauging methods to measure stream discharge (L2)
3. apply the hydrograph concept to develop unit hydrograph of a catchment (L3)

UNIT-III **(10 Lectures)**

ESTIMATION OF FLOOD DISCHARGE:

Estimation of peak discharge, rational method, NRCS method, design flood, return period, flood frequency analysis, Gumbel’s and log Pearson Type III methods.

FLOOD ROUTING:

Basic concepts of flood routing, hydraulic and hydrologic routing, channel and reservoir routing, Muskingum method of channel routing.

Learning outcomes:
At the end of the unit, the student will be able to
1. compute the peak discharge using traditional and probabilistic methods (L3)
2. explain the concept of flood routing (L2)
3. estimate the flood peak at downstream using Muskingum method (L2)

UNIT-IV **(10 Lectures)**

GROUNDWATER:

Groundwater - Occurrence, types of aquifers, aquifer parameters porosity, specific yield, permeability, transmissivity and storage coefficient, types of wells, Darcy's law, radial flow to wells in confined and unconfined aquifers.

Learning outcomes:
At the end of the unit, the student will be able to
1. describe the aquifer properties influencing the groundwater flow (L2)
2. compute the radial discharge from a single well in both confined and unconfined aquifers (L3)
3. explain the Drarcy's law (L2)

UNIT-V **(10 Lectures)**

IRRIGATION AND WATER REQUIREMENT OF CROPS:

Necessity and Importance of Irrigation, advantages and ill-effects of Irrigation, types of Irrigation, methods of application of Irrigation water, Indian agricultural soils, methods of improving soil fertility, preparation of land for Irrigation, standards of quality for Irrigation water.
Soil-water-plant relationship, vertical distribution of soil moisture, soil moisture constants, soil moisture tension, consumptive use, Crop seasons in India, Duty and delta, factors affecting duty, depth and frequency of Irrigation, irrigation efficiencies, determination of irrigation requirements of crops.

Learning outcomes:
At the end of the unit, the student will be able to
1. explain the necessity and importance of irrigation (L2)
2. describe the various moisture constants available for crop growth (L2)
3. compute the crop water requirement for irrigation (L3)

Text Books:

1. Jayaram Reddy, "Engineering Hydrology", 2nd Edition, Laxmi Publications Pvt. Ltd., New Delhi reprint 2008.
2. B.C.Punmia, B.B.L. Pande, Ashok K.R. Jain, Arun K.R. Jain, "Irrigation & Water Power Engineering", 16th Edition, Laxmi Publications (P) Ltd., New Delhi, 2009.
3. K Subramanya, "Engineering Hydrology", Tata McGraw- Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2008.

References:

1. V.P.Singh, "Elementary Hydrology", 2nd Edition, PHI Publications, Prentice Hall of India, 1992.
2. P.N.Modi, "Irrigation, Water Resources & Water Power Engineering", 2nd Edition, Standard Book House, Rajsons Publications Pvt. Ltd., 2008.
3. D.K.Majumdar, "Irrigation Water Management", 3rd Edition, Prentice Hall of India, 2004.
4. K.R.Arora, "Irrigation, Water Power and Water Resources Engineering", 3rd Edition, Standard Publishers Distributors.
5. R.K.Sharma and T.K. Sharma, "Hydrology and Water Resources Engineering", 5th Edition, Dhanapati Rai Publications, 2000.
6. S.K Garg, "Irrigation Engineering and Hydraulic Structures", 24th Edition, Khanna publishers, 2012.