Approval: 9th Senate Meeting

Course Number: CE 303

Course Name: Water Resources Engineering

Credits: 3-0-0-3

Prerequisites: CE 251 - Hydraulics Engineering

Intended for: UG/PG

Distribution: Discipline Core

Semester: Even/Odd

Preamble: This course is an advance course of civil engineering which will cover the aspects of hydrology and surface water, watershed management and other hydraulic engineering concepts. This course will unveil the concepts to more advanced level. The effect of hydrological cycle to runoff generation, calculation of runoff and estimation in a catchment. The subject will also provide the learning opportunity to the students to understand the floods and water shed management in hilly terrain. Students will also understand the concept of groundwater flow and transport problems. Learning outcomes of this course are anticipated as follows:

- Students will understand the basics of hydrology, meteorology, rainfall-runoff calculations and factors affecting the rainfall and runoff relation.
- Students will learn the concepts of storm hydrology, s- curve and depth area duration curves for estimation of rainfall over a catchment area
- Students will develop the skills to analyze the floods, flood routing systems flood forecasting, return period of any flood and probability analysis.
- This subject will help students to analyze the complex mountainous hydrology system and to manage watershed development program.

Course Outline:

- Hydraulic engineering course has flowing outline
- Students will be given tutorials to develop numerical solutions in any of the programming language (FORTRAN, C, C++ or MATLAB)

Modules:

1 Introduction: Hydrology, Open channel flow, Groundwater flow. **(6 contact hours)**

2 Descriptive Hydrology: Hydrology, Meteorology, Rainfall measurements, Runoff, Stream flow, Hydrographs, Factors affecting runoff and its calculation pertaining to Himalayan terrain, Infiltration. **(8 contact hours)**

3 Storm Hydrology: Hydrographs, unit hydrograph theory, S-curve, Mass and flow duration

curve, depth area duration curve, runoff estimation. **(8 contact hours)**

4 Floods: Flood estimation, Forecasting systems, Flash flood studies, Hydrologic and reservoir routing, Return period and Probability analysis. **(8 contact hours)**

5 Watershed Management in Hilly region: introduction and management **(4 contact hours)**

6 Introduction to ground water systems: Types of Aquifer and characteristics, Application of Darcy Law, Groundwater flow equations, well hydraulics. **(6 contact hours)**

Text Books:

a) K. Subramaniya, 'Engineering Hydrology', Tata MacGraw Hill, New Delhi, 2013.
b) H.M. Raghunath, 'Hydrology – Principles, Analysis and Design', Wiley Eastern Ltd., 2006.
c) D.K. Todd, 'Groundwater Hydrology', John Wiley & Sons, 2006.
d) V.T. Chow, D.R. Maidment, and L.W. Mays, 'Applied Hydrology', McGraw Hill, 1988.

Reference Books:

a) R.K. Linsley, J. B. Franzini, D. L. Freyberg and G. Tchobanoglous, 'Water Resource Engineering 4th Edn.', McGraw Hill Book Co., 1992.
b) V.P. Singh, 'Elementary Hydrology', Prentice Hall, 1993.
c) S.K. Garg, 'Irrigation Engineering and Hydraulic Structures', Khanna Publishers, 1992.