Approved in
9th senate
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IIT Mandi
Proposal for a Course Content Change

Course number	: CE303
Course Name	: Water Resources Engineering
Credit Distribution	: 3-0-0-3
Intended for	: B.Tech. (Civil Engineering)
Prerequisite	: CE251-Hydraulic Engineering
Mutual Exclusion	: None

1. 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 floods, flood routing systems flood forecasting, return period of any flood, and probability analysis.

2. Course Modules with quantitative lecture hours:

Module I: Introduction Hydrological Cycle, Water budget equation, Reynold Transport Theory, Principle of mass, momentum, and energy balance in Hydrology	6 Hours
Module II: Precipitation Atmospheric Circulation, Water vapor, Precipitation measurement, rain gauge network, Mean Precipitation, Maximum Intensity/Depth Duration Curve, Rainfall patterns in India and Himachal Pradesh	8 Hours
Module III: Abstractions from Precipitation	6 Hours

Evaporation and its estimation, Evapotranspiration, Estimation of Evapotranspiration, Potential Evapotranspiration, Interception, Infiltration	
Module IV: Hydrometry Measurement of Stage, Velocity, Area Velocity Method, Dilution Technique, Electromagnetic method, Ultrasonic Method, Indirect method, Rating Curve	6 Hours
Module V: Storm Hydrology Hydrographs, unit hydrograph theory, S-curve, Mass and flow duration curve, depth area duration curve, runoff estimation.	8 Hours
Module VI: Floods and Droughts Flood estimation, Frequency analysis, Risk and Reliability, Hydrologic and Hydraulic routing, Clark's and Nash's model	6 Hours
Module VI: Groundwater Hydrology Types of Aquifer and characteristics, Application of Darcy Law, Groundwater flow equations, well hydraulics.	2 Hours

3. **Text books:**
   1. K. Subramaniya, 'Engineering Hydrology', Tata MacGraw Hill, New Delhi, 2013.
   2. V.T. Chow, D.R. Maidment, and L.W. Mays, 'Applied Hydrology', McGraw Hill, 1988.

4. **References:**
   1. H.M. Raghunath, 'Hydrology – Principles, Analysis and Design', Wiley Eastern Ltd., 2006.
   2. V.P. Singh, 'Elementary Hydrology', Prentice Hall, 1993.
   3. R.K. Linsley, J. B. Franzini, D. L. Freyberg and G. Tchobanoglous, 'Water Resource Engineering 4th Edn.', McGraw Hill Book Co., 1992.

5. **Similarity with the existing courses:**
   (Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Code	Similarity Content	Approx. % of Content

6. **Justification of new course proposal if cumulative similarity content is >30%:**
Approvals: