INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Civil Engineering

Subject Code: CEC-531 **Course Title:** Advanced Hydrology

L-T-P: 3-0-0 **Credits:** 03 **Subject Area:** PCC

Course outline: Introduction to the hydrological systems; hydrologic inputs and abstractions; stream flow; space-time characteristics of various input and abstraction variables; introduction to the systems approach; mathematical models in surface hydrology; hydrological and hydraulic routing methods; fundamental and advanced methods of frequency analysis and design floods.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Civil Engineering

Subject Code: CEC-533 **Course Title:** Advanced Fluid Mechanics

L-T-P: 3-0-2 **Credits:** 04 **Subject Area:** PCC

Course outline: Introduction to the equation of continuity in various coordinate systems; Standard 2D Flow Patterns; Laplace Equation and its solution by different methods; Laminar Flow; Navier-Stokes equations; Boundary Layers, similarity solutions; Turbulent Flow and its measurements of turbulence; Statistical Theory of Turbulence.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Civil Engineering

Subject Code: CEC-535 **Course Title:** Free Surface Flows

L-T-P: 3-0-0 **Credits:** 03 **Subject Area:** PCC

Course outline: Introduction to the concepts of free surface flow, governing equation and computation of gradually varied flows, hydraulic jump in a variety of situations; Supercritical Flows; Spatially Varied Flows; De Marchi equations; Aerated Flows; Stratified Flow and its modelling; Unsteady Flows; St. Venant's equations; Various Channel Transitions, applications free surface flow in flood control; design of drainage and waterways.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Civil Engineering

Subject Code: CEC-537 **Course Title:** Modelling, Simulation and Optimization

L-T-P: 3-0-0 **Credits:** 03 **Subject Area:** PCC

Course outline: Introduction to Systematic Approach; Classification of Models; Linear, non-linear and time-(in)variant, models; Linear and Multiple Regression analysis, the concept of random variables, marginal and bivariate distributions, commonly used Probability Distributions; Frequency Analysis; Goodness of fit tests; Return level Estimation; Time Series Analysis and different smoothening and filtering techniques; Spatial Distributions; Bayesian Inference; Monte Carlo simulation; Bootstrap Techniques; Basics of optimization.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Civil Engineering

Subject Code: CEC-539 **Course Title:** Ground Water Engineering

L-T-P: 3-0-0 **Credits:** 03 **Subject Area:** PCC

Course outline: Introduction to the fundamentals of groundwater hydrology; Governing Equations for Groundwater Flow; Wells and Well Hydraulics; Groundwater budget and resources assessment; Groundwater quality aspects including contamination source, remedies and preventive measures; Groundwater Flow Modelling; Hele-Shaw and analog models; Planning of Groundwater Development.