Name of the Faculty: Prof. Rashid Mustafa
Discipline: Civil Engineering (5th Semester)
College: Katihar Engineering College
Subject: Hydraulic Engineering (CE 302)
Course Credit: 3 (2-0-2)

Course Objective	To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic machines. At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering
Subject Synopsis/ Indicative Syllabus	**Module 1**: Boundary Layer Analysis-Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control. **Module 2:** Introduction to Open Channel Flow-Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section. **Module 3:** Uniform Flow-Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient "n" .Most economical section of channel. Computation of Uniform flow, Normal depth. **Module 4:** Non-Uniform Flow- Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions. Measurement of Discharge and Velocity – Venturi Flume, Standing Wave Flume, Parshall Flume, Broad Crested Weir. Measurement of Velocity- Current meter, Floats, Hot-wire anemometer. Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Computation of water surface profile by graphical, numerical and analytical approaches. Direct Step method, Graphical Integration method and Direct integration method. **Module 5:**Hydraulic Jump- Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types,applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges. **Module 6:** Computational Fluid Dynamics: Basic equations of fluid dynamics, Grid generation, Introduction to in viscid incompressible flow, Boundary layer flow as applicable to C.F.D. Hydro informatics: Concept of hydro informatics –scope of internet and web based modeling in water resources engineering.
Gate Syllabus of Hydraulics and Open Channel flow	Concept of boundary layer and its growth, Flow measurement in channels, Channel Hydraulics: Energy-depth relationships, specific energy, critical flow, slope profile, hydraulic jump, uniform flow and gradually varied flow
Reading List and References	**Recommended Text** Flow in Open Channel flow by K. Subramanya. A Textbook of Fluid Mechanics and Hydraulic Machines by Dr. R.K Bansal.

	Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House **References** Chow V.T. "Open Channel Hydraulics". McGraw Hill International, New York, 1959. Seth.et.al (1960), "Hydraulics and Fluid Mechanics Including Hydraulics Machines". Standard Book House, 1960. Schlichting H. "Boundary Layer Theory". 7th Edition, McGraw Hill Book Co., New York, 1979