OPEN CHANNEL, FLOW AND NUMERICAL HYDRAULICS

Paper Code: ETCE-308	**L**	**T/P**	**C**
Paper: Open Channel, Flow and Numerical Hydraulics	**3**	**1**	**4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

Objective*: To introduce the concepts of channel hydraulics. The contents of the course are applicable in design of inland waterways needed for irrigation, navigation etc., the course also deals with finite volume approach for convection, diffusion and transport problems.*

UNIT I

Flow in open channels: Type of channels, classification of flows, continuity energy and momentum equation, concept of critical depth and specific energy, critical depth for rectangular, triangular, circular and trapezoidal channels, flow through transition with a hump and with change in width (contraction and expansion).

Uniform flow: Chezy's equation, Manning's formula, Factors affecting Manning's roughness coefficient, velocity distribution, shear stress distribution, Uniform flow computations for rectangular, trapezoidal and circular channels, standard line canal channels, Hydraulically efficient channel sections, compound sections, Critical slope and limit slope, Design of irrigation canals.

[T1,R1][No. of Hours: 12]

UNIT II

Gradually Varied Flow: Classification of flow profiles, M, S, C, H and A profiles, control sections, serial combination of channel sections, Transitional depth, numerical solution of gradually varied flow problems.

Hydraulic jump: Hydraulic jump in rectangular channel: sequent depth ratio, Energy loss; Classification of jumps, characteristics of jumps in rectangular channels, use of jump as an energy dissipater.

[T2,R1] [No. of Hours: 11]

UNIT III

Sediment Transport : Hydraulics of mobile bed channels, sediment load, bed load, suspended load, Design of stable channels carrying clear water using Critical Tractive Force Approach, Regime channels, Kennedy equation and Lacey's equations, Lining of irrigation canals, Design of lined irrigation canals.

[T2,R3] [No. of Hours: 11]

UNIT IV

The finite volume Method for Diffusion Problems: Introduction, one-dimensional steady state diffusion, two-dimentional diffusion problems, discritised equations for diffusion problems.

The Finite volume Method for Convection-Diffusion Problems: Steady one-dimensional convection and diffusion, The central differencing scheme.

Basic mechanisms for mixing: Laminar and turbulent diffusion, Dispersion and advection. Mixing in rivers, lakes and coastal waters.

The general transport (advection-diffusion) equation: Formulation and special cases, Transport processes and spreading of pollutant. Balance equations for water and pollutants in surface water systems.

[T1,T2][No. of Hours: 11]

Text Books:

[T1] K. Subramanya, "Flow in Open Channels", Tata McGraw Hill

[T2] G.L. Aswa, "Fluid flow in pipes and Open Channel", CBS Publication

References:

[R1] Chow, V.T., "Open Channel Hydraulics", McGraw Hill Book Company 1959

[R2] Asawa, G.L., "Flow of Fluids in Pipes and Channels", CBS Publishers, New Delhi 2007

[R3] H. K. Versteeg and W. Malalasekera, "An Introduction To Computational Fluid Dynamics: The Finite Volume Method", Longman scientific and technical publishers.

[R4] John D. Anderson, "Computational Fluid Dynamics: The Basics with an Applications", McGraw- Hill,

[R5] Vivek V. Ranade, Computational Flow Modeling For Chemical Reactor Engineering, Academic Press, San Diego.