

Advanced Hydraulics - Web course

COURSE OUTLINE

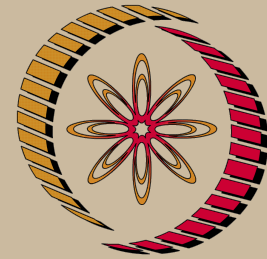
This course introduces the fundamental concepts, advanced principles and application of hydraulic analysis and design to the undergraduate students of civil engineering.

Contents:

Types of open channel flow , resistance relationships in open channel flow, use of momentum principle in open channel flow, concept of specific energy and specific force, velocity measurement, flow profiles, draw down and back water curves, hydraulic jumps, basic characteristics of jump, energy dissipation due to jumps, flow through culverts and bridge piers, types of turbines and pumps, operating characteristic curves, cavitation.

COURSE DETAIL

Sl. No.	Topic	No. of Hours
1	Open Channel Flow: <ul style="list-style-type: none"> • Kinds of open channel flow, channel geometry, types and regimes of flow, • Velocity distribution in open channel, wide open channel, specific energy, critical flow and its computation, • Energy in non-prismatic channel, momentum in open channel flow, specific force. 	7
2	Uniform Flow:	8



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<http://nptel.ac.in>

Civil Engineering

Pre-requisites:

1. Fluid Mechanics.

Additional Reading:

1. Literature on Advanced Hydraulics.

Coordinators:

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	<ul style="list-style-type: none"> • Qualification of uniform flow, velocity measurement, Mannings and Chezy's formula, • Determination of roughness coefficients, determination of normal depth and velocity, • Most economical sections, non-erodible channels, flow in a channel section with composite roughness, flow in close conduit with open channel flow. 		
3	Varied Flow: <ul style="list-style-type: none"> • Dynamic equations of gradually varied flow, assumptions and characteristics of flow profiles, • Classification of flow profile, draw down and back water curves, profile determination, graphical integration, direct step and standard step method, • Numerical methods, flow through transitions, dynamic equation of spatially varied flow, analysis of spatially varied flow profile, computation of spatially varied flow using numerical integration. 	9	
4	Hydraulic Jumps: <ul style="list-style-type: none"> • Hydraulic jump, types of jump, basic characteristics of jump, length and location of jump, jump as energy dissipation, control of jump, surges, surge channel transitions. 	7	
5	Flow Through Non-Prismatic Channel Section: <ul style="list-style-type: none"> • Sudden transition, sub-critical flow through sudden transition, flow through culverts, flow through bridge piers, obstructions, channel junction. 	5	
6	Pumps and Turbines:	9	

- Application of momentum principle, impact of jets on plane and curved plates,
- Turbines, classification, radial flow turbines, axial flow turbines, impulse and reaction turbines,
- Draft tube and cavitations, performance of turbines, similarity laws, centrifugal pump, minimum speed to start the pump, multistage pumps, jet and submersible pumps,
- Positive displacement pumps, reciprocating pump, negative slip, flow separation conditions, air vessels, indicator diagram and its variation, savings in work done, rotary pumps.

References:

1. C.S.P. OJha, R. Berndtsson, and P.N. Chadramouli, "Engineering Fluid Mechanics" Oxford University Press, Dec. 2009.
2. P.N. Chanrdamouli, C.S.P.Ojha and K.M.Singh, "Hydraulic Machines" Oxford University Press, June 2010.
3. K Subramanya, "Flow through open channels" Tata McGraw Hill.