

Advanced Hydraulics - Video course

COURSE OUTLINE

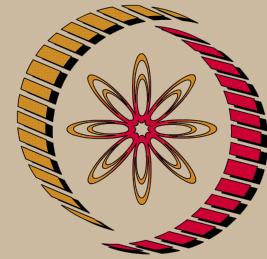
This course on "Advanced Hydraulics" describes the flows and properties in open channels. A total of 41 lectures are devised for this course. After attending this course, a student will be able to describe the various types of flows in open channels, the velocity distribution across and along the channel, hydraulic jumps, and turbines and pumps.

The student will be able to design the channel sections and drains, jumps, and pumps for various hydraulic and hydrologic projects.

Contents: Introduction to kinds of open channel flows and properties like specific energy, force, etc. – Uniform flow – Gradually varied flow – Rapidly varied flow – Hydraulic Jumps – Flow through non-prismatic channel sections like bridges, piers, etc. – Turbines and Pumps

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. 	9



NP-TEL

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Civil Engineering

Pre-requisites:

1. Fluid Mechanics (Civil Engineering).

Additional Reading:

- Any fluid mechanics literature on Pumps and Turbines

Coordinators:

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2	<p>Uniform Flow:</p> <ul style="list-style-type: none"> • Qualification of uniform flow, velocity measurement, Manning's 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. 	8	
3	<p>Varied Flow:</p> <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. 	11	
4	<p>Hydraulic Jumps:</p> <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. 	8	
5	<p>Flow Through Non-Prismatic Channel Section:</p> <ul style="list-style-type: none"> • Sudden transition, sub-critical flow through sudden transition, flow through culverts, flow through bridge piers, obstructions, channel junction. 	3	
6	<p>Turbines:</p>	4	

- 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, centrifugal pump, minimum speed to start the pump
- Multistage pumps, jet and submersible pumps, positive displacement pumps, reciprocating pump, negative slip, flow separation conditions

References:

1. V.T. Chow: "Open-channel hydraulics." McGraw Hill Publications (1959,1973)
2. Rajesh Srivastava: "Flow through open channels". Oxford University Press (2008)
3. K. Subramanya: "Flow in open channels". Tata McGraw Hill (1997)
4. H. Chaudhury: "Open channel flow". Second Edition. Springer (2008)