

HWRM-310 OPEN CHANNEL HYDRAULICS

(03 Credit hours)

PRE-REQUISITE: HWRM-204

LEARNING OUTCOMES

Following are the learning outcomes of the course:

- Students will learn Fluid Flow Mechanism
- Student will be trained about energy and momentum equations
- Student will learn applications of momentum and energy equations
- Student will be trained about uniform flow in open channel
- Student will learn about of non-uniform flow in open channel

CONTENTS

This course provides deep learning of open channel flows and its governing principles.

Unit-1 Fluid Flow Mechanism

- 1.1. Basic Concepts of Fluid Flow
- 1.2. Types, state and regimes of fluid flow,
- 1.3. Channel flow types
- 1.4. Channel geometry
- 1.5. Measurement of velocity in channel
- 1.6. Velocity distribution in channel and its coefficients
- 1.7. Pressure distribution in channel
- 1.8. Effect of slope on pressure distribution.

Unit-II Energy and Momentum Equations

- 2.1. Energy equation
- 2.2. Momentum Principle: Basic equations,
- 2.3. Specific energy
- 2.4. Specific energy and alternate depths
- 2.5. E-Y relationship
- 2.6. Criteria for a critical state of flow
- 2.7. Computation of critical flow,
- 2.8. Fluid flow Control

Unit-III: Applications of Momentum and Energy Equations

- 3.1. Application of flow control in rectangular channel,
- 3.2. Momentum in open channel flow
- 3.3. Specific momentum
- 3.4. Hydraulic jump
- 3.5. M-Y relationship

Unit-IV: Uniform Flow in Open Channel

- 4.1. Establishment of uniform flow
- 4.2. The Chezy's equation

- 4.3. Manning's equations
- 4.4. Resistance coefficient estimation
- 4.5. Normal depth and velocity
- 4.6. Normal and critical slopes
- 4.7. Free board and its estimation
- 4.8. Analysis of hydraulic section
- 4.9. Determination of section dimensions

Unit-V: Non Uniform Flow in Open Channel

- 5.1. Rapidly Varied Flow
- 5.2. Characteristics of varied flow
- 5.3. Sharp crested weir
- 5.4. Aeration of the nappe crest shape
- 5.5. Discharge over spillway
- 5.6. Type and characteristics of the hydraulic jump
- 5.7. Jump as energy dissipater
- 5.8. Flow through sudden transitions

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.

3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.
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RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Kay, M. (2008). *Practical Hydraulics*. Taylor & Francis, Abingdon, UK.
2. Douglas, J. F J. M. Gasiorek, J. A. Swaffield and Jack. L. B. (2005). *Fluid Mechanics*. Pearson Education Limited, Edinburgh, UK.
3. Khurmi, R.S. (2012). *Textbook of Hydraulics and Fluid Mechanics*. Chand & Co Ltd., India
4. Subramanya, K. (2008). *Flow in Open Channels*. Tata McGraw-Hill.
5. Akan, A. O. (2006). *Open Channel Hydraulics*. Butterworth-Heinemann, Burlington, MA, USA.
6. Chaudhry, M.H. (2008) *Open Channel Flow* (Second Edition). Springer Science Business Media, LLC.
7. Sturm, (2001), *Open-Channel Hydraulics*, McGraw Hill