

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

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Course Code

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Fourth Semester B.E. Degree Examinations, July 2026

FLUID MECHANICS AND HYDRAULICS

Duration: 3 hrs

Max. Marks: 100

Note: 1. Answer any FIVE full questions choosing ONE full Question from each Module.
2. Missing data, if any, may be suitably assumed

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO: PI)</u>
<u>MODULE – 1</u>			
1.	a. Define fluid and briefly explain different types of fluid.	04	(1 :1: 1.3.1)
	b. Define surface tension with units.	08	(2 :1: 1.3.1)
	c. Derive expression for hydrostatic law.	08	(3 :1: 1.4.1)
(OR)			
2.	a. With neat sketches, explain the types of simple manometers.	06	(2 :1: 1.4.1)
	b. Derive an expression for total pressure and center of pressure on inclined plane of surface.	08	(3 :1: 1.4.1)
	c. Calculate the pressure due to a column of 0.4 m of : (i)Water (ii) An oil of specific gravity 0.9 (iii) Hg of specific gravity 13.6 Given the density of water equal to 1000 kg/m ³ .	06	(3 :1: 1.4.1)
<u>MODULE – 2</u>			
3.	a. Explain different types of fluid flow in pipe flow.	08	(2 :2: 1.3.1)
	b. Derive an expression for the continuity equation in 3D Cartesian coordinates for fluid flow.	12	(3 :2: 1.4.1)
(OR)			
4.	a. Derive Bernoulli's equation for total energy in fluid flow.	08	(2 :2: 1.3.1)
	b. Derive an expression for discharge in an orifice meter.	06	(3 :2: 1.4.1)
	c. An oil of specific gravity 0.8 is flowing through a venturimeter having an inlet diameter 20 cm and a throat diameter of 10 cm. The oil-Hg differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take C_d equal to 0.98.	06	(3 :2: 1.4.1)
<u>MODULE – 3</u>			
5.	a. Define orifices and classify different types of orifices.	06	(1 :3: 1.3.1)
	b. Derive an expression for discharge over a triangular notch.	08	(3 :3: 1.4.1)
	c. Water flows over a rectangular notch 0.6 m wide at a depth of 170 mm and afterwards passes through a triangular right angled notch. Taking C_d for rectangular and triangular notches as 0.62 and 0.59, respectively. Find the depth of the triangular notch.	06	(3 :3: 1.4.1)

(OR)

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| 6. | a. | Write a note on losses in the pipe. | 06 | (1 :3: 1.3.1) |
| | b. | Derive Darcy's Weisbach equation for head loss due to friction. | 08 | (3 :3: 1.4.1) |
| | c. | Find the head loss due to friction in a pipe of diameter 350 mm and length 600 m through which water is flowing at a velocity of 2.5 m/sec. Take kinematic viscosity =0.01stokes. Use Darcy's Weisbach and Reynolds' Number equation. | 06 | (3 :3: 1.4.1) |

MODULE – 4

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| 7. | a. | Explain the following types of flow in open channels:
(i) Uniform and Non-Uniform
(ii) Sub -critical and Super-critical flow
(iii) Laminar and Turbulent flow | 06 | (2 :4: 1.3.1) |
| | b. | Show that for the most economical rectangle section (i) Depth of flow is equal to half the width (ii) Hydraulic mean depth is equal to half the depth of flow. | 07 | (3 :4: 1.4.1) |
| | c. | A trapezoidal channel has side slopes of 1 horizontal to 2 vertical, and the side slope of the bed is 1 in 1800. The area of the cross-section is 38 m ² . Find the dimensions of the section if it is most economical. Also find the discharge of this most economical section if C = 55. | 07 | (3 :4: 1.4.1) |

(OR)

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| 8. | a. | Derive expressions for critical depth and critical velocity. | 06 | (2 :4: 1.3.1) |
| | b. | A 2.5 m wide rectangular channel carries 2.8 m ³ /s discharge at a depth of 0.6 m. Determine (i) Specific Energy at 0.6 m depth (ii) Critical depth (iii) Critical velocity. | 07 | (3 :4: 1.4.1) |
| | c. | Define Gradually Varied Flow (GVF). Derive an expression for GVF in an open channel flow. | 07 | (3 :4: 1.4.1) |

MODULE – 5

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| 9. | a. | List the differences between the Pelton wheel turbine and the Francis turbine. | 08 | (2 :5: 1.3.1) |
| | b. | With a neat sketch, explain the concepts of velocity triangles. | 06 | (3 :5: 1.4.1) |
| | c. | A jet of water of diameter 75 mm moving with a velocity of 30 m/s, strikes a curved fixed plate tangentially at one end at an angle of 30° to the horizontal. The jet leaves the plate at an angle of 20° to the horizontal. Find the force exerted by the jet on the plate in the horizontal and vertical directions. | 06 | (3 :5: 1.4.1) |

(OR)

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| 10. | a. | Explain with neat sketches working principle of multistage centrifugal pumps for (i) High Heads (ii) High Discharge | 12 | (2 :5: 1.3.1) |
| | b. | With neat sketch explain different components of centrifugal pump. | 08 | (3 :5: 1.4.1) |

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