

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURUJADA VIZINAGARAM
II B. Tech II Semester Regular Examinations April -2025
HYDRAULICS & HYDRAULIC MACHINERY
(DEPARTMENT OF CE)

Time: 3 hours

Max. Marks: 70

The Question paper consists of Part A & Part B.

Part A is compulsory, Answer all questions. Part B Answers any one question from each unit.

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| 1 | PART-A | (20Marks) |
| | a) What is <i>no slip</i> condition? Define boundary layer | [2] |
| | b) Define Prandtl mixing length. | [2] |
| | c) What Moody diagram? And what is its use? | [2] |
| | d) Define uniform and non-uniform flow and steady and unsteady flow in open channel | [2] |
| | e) What are the applications of hydraulic jump | [2] |
| | f) Define subcritical, critical and super critical flows in open channels | [2] |
| | g) Draw inlet and outlet velocity triangle of Pelton wheel turbine | [2] |
| | h) What is draft tube and its functions | [2] |
| | i) Define Net Positive Suction Head (NPSH) | [2] |
| | j) What is priming in a centrifugal pump? | [2] |
| | PART-B | (50Marks) |
| | Question from Unit - I | |
| 2 | a) Derive a relationship between Coefficient of drag (C_D) and Reynolds number for laminar flow around a sphere. | [5] |
| | b) Two parallel plates kept 70mm apart have laminar flow of oil between them with a maximum velocity of 1.2 m/s. Calculate (i) discharge per meter width (ii) shear stress at the plates. | [5] |
| | (OR) | |
| 3 | a) Derive a relation between average velocity and maximum velocity for a steady laminar flow between two fixed parallel plates. | [5] |
| | b) Oil of viscosity 0.1 Pa.s and specific gravity 0.90, flows through a horizontal pipe of 25 mm diameter. If the pressure drop per meter length of the pipe is 12 kPa, determine (i) rate of flow in N/min (ii) the shear stress at the pipe wall. | [5] |
| | Question from Unit - II | |
| 4 | a) Write any five differences between open channel flow and pipe flow. | [5] |
| | b) Define most economical channel section. Show that the half of the top width is equal to one of the sloping sides of trapezoidal channel section. | [5] |
| | (OR) | |
| 5 | a) Discuss with neat diagram the general pattern of velocity distribution in different types of open channels. | [5] |
| | b) Water flows at uniform depth of 1.5m in a trapezoidal channel having a bottom width of 4m and side slopes 2 horizontal to 1 vertical. If it has to carry a discharge of 40 m ³ /s, compute the bottom slope to be provided. Assume Manning's n as 0.025. | [5] |
| | Question from Unit - III | |
| 6 | a) Differentiate between Gradually Varied flow (GVF) and Rapidly Varied Flow (RVF) with practical examples. | [5] |
| | b) Discuss different types channel bottom slopes with neat diagrams. | [5] |
| | (OR) | |
| 7 | a) What is specific energy curve? Draw specific energy curve and explain the critical depth and conjugate depths. | [5] |

- b) A horizontal rectangular channel 3m wide carries a discharge of $12\text{m}^3/\text{s}$. Determine whether a hydraulic jump may occur at an initial depth of 0.4m or not. If a jump occurs, determine the sequent depth to this initial depth. Also determine the energy loss in the jump. [5]

Question from Unit - IV

- 8 a) Show that the efficiency of a free jet striking normally on series of flat plates mounted on the periphery of a wheel does not exceed 50%. [5]
- b) A jet of water 50mm diameter having a velocity of 10 m/s, strikes normally a flat smooth plate. Determine the thrust on the plate (i) if the plate is at rest (ii) if the plate is moving in the same direction as the jet with a velocity of 3 m/s. [5]

(OR)

- 9 a) Differentiate between Impulse turbine and Reaction turbine [5]
- b) A Pelton wheel produces 1500 HP under a gross head of 210m. If the nozzle diameter is 0.1m and the Losses in pipeline are 10% of head. Assume coefficient of velocity C_v is 0.98, find the discharge and overall efficiency [5]

Question from Unit - V

- 10 a) With neat diagram explain the components parts of centrifugal pump and their uses. [5]
- b) Explain briefly minimum starting speed of centrifugal pump [5]

(OR)

- 11 a) Discuss briefly pumps in series and pumps in parallel [5]
- b) A centrifugal pump has outer diameter of impeller has 800mm diameter and width of impeller vanes at outlet is 100mm, angle of impeller vanes at outlet is 40° . The impeller runs at 550 rpm and delivers $0.9\text{ m}^3/\text{s}$ under an effective head of 30m. A 500kW motor is used to drive the pump. Determine the manometric, mechanical and overall efficiency of the pump. Assume water enters the impeller vanes radially at inlet. [5]
