

**R16****Code No: 134BC****JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B.Tech II Year II Semester Examinations, May - 2019****FLUID MECHANICS AND HYDRAULIC MACHINES****(Common to ME, MSNT)****Time: 3 Hours****Max. Marks: 75****Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b as sub questions.

**PART – A****(25 Marks)**

- 1.a) Name the phenomenon of capillarity. [2]
- b) How the pressure can be measured by a manometer. [3]
- c) Name the different forces present in a fluid flow. For the Euler's equation of motion, which forces are taken into consideration? [2]
- d) Explain the working principle of Orifice meter. [3]
- e) Define boundary layer and boundary layer thickness. [2]
- f) Define Hydraulic gradient line and Total energy line. [3]
- g) Mention the causes of cavitation in Francis turbine. [2]
- h) How governing of speed is done on Pelton wheel? [3]
- i) How the centrifugal pumps are classified? [2]
- j) Define Slip, percentage slip and negative slip in of a reciprocating pump. [3]

**PART – B****(50 Marks)**

2. Differentiate between:
  - a) Absolute pressure and gauge pressure
  - b) Piezometer and simple manometer
  - c) U-tube differential manometer and inverted U-tube differential manometer. [10]
- OR**
3. Define viscosity. A plate having an area of  $0.7 \text{ m}^2$  is sliding down the inclined plane at  $45^\circ$  to the horizontal with a velocity of  $0.45 \text{ m/s}$ . there is a cushion of fluid  $2 \text{ mm}$  thick between the plane and the plate. Find the viscosity of the fluid if the weight of the plate is  $300\text{N}$ . [10]
- 4.a) State the momentum equation. How will you apply momentum equation for determining the force exerted by a floating liquid on a pipe bend?
- b) Derive Bernoulli's equation through Euler's equation of motion. [5+5]
- OR**
5. Water flows through a pipe AB  $1.2 \text{ m}$  diameter at  $3 \text{ m/s}$  and then passes through a pipe BC  $14.5 \text{ m}$  diameter. At C, the pipe branches. Branch CD is  $0.8 \text{ m}$  in diameter and carries one-third of the flow in AB. The flow velocity in branch CE is  $2.5 \text{ m/s}$ . find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE. [10]

6. Explain in detail laminar boundary layer, turbulent boundary layer, laminar sub-layer.

[10]

**OR**

- 7.a) At a sudden enlargement of a water main from 240 mm to 480 mm diameter, the hydraulic gradient rises by 10 mm. estimate rate of flow.

- b) Derive an expression for minor losses due to sudden contraction.

[5+5]

- 8.a) Show the governing mechanism of a Pelton wheel turbine with a neat sketch and explain how it works.

- b) A Pelton wheel has a mean bucket speed of 10 meters per second with a jet of water flowing at the rate of 700 litres/s under a head of 30 meters. The buckets deflect the jet through an angle of  $160^\circ$ . Calculate the power given by water to the runner and hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98.

[5+5]

**OR**

- 9.a) Define the terms 'unit power', 'unit speed' and 'unit discharge' with reference to a hydraulic turbine. Also derive expressions for these terms.

- b) A Kaplan turbine runner is to be designed to develop 9100 kW. The net available head is 5.6 m. If the speed ratio = 2.09, flow ratio = 0.68, overall efficiency = 86% and the diameter of the boss is  $\frac{1}{3}$  the diameter of the runner. Find the diameter of the runner, its speed and the specific speed of the turbine.

[5+5]

- 10.a) Obtain an expression for the work done by impeller of a centrifugal pump on water per second per unit weight of water.

- b) The internal and external diameters of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 r.p.m. The vane angles of the impeller at inlet and outlet are  $20^\circ$  and  $30^\circ$  respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water.

[5+5]

**OR**

- 11.a) Define and derive an expression for Manometric Efficiency, Mechanical Efficiency and Overall Efficiency.

- b) A centrifugal pump is to discharge  $0.118 \text{ m}^3/\text{s}$  at a speed of 1450 r.p.m. against a head of 25 m. The impeller diameter is 250 mm, its width at outlet is 50 mm and manometric efficiency is 75%. Determine the vane angle at the outer periphery of the impeller. [5+5]

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