Code No: 134BC **R16**

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 m^2 is sliding down the inclined plane at 45^0 to the horizontal with a velocity of 0.45 m/s. there is a cushion of fluid 2 mm thick between the plane and the plate. Find the viscosity of the fluid if the weight of the plate is 300N. [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 m diameter at 3 m/s and then passes through a pipe BC 14.5 m dimeter. At C, the pipe branches. Branch CD is 0.8 m in diameter and carries one-third of the flow in AB. The flow velocity in branch CE is 2.5 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 160^0. 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 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 20^0 and 30^0 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 m^3/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]

---ooOoo---