Code No: 124DF **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, November/December - 2020
MECHANICS OF FLUIDS AND HYDRAULIC MACHINES
(Common to ME, MIE)

Time: 2 hours **Max. Marks: 75**

Answer any Five Questions
All Questions Carry Equal Marks
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1.a) Two points M and N of a pipeline carrying water lie in the same horizontal plane. The pressure at M is 10 kPa (vaccum) and the pressure at N is 20 kPa (gauge). If both M and N are connected to a mercury differential manometer what would be the difference in the heights of mercury columns in the two limbs.

b) Two vertical plates are placed with a gap of 15 mm between them and the gap is filled with glycerin (with density of 1260 kg/m^3 and dynamic viscosity of 1.5 kg.s/m^2). An 80 cm square, 3 mm thick steel plate weighing 110 N is placed exactly midway in the glycerin-filled gap of vertical plates. If it required to pull the steel plate vertically upwards at a constant velocity of 15 cm/s, estimate the force required. (neglect the resistance at the edges of plate). [6+9]

2.a) Five litres of oil weigh 30 N. Calculate the mass density, specific gravity and specific weight.

b) A cylindrical shaft of 50 mm diameter rotates about a vertical axis inside a fixed cylindrical tube of length 60cm and 55mm external diameter. If the space between the tube and the shaft is filled by a lubricant of dynamic viscosity of 2 poise, determine the shear force and Torque required to overcome the viscous resistance when the shaft rotated at a speed of 200 rpm. (take the clearance between shaft and tube as 2.5mm). [5+10]

3.a) A bend in pipe line carrying water gradually reduces from 0.7 m to 0.4 m diameter and deflects the flow through angle of 60^0. At the larger end the gauge pressure is 200 kN/m^2. Determine the magnitude of the force exerted on the bend when there is flow of 1 m^3/s in the pipe.

b) Differentiate Euler's equation and Bernoulli's equation. [10+5]

4. A reducer bend having an outlet diameter of 15cm discharges freely. The bend, connected to a pipe of 20 cm diameter, has a deflection of 60^0 and lies in a horizontal plane. Determine the magnitude and direction of force on an anchor block supporting the pipe when a discharge of 0.3 m^3/s passes through the pipe. [15]

5.a) A pipeline carrying water has a diameter of 0.4 m and is 2.5 km long. To increase the delivery, another pipeline of same diameter is introduced parallel to the first pipe in the second half of its length. Find the increase in discharge if the total head loss in both the case is 20 m. Assume f=0.02 for all the pipes.

b) Write about separation of boundary layer. [10+5]

6.a) Differentiate venuri meter and orifice meter with neat figures.
b) Explain about Reynolds experiment. [5+10]

7.a) Derive the force exerted by the fluid jet on the moving symmetrical curved vane when jet strikes at one end tangentially.
b) A jet of water moving at 15 m/s imping on a symmetrical curved vane shaped to deflect the jet through 120^0 (that is the vane angles θ and Φ each equal to 30^0). If the vane is moving at 4 m/s, find the angle of the jet so that there is no shock. Also determine the absolute velocity of exit in magnitude and direction and the work done. [5+10]

8.a) Write about losses in centrifugal pump.
b) Describe about the working principle of reciprocating pump with neat diagram. [6+9]

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