R15/R13

Code No: 124DF/114DF

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, March/April - 2021
MECHANICS OF FLUIDS AND HYDRAULIC MACHINES
(R15 - Common to ME, MIE; R13 - Common to ME, MIE)

Time: 3 hours **Max. Marks: 75**

Answer any Five Questions
All Questions Carry Equal Marks
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1.a) What is the pressure corresponding to 30 cm column of Kerosene of relative density 0.85? What is the equivalent head of mercury corresponding to this pressure?
b) A sleeve 20 cm long encases a vertical metal rod 5 cm in diameter with a radial clearance of 0.02 mm. If when immersed in an oil of viscosity 8 poise, the weight of the sleeve is 10 N, will the sleeve slide down the rod and if so at what velocity? [5+10]

2.a) The pressure outside the droplet of water of diameter 0.03 mm is 9.5 N/cm ^{2} (atmospheric pressure). Calculate the pressure within the droplet if surface tension is given as 0.0685 N/m of water.
b) 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 300 N. [6+9]

3.a) Differentiate (i) uniform and non-uniform flow (ii) rotational and irrotational flow with suitable examples.
b) A jet of water from a 15mm diameter nozzle is directed vertically upwards. Assuming that the jet remains circular and neglecting any loss of energy, what will be the diameter at a point 3.5 m above the nozzle, if the velocity with which the jet leaves the nozzle is 15 m/s. [6+9]

4.a) A bend in pipe line carrying water gradually reduces from 0.5 m to 0.2 m diameter and deflects the flow through angle of 60^0. At the larger end the gauge pressure is 180 kN/m ^{2}. Determine the magnitude of the force exerted on the bend when there is no flow in the pipe.
b) Differentiate continuity equation for 1-D and 3-D flows. [10+5]

5.a) A pipe 8 cm in diameter, 500m long and with f=0.018 is connected in parallel between two points M and N with another pipe 5 cm diameter, 1000 m long and having f=0.020. A total discharge of 40 lit/s enters the parallel pipes through division at M to rejoin at N. Estimate the division of discharge in the two pipes.
b) Explain about Displacement thickness and energy thickness of boundary layer. [9+6]

6.a) Air flows at 15 m/s past a smooth rectangular flat plate 0.2 m wide and 3 m long. Assuming that the turbulence level in the oncoming stream is low and that transition occurs at $R_e=5\times10^5$, calculate drag force due to laminar and turbulent boundary layer.
b) Differentiate total energy line and hydraulic gradient line. [10+5]

7.a) Derive the work done/sec when jet striking at series of radial curved vanes.
b) Differentiate impulse turbines and reaction turbines. [10+5]

8.a) Describe about discharge slips in reciprocating pumps.
b) A centrifugal pump of the radial type delivers 5000 lit/minute against a total head of 38m, when running at a speed of 1450 rpm. If the outer diameter of the runner is 300 mm and its width at the outer periphery is 13mm, find the vane angle at exit. Assume manometric efficiency is 80%. [5+10]

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