Code: 13A01408 **R13**

B.Tech II Year II Semester (R13) Regular & Supplementary Examinations May/June 2016

MECHANICS OF FLUIDS

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define cohesion and adhesion.

(b) A vessel of 4 m^3 volume contains an oil of weight 30.2 kN. Find the specific gravity of the oil.

(c) Define circulation and vorticity.

(d) Water is flowing through a pipe of 70 mm diameter under a gauge pressure of 50 kPa and with a mean velocity of 2.0 m/s. Neglecting friction find the total head if the pipe is 7 m above the datum line.

(e) Sketch the pattern of laminar flow and transition flow in Reynold's experiment.

(f) What is stagnation pressure?

(g) Give any two methods to control boundary layer separation.

(h) Define boundary layer.

(i) Name two types of drags.

(j) What is airfoil? Give the sketch.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) A vertical gate closes a horizontal tunnel 5 m high and 3 m wide running full with water. The pressure at the bottom of the gate is 196.2 kN/m^2. Find the total pressure on the gate and position of centre of pressure.

(b) A simple manometer containing mercury is used to measure the pressure of water flowing in a pipeline. The mercury level in the open tube is 60 mm higher than that on the left tube. If the height of water in the left tube is 50 mm, find the pressure in the pipe in terms of head of water.

OR

3 (a) Determine the minimum size of glass tube that can be used to measure water level if the capillary rise in the tube is not to exceed 0.25 m. Take surface tension of water in contact with air as 0.0075 kg(f)/m.

(b) A plate having an area of 0.6 m^2 is sliding down the inclined plane at 30° to the horizontal with a velocity of 0.36 m/s. There is a cushion of fluid 1.8 mm thick between the plane and the plate. Find the viscosity of the fluid if the weight of the plate is 280 N.

UNIT – II

4 (a) For a three dimensional flow if two velocity components are $u = xy$ and $v = 2yz$, find the third velocity component.

(b) Define stream line, path line, streak line and stream tube.

OR

5 (a) List the assumptions and limitations of Bernoulli's equation.

(b) A pipe 5 m long is inclined at an angle of 15° with the horizontal. The smaller section of the pipe which is at a lower level is of 80 mm diameter and the larger section of the pipe is of 240 mm diameter. Find the difference of pressures between the two sections if the pipe is uniformly tapering and the velocity of water at the smaller section is 1 m/s.

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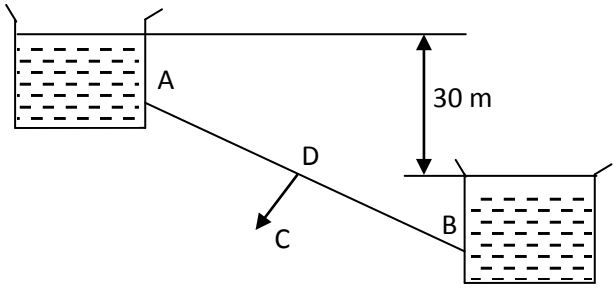
UNIT – III

6 A pipeline of 6 km long and of 700 mm diameter connects two reservoirs A and B as shown here.



In the middle of the pipeline there is a tap through which water can be supplied to a third reservoir C. Determine the rate of flow to the reservoir B when no water is discharged to the reservoir C and the quantity of water discharged to the reservoir C is 150 lps. Neglect all losses except friction and take 4f = 0.006.

OR

7 (a) Water flows over a rectangular notch of 1 m length over a depth of 150 mm. Then the same quantity of water passes through a triangular right-angled notch. Find the depth of water through the notch. Take the coefficient of discharges for the rectangular and triangular notch as 0.62 and 0.59 respectively.

(b) Compare and contrast Venturi meter and Orifice meter.

UNIT – IV

8 If the velocity distribution in the boundary layer is $\frac{u}{U} = \frac{3}{2}.\frac{y}{\delta} - \frac{1}{2}.\frac{y^2}{\delta^2}$, δ being boundary layer thickness, calculate the displacement and momentum thicknesses.

OR

9 Explain the formation of boundary layer along a thin flat plate.

UNIT – V

10 A cylinder 1.2 m in diameter is rotated about its axis in air having a velocity of 128 kmph. A lift of 5886 N per meter length of the cylinder is developed on the body. Assuming ideal fluid theory, find the rotational speed and the location of the stagnation points. Given $\rho = 1.236$ kg/m^3.

OR

11 (a) Give the effect of compressibility on drag.

(b) A circular disc 3 m in diameter is held normal to a 26.4 m/s wind of density 1.2 kg/m^3. What force is required to hold it at rest? Assume coefficient of drag of disc as 1.1.

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