25/05/2019

Roll No. .....

34026

Printed Pages : 2

BT-4/M–19

FLUID MECHANICS

Paper–ME–208 E

Time allowed : 3 hours] *[Maximum marks : 100*

Note : *Attempt **five** questions, selecting at least **one** question from each unit. Assume any missing data suitably.*

Unit–I

1. (i) What is a fluid ? How are fluids classified ? 8

   (ii) An annular plate 2 m external diameter and 1 m internal diameter lies in water with its greatest and least depths below the surface being 1.5 m and 0.75 m respectively. Calculate the magnitude, direction and location of the force acting upon one side of the plate due to water pressure. 12

2. (i) A metallic cube 30 cm side and weighing 450 N is lowered into a tank containing a two-fluid layer of water and mercury. Determine the position of block at mercury-water interface when it has reached equilibrium. 10

   (ii) Check whether the flow defined by the stream function $\Psi = 2xy$ is irrotational. If so, determine the corresponding velocity potential. 10

Unit–II

3. (i) Derive and explain the significance of the kinetic energy and momentum correction factor. 8

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(ii) A 2 m long pipeline tapers uniformly from 10 cm diameter to 20 cm diameter at its upper end. The pipe centre line slopes upwards at an angle of 30° to the horizontal and the flow direction is from smaller to bigger cross-section. If the pressure gauges installed at the lower and upper ends of the pipeline read 200 kPa and 230 kPa respectively, determine the flow rate and the fluid pressure at the mid-length of the pipeline. Assume no energy losses. 12

4. Discuss the incompressible non-viscous fluid flow over a Rankine half body. 20

Unit–III

5. Derive the Hagen-Poiseuille equetion and state the assumptions made. 20

6. A pipeline, 40 m long, is connected to a water tank at one end discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 15 cm diameter and then its diameter is suddenly enlarged to 30 cm. The height of water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Assume pipe friction factor $4f = 004$. 20

Unit–IV

7. (i) Obtain von Karman momentum integral equation. 10

(ii) What is boundary layer separation ? How can it be prevented ? 10

8. Obtain an expression for co-efficient of lift for a rotating cylinder placed in a uniform flow. 20

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