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B. E. (Fourth Semester) EXAMINATION, June, 2012

(Grading/Non-Grading)

(Common for AU, CE, IP & ME Engg.)

FLUID MECHANICS

Time : Three Hours

Maximum Marks : $\begin{cases} GS : 70 \\ NGS : 100 \end{cases}$

Note : Attempt any *five* questions. All questions carry equal marks.

Unit—I

1. (a) What is meant by viscosity of a liquid ? How does it manifest and in what units is it measured ?

   (b) Does the viscosity of liquids and gases increase with temp. growth ? Suggest reasons for the difference in behaviour, if any.

Or

2. In a 50 mm long journal-bearing arrangement the clearance between the two at concentric condition is 0·1 mm. The shaft is 20 mm in diameter and rotates at 3000 r. p. m. The dynamic viscosity of the lubricant used is 0·01 PaS and the velocity variation in the lubricant is linear. Considering the

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lubricant to be Newtonian, calculate the frictional torque the journal has to overcome, and the corresponding power loss.

Unit – II

3. (a) Write the different types of fluid flows.

   (b) In a steady fluid flow the velocity components are :

$$u = 2kx$$

$$v = 2ky$$

$$w = -4kz$$

   Find the equation of a stream line passing through the point (1, 0, 1).

Or

4. (a) A jet of water 20 mm diameter nozzle leaves the nozzle tip with 15 m/s and is directed vertically upwards. If the remains circular, work out its diameter at a point 5 m above the nozzle tip. Neglect any loss of energy.

   (b) Define path line, streak line and the stream line. For what type of flow these lines are identical ?

Unit – III

5. (a) Define and explain the significance of the kinetic energy correction factor and the momentum correction factor. Suggest their practical values for laminar and turbulent flows.

   (b) Show that when velocity distribution across a section is uniform, the momentum correction factor is unity.

Or

6. 250 litres per second of water is flowing in a pipe having a diameter of 30 cm. If the pipe is bent by 135°, find the magnitude and direction of resultant force on the bend. The pressure of water flowing in the pipe is 400 kPa.

Unit – IV

7. (a) Write the dimensional homogeneity and its applications.

   (b) Write the objective and importance of model studies.

Or

8. Show by the use of Buckingham's pi-theorem that the velocity through an orifice is given by :

$$V = \sqrt{2gH} f\left(\frac{D}{H}, \frac{\mu}{\rho VH}, \frac{\sigma}{\rho V^2 H}\right)$$

where H is the head causing flow, D is the dia of the orifice, μ is the coefficient of viscosity, ρ is the mass density, σ is the surface tension and g is the gravitational acceleration.

Unit – V

9. (a) Describe Reynolds' experiments to demonstrate the laminar and turbulent fluid flows. How is the type of flow related to Reynolds number ?

   (b) Determine the nature of flow when an oil of specific gravity 0·85 and kinematic viscosity $1{\cdot}8 \times 10^{-5}$ m^2/s flows in a 10 cm dia. pipe at 0·5 litre per second.

Or

10. A horizontal pipe of 5 cm diameter conveys on oil of specific gravity 0·9 and dynamic viscosity 0·8 kg/ms. Measurements indicate a pressure drop of 20 kN/m^2 per meter of pipe length traversed. Make calculations for the :

(i) flow rate of oil and centre line velocity

(ii) wall shear stress and the frictional drag over 100 m of pipe length

(iii) power of pump required assuming an overall efficiency of 60 percent

(iv) the velocity and shear stress at 1 cm from the pipe surface