No. of Printed Pages : **4** **BME-028**

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

December, 2013

BME-028 : FLUID MECHANICS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **any seven** questions. All questions carry **equal** marks. Use of calculator is **permitted**.*

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1. (a) Explain the following properties of fluids with suitable examples. 5

(i) Viscosity

(ii) Specific gravity

(iii) Specific weight

(b) Calculate the capillary effect in mm. in a glass tube of 4 mm diameter when immersed in a container of : 5

(i) Water and

(ii) Mercury

Surface tension of water and mercury are 0.0735 and 0.0510 N/m respectively. The wetting angle (angle of contact) for water is 0° and that for mercury is 130°.

Specific Gravity of mercury = 13.6, Specific Gravity of water = 1 and specific weight of water = 9806 N/m^3.

2. (a) Determine the magnitude, direction and point of action of the bouyant force. 5

   (b) What fraction of an iceberg would be above the free surface in the ocean, if the density of ice is 920 kg/m^3 and density of sea water is 1030 kg/m^3 ? 5

3. (a) Derive an expression for discharge over a triangular notch. 5

   (b) Derive the continuity equation for the fluid flow. 5

4. (a) Define flow net and enumerate its uses and applications. 5

   (b) The velocity potential is given by $\phi = x^2 - y^2$. Does this represent a possible flow field ? If it so, prove that the flow is irratational. 5

5. (a) A cylinder of diameter D and length l is placed in a steady uniform stream of velocity V. Density of the fluid is ρ and dynamic viscosity is μ. Find the drag force 'F' on the cylinder as a function of the variables V, D, l ρ and μ. 5

8. (a) What is meant by "equivalent pipe length" ? 5

(b) Find an expression for head loss in an orifice flow in terms of coefficient of velocity and jet velocity. 5

9. (a) Obtain exact solutions of Navier strokes equations as applicable to some laminar flow. 5

(b) Two plane boundaries are 6 mm apart, the space between them is filled with a liquid of viscosity of 1.2 kg/m.s. What force would be required to move edgewise through the liquid, a plate 3mm thick and $25 cm^2$ at a velocity of 15cm/sec. ? 5

10. (a) At a certain value of Re (Reynold's No.), there is a sudden drop in the value of C_D in case of a sphere. What is this value Re ? Also explain the reason for such a drop in C_D. 5

(b) What is the physical significance of Reynold's Number and Froude Number ? 5

(b) The wave resistance of a ship's model built to a scale of 1: 25 is found to be 2.0 Newtons. What is the scale for velocity and time in the model ? State the governing parameters in the model similitude. What is the wave resistance in the prototype ? 5

6. (a) Define mixing length and state the relationship that exists between the turbulent shear stress and the mixing length. 5

(b) Air at 20°C (Pair = 1.208 kg/m^3, $\mu = 1.85 \times 10^{-5}$ kg/ms) flows over a 2.0 m wide plate at 10.0 m/s velocity. Determine : 5

(i) τ_0 and δ at a place where the boundary layer ceases to be laminar.

(ii) Drag force on one side of the plate in the laminar region.

7. (a) Calculate head loss due to friction in pipes and obtain hydraulic gradient and total energy lines. 5

(b) A 600 mm diameter rough pipe carries 600 lit/sec of water over a distance of 1 km. Determine 'h_f' if ks = 3.0 mm. 5