No. of Printed Pages : 4

**BME-028**

# B.Tech. MECHANICAL ENGINEERING

01107 **(COMPUTER INTEGRATED MANUFACTURING)**

## Term-End Examination

## June, 2014

## BME-028 : FLUID MECHANICS

*Time : 3 hours* *Maximum Marks : 70*

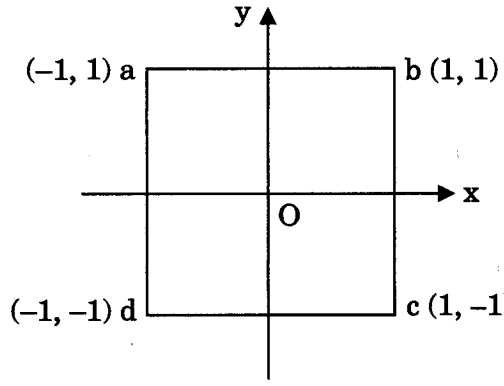
***Note :*** *Answer any* ***seven*** *questions. All questions carry equal marks. Use of calculator is permitted.*

**1.** (a) Determine the magnitude, direction and point of action of the buoyant force. *5*

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

**2.** (a) Describe the free vortex flow and forced vortex flow. *5*

(b) Find the circulation around the square enclosed by the lines $x = \pm 1$, $y = \pm 1$ for a two-dimensional flow given by $u = x + y$, $v = x^2 - y$ at centre O. *5*




**3.** (a) The velocity $c$ of a capillary wave formed due to a gentle breeze over the surface of a lake is dependent on surface tension $\sigma$, wavelength $\lambda$, and fluid density $\rho$. Determine a functional relationship for the wave celerity. *5*

(b) The discharge over a weir 150 m long and 15 m in height is to be estimated by means of a model built to a scale of 1 : 25. What are the scales for velocity and discharge ? If the pressure head measured at a given point in the model is 0·01 m, to what pressure does this correspond in the prototype ? *5*

4. (a) Derive Euler's equation in fluid particle moving along a stream line. 5

(b) Discuss the Momentum Theory for the Airplane propellers. 5

5. (a) Discuss the losses due to Sudden Enlargement and derive an expression for the same. 5

(b) Determine the power that can be obtained from a series of vanes curved through 155°, moving at 18 m/s away from a 75 lit/sec. water jet having a cross-section of 25 $cm^2$. Calculate the energy remaining in the jet. 5

6. (a) Show that time required to reduce the water level from $H_1$ to $H_2$ by rectangular weir is given by $t = \frac{3A}{C_d L\sqrt{2g}}\left(\frac{1}{\sqrt{H_2}} - \frac{1}{\sqrt{H_1}}\right)$ in which A is the area of the reservoir, $C_d$ is the discharge coefficient and L is the length of the weir. 5

(b) Define viscosity and its role in fluid flow. 5

7. (a) Develop the Navier – Stokes equation of fluid motion. 5

(b) Discuss the combined Hagen – Poiseuille flow and Couette flow along inclined plates. 5

8. (a) List the factors which affect the transition from laminar to turbulent flow. *5*

(b) Define nominal thickness of boundary layer and also define laminar sublayer. *5*

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

(b) A 300 mm diameter pipe with friction factor of 0·02 has a pipe fitting with loss coefficient of 1·9 and 200 mm diameter pipe of 50 m length with friction factor of 0·022. Determine their equivalent length in terms of 300 mm diameter pipe. *5*

10. (a) Comment on 'Drag characteristics' that are greatly affected by Reynolds' number and the body shape. *5*

b) Write short note on the Drag of a Ship model and River model. *5*