*Total No. of Questions :8]* *[Total No. of Printed Pages :2*

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# AU/ME-225

## B.E. IV Semester

Examination, June 2017

## Choice Based Credit System (CBCS)

## Fluid Mechanics

***Time : Three Hours***

***Maximum Marks: 60***

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

1. a) Define the following:
   i) Centre of Buoyancy
   ii) Metacentre
   iii) Centre of pressure
   b) A rectangular plane surface is 2m wide and 3m deep. It lies in vertical plane in water. Determine the total pressure and position of centre of pressure on the plane surface when its upper edge is horizontal and
   i) Coincides with water surface
   ii) 2.5m below the free water surface.



2. The velocity components in a two dimensional flow field for an incompressible fluid are as follows:

$$u = \frac{y^3}{3} + 2x - x^2 y \text{ and } v = xy^2 - 2y - \frac{x^3}{3}$$

obtain an expression for stream function $\psi$.

3. a) How the notches and weir are classified.
   b) A pipe, 100mm in diameter, has a nozzle attached to it at the discharge end, the diameter of the nozzle is 50mm. The rate of discharge of water through the nozzle is 20lit/s and the pressure at the base of the nozzle is 5.886N/cm². Calculate the co-efficient of discharge. Assume that the base of the nozzle and outlet of the nozzle are at the same elevation.







4. Using Buckingham's π theorem. Show that the discharge Q consumed by an oil ring is given by

$$Q = Nd^3 \phi \left[ \frac{\mu}{\rho N d^2}, \frac{\sigma}{\rho N^2 d^3}, \frac{\omega}{\rho N^2 d} \right]$$

where $d$ is the internal diameter of the ring, $N$ is rotational speed, $\rho$ is density, $\mu$ is viscosity, $\sigma$ is surface tension and $\omega$ is the specific weight of oil.



5. Derive the Von Karman momentum integral equation.

6. Derive the shear stress distribution the velocity distribution across a section and ratio of maximum velocity to average velocity for flow of viscous fluid between two parallel plates.

7. A 30cm×15cm venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.9, the flow being upwards. The difference in elevation of the throat section and entrance section of the venturimeter is 30cm. The difference U-tube mercury manometer shows a gauge deflection of 25cm. Calculate:
   i) The discharge of oil and
   ii) The pressure difference between the entrance section and the throat section, Take the co-efficient of discharge as 0.98 and sp. gravity of mercury as 13.6.



8. Write short notes on (any three):
   a) General three dimensional equation of continuity.
   b) Different condition of equilibrium.
   c) Path line, Stream line and Streak line.
   d) Vapour pressure and Cavitation.

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