

II B.Tech II Semester Examinations, April/May 2012

MECHANICS OF FLUIDS

Metallurgy And Material Technology

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) What do you mean by 'pipes in series'? When pipes are connected in series? What is the loss of head in the system?
- (b) A pipe system consists of three pipes in series [8+8]
 - i. 300 m long, 150 mm in diameter,
 - ii. 150 m long, 100 mm in diameter and
 - iii. 250 m long, 200 mm in diameter. Determine the equivalent length of a 125 mm diameter pipe. Take friction factor, $4f = 0.02$ and coefficient of contraction, $C_c = 0.6$.
2. (a) Discuss the relative merits and demerits of venturimeter with respect to orifice meter
- (b) A rectangular channel 6mts wide carries 2800 lit/sec at the depth of 0.9mts. What height of a broad crested rectangular weir must be installed to **double** the depth? Assume a weir co coefficient as 0.86. [7+9]
3. (a) Explain the mechanics of boundary layer transition.
- (b) A 1.8 m long, 300 mm wide plate moves in water at 2.6 m/sec Assuming a velocity distribution $\frac{u}{u_\infty} = \left(\frac{y}{\delta}\right)^{0.25}$ in the boundary layer, find the drag resistance if the thickness of boundary layer is 56 mm at the trailing edge. Find also the drag coefficient. [8+8]
4. The velocity components in a two-dimensional flow field for an incompressible fluid are expressed as

$$u = \frac{y^3}{3} + 2x - x^2y; v = xy^2 - 2y - \frac{x^3}{3}$$
 - (a) Show that these functions represent a possible case of an irrotational flow
 - (b) Obtain expression for stream function ψ
 - (c) Obtain an expression for velocity potential ϕ . [16]
5. A 300mm diameter pipe carries water under a head of 20m with a velocity of 3.5m/s. If the axis of the pipe turn through 45° , find the magnitude and direction of the resultant force at the bend . [16]
6. (a) Define capillarity and surface tension and discuss the factors affecting them.
- (b) Explain with sketches how an inverted U-tube manometer is used to measure small pressure differences. [8+8]

7. (a) Distinguish between laminar and turbulent flow?
(b) A shaft of diameter 50 mm is running a bearing at 900 rpm is having a radial clearance of 0.1 mm calculate the torque resistance if the length of bearing is 80 mm and space is filled with oil of dynamic viscosity 0.075 pascal-sec. [6+10]
8. Air flows through a frictionless adiabatic convergent divergent nozzle in which air is flowing at a pressure, velocity, temperature and cross section area are $200 \text{ KN}/m^2$, 170 m/s, 20°C and 1000mm^2 respectively. If the flow conditions are isentropic, determine
- (a) sonic velocity and Mach number at inlet
(b) Stagnation temperature and pressure
(c) Mach number at outlet section where the pressure is $110\text{KN}/m^2$. Take $R=290 \text{ J}/\text{kg}\cdot\text{K}$ and $k=1.4$, $c_p=1\text{kJ}/\text{kg}\cdot\text{K}$. [16]

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