Code No. : 3017

FACULTY OF ENGINEERING

B.E. 2/4 (Civil) II Semester (Main) Examination, May/June 2011

FLUID MECHANICS – I

Time : 3 Hours] **[Max. Marks : 75**

Note : Answer **all** questions from Part – A. Answer any **five** questions from Part – B.

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PART – A (Marks : 25)

1. Differentiate between cohesion and adhesion. 2
2. A jet of water 40 mm in diameter has a velocity of 25.0 m/s. Find the power of the jet. 2
3. How is a U-tube manometer more useful than the piezometer tube ? 2
4. What is a drowned weir ? 2
5. Explain about the internal energy of a gas. 2
6. State the laws of fluid friction for steady stream line flow. 3
7. A sphere 100 mm in diameter is just supported in equilibrium in a vertical air stream. If the velocity of the air stream is 12.0 m/s. Find the weight of the sphere. Take $C_d = 0.42$ and $\rho = 1.225$ kg/m^3 for air. 3
8. Mention some applications of impulse momentum equation. 3
9. Explain static and stagnation temperatures. 3
10. Define centre of buoyancy and metacentre. 3

PART – B (Marks : 50)

11. (a) Explain the concepts of stream line, stream tube, path and streak line. 5

    (b) The velocity components in a two dimensional incompressible flow are, $u = y^3 + 6x - 3x^2y$ and $v = 3yx^2 - 6y - x^3$. 5

    (i) Is the flow continuous ?

    (ii) Is the flow irrotational ?

    (iii) In case the flow is irrotational, find the potential function and the stream function.

12. (a) Explain the significance of Bernoulli's equation alongwith its limitations and applications. 5

    (b) A 200 mm dia pipe conveys water at a pressure of 147.15 kPa at a velocity of 2.0 m/s. If the axis of the pipe has a 45° bend, find the magnitude and direction of the resultant force on the bend. Take specific weight of water equal to 9.81 kN/cu.m. 5

13. (a) Explain in detail the importance of bourdon Gauge. 5

(b) A submerged weir spans the entire width of a rectangular channel 6 mts. wide, the crest of the weir being 1.0 m above the bottom of the channel. Estimate the discharge when the depth of water is 1.50 mts on the upstream side and 1.5 mts on the downstream side of the weir. Allow for the velocity of approach. Take coefficient of discharge equal to 0.58 and 0.80 for the free and the orifice portions respectively. 5

14. (a) Define stagnation temperature and derive the general equation for stagnation temperature of compressible fluid in terms of mach no. 5

(b) A horizontal pipe conveys a gas at a temperature of 5 °C. At a section 1 – 1 of the pipe the diameter is 6 cm and the gas pressure is 2.75 kg/cm^2 (gauge). At a section 2 – 2 of the pipe the dia. is 3.0 cm and the gas pressure is 1.60 kg/cm^2 (gauge). Assuming an isothermal change, find the velocities of the gas at these sections. Take R = 20.27 m/°K. 5

15. The difference of water levels of two water reservoirs is 8.0 m. They are connected by a 40 m long pipe. For the first 25 m length, the dia of the pipe is 120 mm and for the remaining length, the diameter is 200 mm, the change in dia. being sudden. Find the discharge into the lower reservoir. Take f = 0.008. 10

16. (a) Explain briefly the significance and use of flow nets. 5

(b) Derive the impulse momentum equation for compressible fluids. 5

17. Write short notes on the following :

(a) Elbowmeter 3

(b) Reynold's Experiment 4

(c) Characteristics of Turbulent Flow 3