Code No. : 5182

FACULTY OF ENGINEERING
B.E. 2/4 (M/P) II Semester (Supple.) Examination, January 2012
FLUID DYNAMICS

Time : 3 Hours] [Max. Marks : 75

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

PART – A **(10×2$^{1}/_{2}$=25 Marks)**

1. Two horizontal plates are placed at 10.5 mm apart, the space between plates is filled with an oil of viscosity 12 poise. Calculate the shear stress of oil when upper plate is moved with a velocity of 2.4 m/s.
2. Distinguish between Uniform flow and Steady flow with relevant differential equations.
3. A pump 100 mm diameter of suction pipe and 75 mm diameter of delivery pipe have an efficiency of 85% and are driven by 8 kW motor. Differential manometers connected to suction and deliver pipe show a maximum pressure head of 8.00 m of water. What is the discharge through pump ?
4. State Bernoulli's principle and all the terms of the Bernoulli's equation.
5. State the principle of working of Rotameter.
6. A pitot tube is used to measure the velocity of flow in a stream. The coefficient of pitot tube may be taken as 0.95. Determine the reading in the pitot tube when the depth of measurement using this pitot tube is 200 mm and velocity is 4 m/s.
7. Distinguish between a Laminar and Turbulent flow in a pipe in terms of their Reynolds number and flow patterns.
8. State how Moody's chart is useful in fluid mechanics.
9. Define Boundary Layer and what is its effect on the flow phenomenon.
10. Define Mach number and state its significance.

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PART – B (5×10=50 Marks)

11. a) Derive the continuity equation in Cartesian coordinates for 3 Dimensional flow. State all the assumptions made.

b) An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of shaft is 0.50 m and it rotates at 200 RPM. Calculate the power of lost in the oil for sleeve length of 100 mm the thickness of oil film is 1.0 mm.

12. a) Derive Impulse momentum equation for Pipe bend laid horizontally with diameters 'd' and 'D' from the first principles. State the assumptions made.

b) A conical pipe has diameters at the two ends of 0.50 m and 1.50 m and 15 meters long. It is vertical and the friction loss is 2.50 m for flow on either direction, when the velocity at the smaller section is 10 m/s. If the smaller section is at top and the pressure head is 2 meters of water, find the pressure head at the lower end when the flow is :

a) Downward

b) Upward

13. a) Derive the expression for discharge through a venturimeter and state the assumptions made.

b) A suppressed rectangular weir is constructed across a channel of 1.50 m width with a head of 0.70 m over the crest and crest is 0.50 m above bed level. Estimate the difference in discharge without considering the velocity of approach and considering velocity of approach. Assume coefficient of discharge for the weir as 0.615.

14. a) A sign for advertising is mounted on the top of delivery truck and is fixed near the front of the truck. The sign board is 1.50 m wide and 0.75 m high. The drag coefficient of sign board is 1.40. Calculate the net force acting on it when the truck is travelling with 70 km/hour speed. Assume specific weight of air as 11.85 N/m^3.

b) Derive Darcy's equation for friction factor from first principles. State the various assumptions while deriving the above equation.

15. a) Derive the basic energy equation for compressible flows. List out the assumptions made.

    b) At a certain duct section where in air is flowing at a temperature of 30° C. and pressure of 72.5 kN/m^2 with a velocity of 425 m/s. assuming isentropic flow determine the following :

        i) The velocity and temperature at a section where the pressure is 110 kN/m^2 and

        ii) Mach number at both sections.

        Assume R = 287 Nm/kg° K and k for air as 1.40.

16. a) Derive the expression for Stagnation pressure and state the assumptions made.

    b) Define, Boundary layer and how is useful. What do you understand by phenomenon of flow separation in the case of Boundary layer and it can be controlled ?

17. Write note on the following :

    a) Stream function and velocity potential function

    b) Hot-wire anemometer

    c) Mach cone and Mach angle.
