Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

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# [5252]-115

**S.E. (Mechanical/Automobile Engg.) (I Sem.) EXAMINATION, 2017**

**FLUID MECHANICS**

**(2012 PATTERN)**

**Time : Two Hours** **Maximum Marks : 50**

***N.B.*** **:—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** and Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of electronic pocket calculator is allowed.

(*v*) Assume suitable data, if necessary.

**1.** (*a*) Explain the phenomenon of capillarity. Obtain an expression for capillary rise of a liquid. [6]

(*b*) The greatest and the least depth of a circular plate below the free surface of water are 4 m and 2 m respectively. Diameter of the plate is 4 m. Determine the total pressure on one face of the plate and the position of centre of pressure. [6]

*Or*

**2.** (*a*) The dynamic viscosity of an oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of 0.4 m

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diameter and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90 mm. Thickness of oil film is 1.5 mm. [6]

(*b*) Derive the continuity equation for three dimensional, steady, incompressible flow of fluid in cartesian co-ordinates. [6]

**3.** (*a*) State and prove Bernoulli's equation. What are the limitations of Bernoull's equation ? [6]

(*b*) A 20 cm × 10 cm venturimeter is inserted in a vertical pipe carrying oil of specific gravity 0.8. The oil flows in upward direction. The difference of levels between the throat and inlet section is 50 cm. The oil mercury differential manometer gives a reading of 30 cm of mercury. Find the discharge of oil. Neglect losses. [6]

*Or*

**4.** (*a*) Prove that the maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of the flow. [6]

(*b*) Oil flows with a maximum velocity of 2 m/s between two horizontal parallel fixed plates which are 100 mm apart. Determine : [6]

(*i*) The pressure gradient

(*ii*) The shear stress at the two horizontal parallel plates and

(*iii*) The discharge per meter width.

Take μ = 2.4525 Pa-s. Assume flow to be laminar.

**5.** (*a*) Explain in brief the physical significance of : [6]

(*i*) Reynolds' number

(*ii*) Froude number

(*iii*) Mach number.

(*b*) Explain the concept of equivalent pipe and derive Dupit's equation. [7]

*Or*

**6.** (*a*) The discharge Q over a small weir is known to depend upon the head 'H' over a weir the weir height 'P', gravity 'g', width of the weir 'L', fluid density '$\rho$', dynamic viscosity '$\mu$' and surface tension '$\sigma$'. Express the relationship between the variables in the dimensionless form. [7]

(*b*) Two reservoirs containing water have difference of levels of 70 m, and are connected by a 250 mm diameter pipe which is 4 km long. The pipe is tapped midway between reservoirs and water is drawn at the rate of 0.04 $m^3$/sec. Assuming friction factor = 0.04, determine rate at which water enters in the lower reservoir. [6]

**7.** (*a*) Explain the development of boundary layer over a flat plate held parallel to the direction of flow. State the factors affecting growth of boundary layer. [6]

(*b*) A jet plane which weighs 29.43 kN and having a wing are of 20 $m^2$ flies at a velocity of 950 km/hr, when the engine delivers 7357.5 kW power. 65% of the power is used to overcome the drag resistance of the wing. Calculate the coefficients of lift and drag for the wing. Take density of air as 1.21 kg/$m^3$. [7]

*Or*

**8.** (*a*) Define displacement thickness. Derive an expression for displacement thickness. [6]

(*b*) Experiments were conducted in a wind tunnel at 50 kmph on a flat plate of size of 2 m × 1 m. The specific weight of air is 11.28 $N/m^3$. The plate is kept at such an angle that the coefficient of lift and drag are 0.75 and 0.15 respectively. Determine lift force, drag force, resulting force and power exerted by air stream on plate. [7]