B.E.(with Credits)-Regular-Semester 2012-Mechanical Engineering Sem III

ME302 - Fluid Mechanics

P. Pages : 3 **GUG/W/16/3791**

Time : Three Hours * 3 6 3 1 * Max. Marks : 80

Notes : 1. All questions carry equal marks. Answer Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8, Q. 9 or Q. 10.
2. Use of tables, non programmable calculator, Drawing instruments in permitted.

1. a) Explain the following terms. **6**

i) Specific weight.
ii) Specific gravity.
iii) Specific volume.

b) Calculate capillary effects in mm in glass tube of 5mm diameter when immersed in **10**
i) Water
ii) Mercury
Take temperature of liquid 20ºC
Surface tension of water = 0.0736 N/m
Surface tension of mercury = 0.51 N/m
Angle of contact for water is 0º (zero)º
Angle of contact for mercury is 130º

OR

2. a) For the set up shown in fig 2 (a) make calculations for absolute pressure in drum A that contains an oil of specific gravity 0.8. Assume an atmospheric pressure of 100kPa and take **8**
$h_1 = 60cm$, $h_2 = 30cm$, $h_3 = 15cm$ and $h_4 = 10cm$

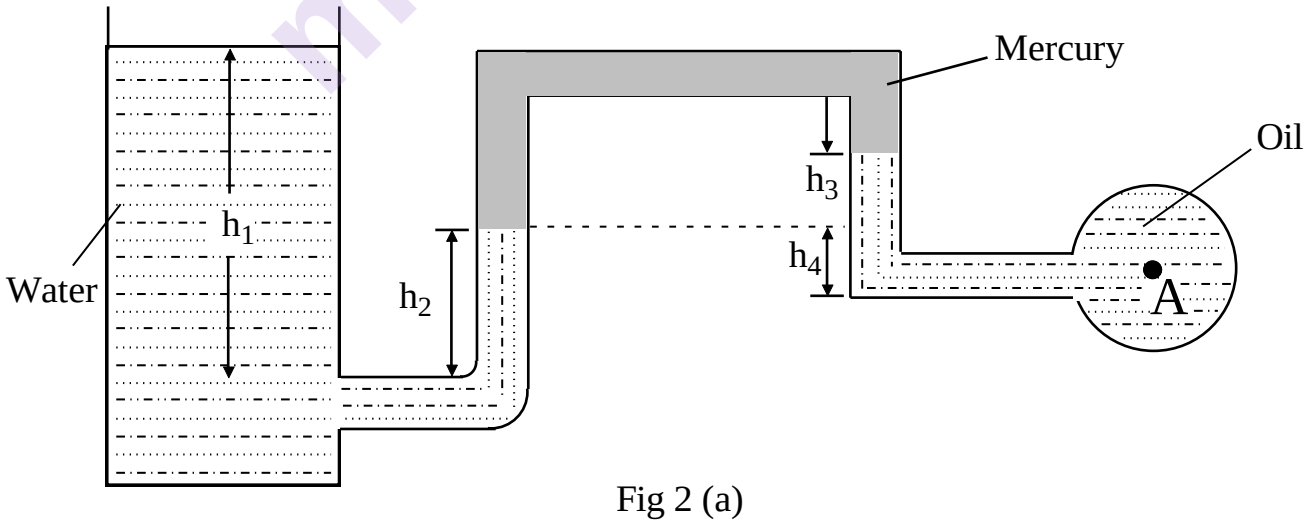

Fig 2 (a)

b) A rectangular plate 0.6m wide and 1.2m deep is submerged in an oil bath of specific gravity 0.8. The maximum and minimum depths of the plate are 1.6m and 0.75m from the free surface. Calculate the hydrostatic force on one face of the plate and depth of centre of pressure. **8**

3. a) Explain the terms. **3**
i) Centre of buoyancy.
ii) Meta centre.
iii) Metacentric height.

b) Differentiate. **3**
i) Steady & unsteady flow
ii) Uniform & non uniform flow
iii) Laminar & turbulent flow.

c) If for 2 dimentional petential flow, **10**
velocity potential $\phi = x(4y - 1)$
Determine velocity at point P (2, 3).
Determine also value of stream function ψ.

OR

4. a) Derive Bernoulli equation from first principles. **8**

b) The water is 8m diameter, 3m high above ground swimming pool is to be emptied by unplugging a 3cm diameter, 25m long horizontal pipe attached to the bottom of pool. Determine maximum discharge rate of water through pipe. **8**

5. a) An oil of relative density 0.8 flows through a vertical pipe of diameter 24cm. The flow is measured by a 240mm x120mm venturimeter. The throat is 200mm above the inlet section. A differential mercury U tube manometer is connected to the inlet & throat. The manometer shows difference in liquid level 130mm. Calculate flow rate through pipe. Take coefficient of discharge of venturimeter as 0.98. **10**

b) A rectangular orifice is 1.5m wide & 1m deep is discharging water from tank. If the water level in the tank is 3m above top edge of orifice, Find discharge through orifice. Take coefficient of discharge of orifice as 0.6. **6**

OR

6. a) A pipe of 0.4m diameter inclined 25° to horizontal is carrying gasoline (specific gravity $\rightarrow$ 0.82). A venturimeter is filted in pipe to find out flow rate whose throat diameter is 0.15m. The throat is 1.2m from entrance along its length. The pressure gauges filted to venturimeter reads 140 kN/m^2 & 80 kNm^2 respectively. **10**
Find discharge of gasoline through venturimeter.
Take coefficient of discharge as 0.9.

b) Find discharge through a trapezoidal notch which is 1m wide at top & 0.40m at bottom & is 30 cm in height. The head of water on notch is 0.25m. Take coefficient of discharge for rectangular portion as 0.64 & triangular as 0.59. **6**

7. a) Explain the terms. **6**
i) Major head loss
ii) Hydraulic gradient line
iii) Total energy line

b) A pipe of 20cm diameter and 1500m long connects 2 tanks. The level of water in first tank in 10m above inlet of pipe & in second tank 2.5m above outlet of pipe. The slope of pipe in 1 is 100. Considering inlet, exit & frictional losses in pipe. Find out discharge in leters/second through pipe. Take 'f' = 0.005 for pipe. **10**

OR

8. a) What do mean by equivalent pipe. **3**

b) What is a compound pipe? **3**

c) Explain the phenomenon of water hammer. **3**

d) Two water tanks are connected by pipe line of 20cm diameter of 300m long. The flow rate is $0.4m^3/s$. Find difference in head between two tanks. Take f = 0.008 for pipes. **7**

9. a) Find expression for power (P), developed by pump when P depends upon H, discharge Q and specific weight of fluid by Rayleigh's method. **8**

b) The capillary rise h of liquid in tube varies with tube diameter d, gravity g, fluid density ρ Surface tension σ and contact angle θ. Find dimensionless statement of the relation using Buckingham's π theorem. **8**

OR

10. a) What do you mean by **6**
i) Displacement thickness.
ii) Momentum thickness.
iii) Energy thickness.

b) An advertisement board (3mx2m) is mounted on pole 5m in height. Wind is blowing with velocity of 36 kmph. Find bending moment at base of people.. **10**

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