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4E 4141

B.Tech. IV Semester (Old/Back) Examination, June/July - 2015

Mechanical Engineering

4ME2A Fluid Mechanics

Common with AE

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five questions**, selecting **one** question from **each unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Unit - I

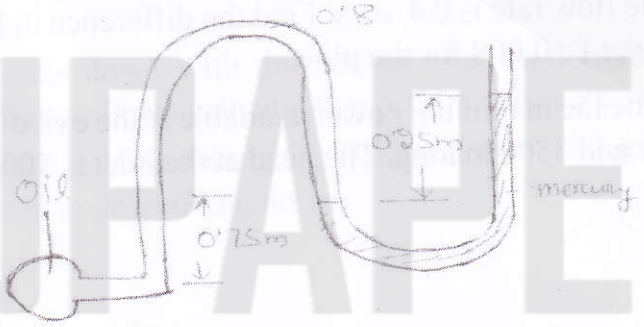
1. a) A Circular disc of diameter D is immersed vertically in a Liquid of density ρ. The top most point of the disc just touches the liquid surface. Derive an expression for the depth of centre of pressure. **(8)**

   b) A solid cylinder of diameter 30cm and height 15cm is to float in water with its axis vertical in sea water (S=1.03). The relative density of the cylinder material is 0.9. Find the meta centric height of cylinder. **(8)**

OR

1. a) Derive an expression for Meta-centric height of floating body. **(10)**

   b) Figure shows a manometer connected to a pipeline containing oil of specific gravity 0.8. Find the pressure of oil. **(6)**



Unit - II

2. a) Derive an expression for the discharge over V-notch. **(8)**

b) A horizontal boiler of 4m in diameter and 12 m long contains water upto 2.5m. Find the time taken to empty the tank through an orifice of 16 cm diameter located at the bottom of the boile. Take C_d=0.75 **(8)**

OR

2. a) The Velocity components in a steady two dimensional flow are given as $u = 5x^2$ and $v = -15x^2$ obtain an equation of a stream line. **(8)**

b) Derive an expression of discharge through venturimeter. **(8)**

Unit - III

3. a) An oil ρ=920 kg/m^3, μ=0.08 poise) is flowing through a pipe of 8cm. The bead loss was 2m in the distance of 20m along the flow. Determine
(i) The mean Velocity
(ii) Discharge. **(8)**

b) A pipeline of 2m diameter is to be designed to carry the oil at the rate 5 m^3/s having sp.gr =0.92 and μ=0.04 poise. Test were conducted using a pipe of 20 cm diameter and water as a liquid. Find the velocity and rate of flow required for the model pipe. Take μ (water = 0.01 poise) **(8)**

OR

3. Using Buckingham π-theorem, prove that the thrust F in a screw propeller is given by $F = \rho v^2 d^2 \, f\left(\frac{v}{dN}, \frac{T}{\rho v^2 d^3}\right)$

Where d, v, N, T and ρ are diameter, velocity, speed, torque and density of the fluid respectively. **(16)**

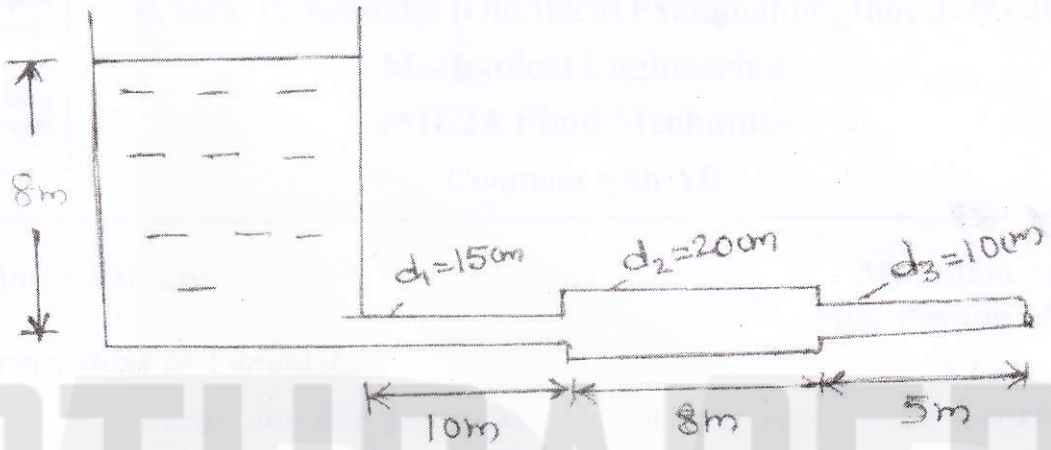
Unit - IV

4. a) Two water tanks are connected by a pipe line of 20cm diameter and 300m long. The flow rate is 0.4 m^3/s. Find the difference in head between the two tanks. Take f =0.008 for the pipe. **(8)**

b) Determine the maximum power available at the exit of the pipe of 30 cm diameter and 3500 m long. The head at the inlet is 500m. Take f=0.006 **(8)**

OR

4. Determine the discharge through pipe consider all losses and take $f_1 = f_2 = f_2 = 0.001$



Unit - V

5. (a) A flat plate of 2m×1.5m is fixed horizontally in a wind tunnel where the wind speed is maintained at 60km/wz. Taking ρ (air-density)=1.15 kg/m^3 C_D=0.20 and C_L =0.8, find out
   (i) Lift force
   (ii) Drag force
   (iii) Power required to hold the plate stationary **(8)**

   b) Define displacement thickness. Derive an expression for the displacement thickness. **(8)**

OR

5. (a) Given that the velocity distribution in a laminae boundary layer due to flow over a flat plate is $\frac{u}{U} = (\frac{3}{2}\eta - \frac{1}{2}\eta^3)$ where $\eta = \frac{y}{\delta}$, Calculate the displacement and momentum thickness in terms of the nominal boundary layer thickness δ. **(8)**

   b) A man descends down with the help of hemispherical parachute of 3m diameter with an uniform velocity 20 m/s from a flying aeroplane. The weight of the parachute is 10N. Taking C_D=0.62 and ρ = 1.2 Kg/m^3 for air, find the weight of the man descending down. **(8)**
