4E4148

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4E4148

B.Tech. IV sem.(Main&Back) Examination May - 2018
Mechanical Engg.
4ME2A Fluid Mechanics & Machines
AE, ME

Time : 3 Hours

Maximum Marks : 80
Min. Passing Marks : 26

*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.*

Use of following supporting material is permitted during examination. (Mentioned in form No. 205).

1. Moody's chart.

Unit - I

1. a) Calculate the Pressure and density of air at a height of 4000m from sea - level where pressure and temperature of the air are 10.143 N/cm^2 and 15°C respectively. The temperature lapse rate is given as 0.0065°C/m. Total density of air at sea - level equal to 1.285 kg/m^3. **(8)**

   b) What do you mean by

   i) Weight Density

   ii) Newtonian Fluid

   iii) Bluk modulus of Elasticity

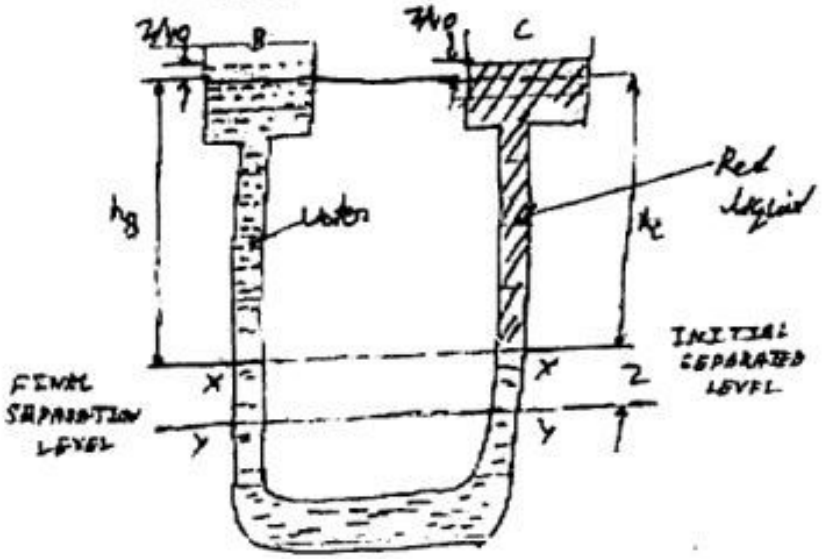
   iv) Cavitations. **(4×2=8)**

OR

1. a) With neat sketches, explain the conditions of equilibrium for floating and sub-merged bodies. **(6)**

   b) A pressure gauge consists of two cylindrical bulbs B and C each of 10 sq.cm cross - sectional area, which are connected by a U- tube with vertical limbs each of 0.25 sq. cm. cross sectional area. A red liquid of specific gravity 0.9

is filled into C and clear water is filled into B, the surface of separation being in the limb attached to C. Find the displacement of the surface of separation when the pressure on the surface in C is greater than that in B by an amount equal to 1 cm head of water.



(10)

Unit - II

2. a) What is a 'flownet'? Enumerate the methods of drawing flownets. (8)

b) State the Euler's equation of motion and also establish the Bernoulli's equation. (8)

OR

2. a) Explain the following :

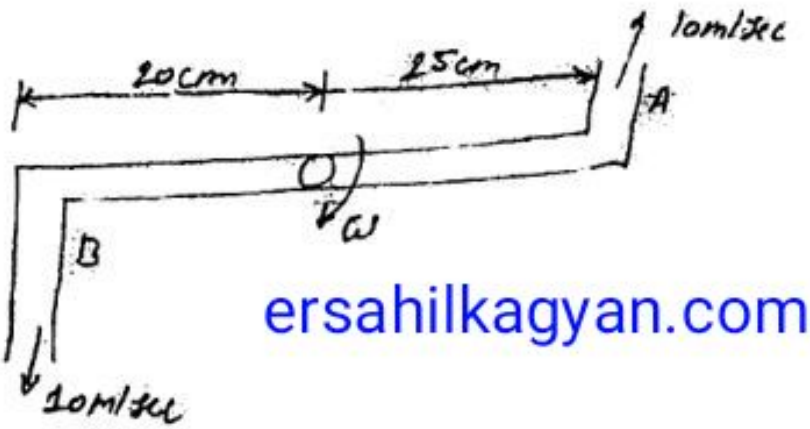
i) Laminar and Turbulent flow

ii) Stream line and streak line

iii) Uniform and Non - uniform flow

iv) Steady and Unsteady flow. (4×2=8)

b) A lawn sprinkler shown in fig has 0.8 cm diameter nozzle at the end of a rotating arm and discharges water at the rate of 10 m/s velocity. Determine the torque required to hold the rotating arm stationary. Also determine the constant speed of ratation of the arm, at free to rotate.



(8)

Unit - III

3. a) Determine the fall velocity of 0.06 mm sand particle (specific gravity = 2.65) in water at 20°C, take $\mu = 10^{-3} kg/ms$. **(8)**

b) Prove that for laminar flow in a round pipe, the drop of pressure ΔP over a finite length L is given by :

$$\Delta P = \left(8\mu VL / R^2\right)$$

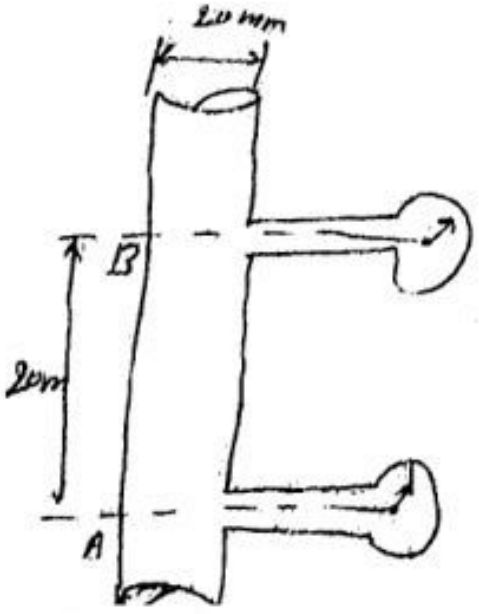
Where, V = Average velocity of flow in the pipe.

R = Radius of pipe. **(8)**

OR

3. a) A smooth pipe line of 100 mm diameter carries 2.27 m^3 per minute of water at 20°C with kinematic viscosity of 0.0098 stokes. Calculate The friction factor, maximum velocity as well as shear stress at the boundary. **(8)**

b) Crude oil of $\mu = 1.5$ poise and relative density 0.9 flows through a 20 mm diameter vertical pipe. The pressure gauges fixed 20 m apart read 58.86 N/cm^2 and 19.62 N/Cm^2 and shown in fig. Find the direction and rate of flow through the pipe.



(8)

Unit - IV

4. a) Derive an expression for the power transmission through the pipes. Find also the condition for maximum transmission of power. **(8)**

b) Three pipes of 400 mm, 200mm, and 300 mm diameters have lengths of 400 m, 200 m & 300 m respectively. They are connected in series to make a compound pipe. The ends of this compound pipe are connected with two tanks whose difference of water levels is 16m. If co - efficient of friction for these pipes is same and equal to 0.005, determine the dischrage through the compound pipe reglecting first the minor losses and then including them. **(8)**

OR

4. a) Define an arifice meter. Prove that the discharge through an orifice meter is given by the relation :

$$Q = C_d \frac{a_0 a_1}{\sqrt{a_1^2 - a_2^2}} \sqrt{2gh}$$

Where : a_1 = Area of pipe in which orific meter in fitted. a_2 = Area of orifice. **(8)**

b) A 150 mm diameter pipe reduces in diameter abruptly to 100 mm diameter. If the pipe carries water at 30 litres per second, calculate the pressure loss across. the contraction. Take the co-efficient of contraction as 0.6. **(8)**

Unit - V

5. a) A water turbine has a velocity of 6 mts at the entrance to the draft - tube and a velocity of 1.2 mts at the exit. For friction losses of 0.1m and a fail water 5 m below the entrance to the draft - tube, find the pressure head at the entrance. **(8)**

b) Describe the following hydraulic system in details describing their working; Hydraulic Accumulator, Hydraulic Intensities, Hydraulic coupling and hydraulic torque converter. **(2×4=8)**

OR

5. a) Prove that for hydraulic efficiency can be expressed by :

$$y_n = \frac{2}{2 + \tan^2 \frac{}{a}}$$ **(8)**

b) A pelton wheel is to be designed for a head of 60 m when running at 200 rpm. The pelton wheel develops 95.6475 KW shaft power. The velocity of the buckets = 0.45 times the velocity of the jet, overall efficiency = 0.85 and co-efficient of the velocity is equal to 0.98. **(8)**