B.E. (Mechanical Engineering / Power Engineering) (New) Third Semester (C.B.S.)

Fluid Mechanics

P. Pages : 4 **NRT/KS/19/3314/3340**

Time : Three Hours * 0 2 0 9 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Explain the following fluid properties **any four.** **8**

i) Specific gravity ii) Viscosity

iii) Surface tension iv) Capillary

v) Compressibility vi) Vapour pressure

b) A plate, 0.025 mm distant from a fixed plate, moves at 60 cm/s and require force 2 N per unit area to maintain this speed. Determine the fluid viscosity between the plates. **5**

OR

2. a) Define the following and give one practical example for each - **6**

i) Turbulent flow

ii) Steady flow and

iii) Uniform flow

b) The velocity vector in a fluid flow is given by $V = 2x^2\hat{i} - 5x^2y\hat{j} + 4t\hat{k}$. **7**
Find the velocity and acceleration of a fluid particle at (1, 2, 3) at time, t = 1.

3. a) State the Pascal law and Hydrostatics law. Also explain different type of manometer. **6**

b) A differential manometer is connected at the two points A and B as shown in figure 1. The pipe A contain a liquid of Sp. gravity = 1.5 while pipe B contain a liquid of sp. gravity = 0.9. the pressure at A and B are 10 N/m^2 and 18 N/m^2 respectively. Find difference in mercury level in the differential manometer. **7**

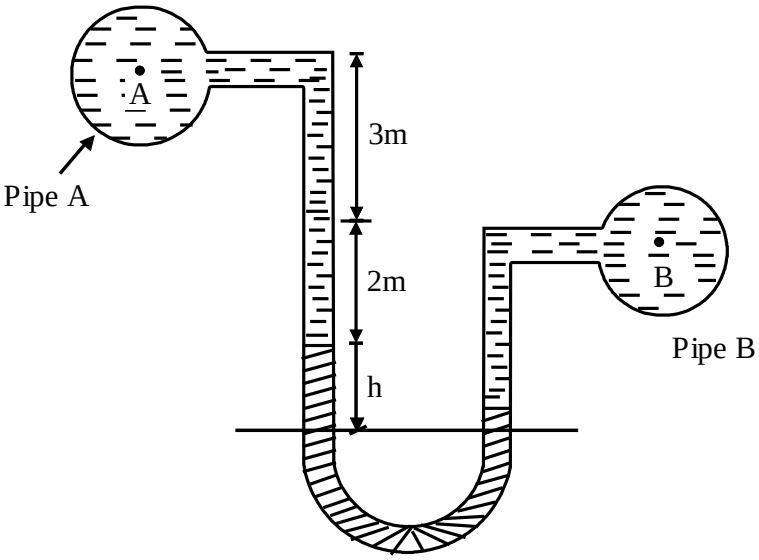

Figure. 1

OR

4. a) Explain the terms, metacentre and metacentric height. Give its significance in practical problem. **6**

b) Determine the total pressure and centre of pressure on an isosceles triangular plate of base 5m and altitude 5m when the plate is immersed vertically in an oil of sp. gravity 0.8. The base if plate is 1m below the free surface of oil. **7**

5. a) Explain Euler equation and deduce Bernoulli's equation from it. Also sate assumption made in the derivation of Bernoulli's equation. **7**

b) Water is flowing through a pipe having diameter 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.5 N/cm^2 and the pressure at the upper end is 9.81 N/cm^2. The difference in datum is 13.7 m. Determine the rate of flow through the pipe. **7**

OR

6. a) Derive the expression for discharge of venturimeter connected to the vertical pipe line. **7**

b) An orifice meter with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure difference measured by a mercury oil differential manometer on the two sides of the orificemeter gives a reading of 50 cm of mercury. Find the rate of flow of oil of sp. gravity 0.9 when coefficient of discharge of the meter = 0.64. **7**

7. a) For the laminar flow through a circular pipe, prove that - **6**

i) the shear stress variation across the section of the pipe is linear and

ii) the velocity variation is parabolic

b) Water is flowing between two large parallel plates which are 2 mm apart. Determine **7**
i) maximum velocity
ii) pressure drop per unit length and
iii) the shear stress at walls of the plate if the average velocity is 0.4 m/s.
Take viscosity of water as 0.01 poise.

OR

8. a) What are the method of dimensional analysis ? Describe the Rayleigh's method for dimensional analysis. **6**

b) The efficiency n of geometrically similar fan depends upon the mass density of air ρ its viscosity μ, speed of fan N, diameter of blades D and discharge Q. Obtain equation of efficiency using dimensional analysis. **7**

9. a) Explain major and minor losses take place in the pipe flow. **5**

b) Determine the difference in the elevation between the water surface in the two tanks which are connected by a horizontal pipe of diameter 320 mm and length 380 m. The rate of flow of water through the pipe is 305 litre/s. Consider all losses and f = 0.008.

OR

10. a) Write a shorts note on **any three.** **6**

i) Equivalent pipe

ii) Compound pipe

iii) Efficiency of power transmission in pipe.

iv) HGL & TEL

b) A syphon of diameter 225 mm connects two reservoir having a difference in elevation of 15 m. The total length of the syphon is 600 m and the summit is 4.5 m above the water level in the upper reservoir. If the separation take place at 2.73 m of water absolute, find the maximum length of the syphon from upper reservoir to the summit. Take f = 0.004 and atmospheric pressure = 10.3 m of water. **7**

11. a) Explain the boundary layer formation on the solid surface. What are the different methods of preventing the separation of boundary layers ? **7**

b) Water is flowing over a thin smooth plate of 4.5 m and width 2.5 m at a velocity of 0.9 m/s. If the boundary layer flow changes from laminar to turbulent at a Reynold number 5×10^5, find - **7**
i) the distance from the leading edge upto which boundary layer is laminar
ii) thickness of the boundary layer at the transition point,
iii) the drag force on-one side of the plate take viscosity of water as 0.01 poise.

OR

12. a) Differentiate between : **6**

i) Pressure drag and friction drag

ii) Drag & lift

iii) Streamlines body and bluff body.

b) A kite 60 cm x 60 cm weighing 3N assumes an angle of 10º to the horizontal the string attached to the kite makes an angle of 45º to the horizontal. If the pull on the string is 30 N when the wind is flowing at a speed of 40 km/hr. Find the corresponding co-efficient to drag and lift. Density of air is given as 1.25 kg/m^3. **8**

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