Roll No. | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(AE) (2011 onwards) (Sem.–4)

FLUID MECHANICS AND MACHINERY

Subject Code : BTAE-403

Paper ID : [A1163]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Write briefly :

a) Differentiate between Newtonian and non-Newtonian fluids.

b) State Pascal's law. Give its engineering applications.

c) Define metacentric height.

d) Distinguish between surface tension and capillarity.

e) What is hydraulic and energy gradient line?

f) What is Mach number? Give examples where it is applicable.

g) Write the continuity equation for compressible fluid flow.

h) What is uniform and non-uniform flow?

i) What is meant by flow losses in pipes?

j) What is the function of a hydraulic accumulator?

SECTION-B

2 A solid cylinder of diameter 4.0 *m* has a height of 4.0 *m*. Find the metacentric height of the cylinder if the specific gravity of the material of cylinder = 0.6 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable.

3 The velocity vector in a fluid flow is given $V = 4x^3\, i - 10x^2 y\, j + 2t\, k$. Find the magnitude of velocity and acceleration of a fluid particle at (2,1,3) at time $t = 1$.

4 What are the basic components of a turbo machine? Give detailed classification of turbo machine.

5 Distinguish between centrifugal and axial pumps.

6 Explain the principle of Pitot-tube. Derive the expression of flow velocity using this principle.

SECTION-C

7 State Buckingham's π theorem. Show that velocity through a circular orifice is given by $V = \sqrt{(2gh)}\,\Phi[D/H, \mu/\rho VH]$ where H is the head causing flow, D is the diameter of the orifice, μ is the co-efficient of viscosity, ρ is the mass density and g is the acceleration due to gravity. (10)

8 a) Write Bernoulli's equation. State the assumptions for its derivations. (4)

b) A closed tank of a fire engine is partly filled with water, the air space above being under pressure. A 5 *cm* hose connected to the tank discharges on the roof of building 2 *m* above the level of water in the tank. The friction losses are 50 *cm* of water. What air pressure must be maintained in the tank to deliver 15 *litres/s* on the roof? (6)

9 a) Discuss the briefly the minor head losses in pipe flow. Under what conditions they are significant as compared to friction losses? (5)

b) Describe the constructional features and principle of working of Venturimeter. (5)