

B.E. DEGREE EXAMINATIONS NOV/DEC 2010

Third Semester

U07ME303: FLUID MECHANICS AND MACHINERY

(Common to Aeronautical Engineering and Mechanical Engineering)

(Approved charts for the properties of fluids may be permitted)

Time: Three Hours

Maximum Marks: 100

Answer ALL Questions:-

PART A (10 x 1 =10 Marks)

1. An ideal flow of any fluid must fulfill the following
 - (a) Newton's law of motion
 - (b) Newton's law of viscosity
 - (c) Pascal's law
 - (d) continuity equation
2. Which of the following is dimensionless
 - (a) Specific weight
 - (b) specific volume
 - (c) specific speed
 - (d) specific gravity
3. The buoyancy depends on
 - (a) mass of liquid displaced
 - (b) viscosity of liquid
 - (c) pressure of liquid displaced
 - (d) depth of immersion
4. Piezometer is used to measure
 - (a) pressure in the pipe,channel
 - (b) atmospheric pressure
 - (c) very low pressure
 - (d) difference in pressure between two points
5. For a body floating in a liquid the normal pressure exerted by the liquid acts at
 - (a) bottom surface of the body
 - (b) c.g.of the body
 - (c) meta centre
 - (d) all points on the surface of the body
 - (e) none of the above
6. During the opening of a valve in a pipe line, the flow is
 - (a) steady
 - (b) unsteady
 - (c) uniform
 - (d) laminar
7. A hydraulic ram acts like
 - (a) a centrifugal pump
 - (b) a rotary pump
 - (c) a reciprocating pump
 - (d) an impulse pump
8. Francis turbine is best suited for
 - (a) medium head application from 24-180m
 - (b) low head installation upto 30m
 - (c) high head installation up to 180m
 - (d) all types heads
9. Flow rate in gear pump
 - (a) increase with increase in pressure
 - (b) decrease with increase in pressure
 - (c) constantwith increase in pressure
 - (d) unpredictable

10. For pumping viscous oil, which pump will be used

- (a) turbine pump (b) screw pump (c) centrifugal pump (d) reciprocating pump

PART B (10 x 2 = 20 Marks)

11. Define kinematic viscosity

12. What are the properties of ideal fluid?

13. What are the types of fluid flow?

14. Define Dimensional Analysis

15. What is boundary force?

16. Write the Darcy- weisbach formula and where it is used?

17. Define specific speed of turbine?

18. What is a draft tube? In which type of turbine it is mostly used?

19. Define speed ratio and what is the speed ratio for kaplan turbine?

20. What is indicator diagram?

PART C (5 x 14 = 70 Marks)

21. (a) If the variation of velocity with distance from the surface, y is given by $u = 10y^{0.5}$ where u is in m/s and y is in a flow field up to $y=0.08$ m, determine the wall shear stress and the shear stress at $y = 0.04$ and 0.08 m from the surface.

(OR)

(b) A U- tube manometer has both its limbs enlarged to 25 times the tube area. Initially the tube is filled to some level with oil of specific weight w_g . then both limbs are filled with fluid of specific weight w_s to the same level, both limbs being exposed to the same pressure. when a pressure is applied to one of the manometric fluid rises by h m. derive an expression for the pressure difference in the limbs. In both cases assume that the liquid level remains in the enlarged section.

22. (a) State the Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's equation.

(OR)

(b) A pump with centre line 2m above the sump water level develops 50m head of water. The suction pipe is of 150 mm ID. The loss head in the suction line is given by $5 V_s^2/2g$. the delivery line is of 100mm dia and the loss in the line is $12 V_d^2/2g$. the water is delivered through a nozzle of 75 mm dia. The delivery is at 30m above the pump centre line. Determine the velocity at the nozzle outlet and the pressure at the pump inlet.

23. (a) An oil of specific gravity 0.82 and kinematic viscosity $16 \times 10^{-6} \text{ m}^2/\text{s}$ flows in a smooth pipe of 8 cm dia at a rate of 2L/s. determine whether the flow is laminar or turbulent. Also calculate the velocity at the centre line and the velocity at a radius of 2.5 cm. what is head loss for a length of 10 m. what will be the entry length? Also determine the wall shear.

(OR)

- (b) Petrol of sp.gravity 0.7 and kinematic viscosity of $0.417 \times 10^{-6} \text{ m}^2/\text{s}$ flows through a smooth pipe of 250 mm ID. The pipe is 800 m long. The pressure difference between the is 0.95 bar.determine the flow rate.
24. (a) A pelton turbine running at 720 rpm uses 300 kg of water per second. If the head available is 425 m determine the hydraulic efficiency. The bucket deflect the jet by 165° . also find the diameter of the runner and jet. Assume $C_V = 0.97$ and $\phi = 0.46$, blade velocity coefficient is 0.9.

(OR)

- (b) A francis turbine developing 16120 kw under an a head of 260 m runs at 600 rpm. The runner outside diameter is 1500 mm and the width is 135 mm. the flow rate is $7 \text{ m}^3/\text{sec}$. the exit velocity at the draft tube out let is 16 m/s. assuming zero whirl velocity at exit and neglecting blade thickness determine the overall and hydraulic efficiency and rotor blade angle at inlet, also find the guide vane outlet angle.
25. (a) The diameter and width of a centrifugal pump impeller are 50 cm and 2.5 cm. the pump runs at 1200 rpm. The suction head is 6 m and the delivery head is 40 m. the friction drop in suction is 2 m and in the delivery 8 m. the blade at out let is 30° . the manometer efficiency is 80% and the overall efficiency is 75%. Determine the power required to drive the pump. Also calculate the pressure at the suction and delivery side of the pump.

(OR)

- (b) A single acting reciprocating of pump handles water. The bore and stroke of the unit are 20 cm and 30 cm. the suction pipe diameter is 12 cm and length is 8 m. the delivery pipe diameter is 12 cm and length is 24 m. $f = 0.02$. the speed of operation is 32 rpm. Determine the friction power with and without air vessels.
