Reg. No. : | | | | | | | | | | |

Question Paper Code: 43704

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Third Semester

Mechanical Engineering

14UME304 - FLUID MECHANICS AND MACHINERY

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. A fluid in which resistance to deformation is independent of the shear stress is known as

   (a) Pseudo plastic fluid (b) Bingham plastic fluid
   (c) Dilatant fluid (d) Newtonian fluid

2. A flow is said to be rotational when

   (a) The streamlines are curved.
   (b) A velocity gradient in the normal direction to flow exist
   (c) Every fluid element has finite angular velocity about it mass center
   (d) Every fluid element has an angular velocity about a common axis

3. Navier stokes equation represents the conservation of

   (a) mass (b) momentum (c) energy (d) pressure

4. For fully developed, laminar flow through circular pipes Darcy friction factor is given by

   (a) $f = 16/Re$ (b) $f = 64/Re$ (c) $f = 4/Re$ (d) $f = 32/Re$

5. Geometric similarity between model and prototype means the similarity of

   (a) discharge (b) linear dimensions (c) motion (d) forces

6. Euler's number relates

(a) Pressure force & Viscous force
(b) Inertia force & elastic force
(c) Inertia force & gravity force
(d) Inertia force & pressure force

7. A draft tube is used with

(a) Centrifugal pump
(b) Axial flow pump
(c) Reaction turbine
(d) Reciprocating compressor

8. Kaplan turbine is a propeller turbine in which the vanes fixed on the hub are

(a) non-adjustable
(b) adjustable
(c) fixed
(d) none of these

9. In axial flow turbines fluid enters and leaves as follows

(a) Radially, axially
(b) Axially, axially
(c) Axially, radially
(d) Combination of axial & radial

10. Cavitation can take place in case of

(a) Pelton Wheel
(b) Francis Turbine
(c) Centrifugal Pump
(d) Both (b) and (c)

PART - B (5 x 2 =10 Marks)

11. Define surface tension.

12. List out the minor energy losses in pipe.

13. State the methods of dimensional analysis.

14. Define hydraulic efficiency of a turbine.

15. What is meant by priming?

PART - C (5 x 16 = 80 Marks)

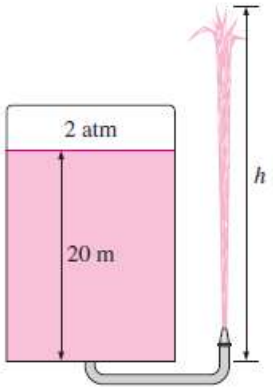
16. (a) (i) Ten litres of a liquid of specific gravity 1.3 is mixed with eight litres of a liquid of specific gravity 0.8. If the bulk of the liquid shrinks by one percent on mixing. Calculate specific gravity, the volume and the weight of the mixture. (10)

(ii) What is the bulk modulus of elasticity of a liquid which is compressed in a cylinder from a volume of 0.0125 m^3 at 80 N/cm^3 pressure to a volume of 0.0124 m^3 at 150 N/cm^2 pressure? (6)

Or

(b) A hollow cylinder of 150 mm OD with its weight equal to the buoyant forces is to be kept floating vertically in a liquid with a surface tension of 0.45 N/m. The contact angle is 60°. Determine the additional force required due to surface tension. (16)

17. (a) (i) The water level in a tank is 20 *m* above the ground. A hose is connected to the bottom of the tank, and the nozzle at the end of the hose is pointed straight up. The tank cover is airtight, and the air pressure above the water surface is 2 *atm* gage. The system is at sea level. Using Bernoulli's equation, Determine the maximum height to which the water stream could rise. (10)



(ii) What are the assumptions made in Bernoulli's equation .State their limitation. (6)

Or

(b) A horizontal Venturimeter with inlet diameter 200 mm and throat diameter 100 mm is employed to measure the flow of water. The reading of the differential manometer connected to the inlet is 180 mm of mercury. If Cd = 0.98, determine the rate of flow. (16)

18. (a) The power developed by hydraulic machines is found to depend on the head *h*, flow rate *Q*, density ρ, speed *N*, runner diameter *D*, and acceleration due to gravity, *g*. Obtain suitable dimensionless parameters to correlate experimental results. (16)

Or

(b) Water is flowing through a pipe of diameter 30 *cm* at a velocity of 4 *m/s*. Find the velocity of oil flowing in another pipe of diameter 10 *cm*, if the condition of dynamic similarity is satisfied between the two pipes. The Viscosity of water and oil is given as 0.01 *poise* and 0.025 *poise*. The specific gravity of oil = 0.8. (16)

19. (a) A Kaplan turbine delivering 40 *MW* works under a head of 35 *m* and runs at 167 *rpm*. The hub diameter is 2.5 *m* and runner tip diameter is 5 *m*. The overall efficiency 87%. Determine the blade angles at the hub and tip and also at a diameter of 3.75 *m*. Also find the speed ratio and flow ratio based on tip velocity. Assume η_H = 90%. (16)

Or

(b) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 *rpm* works against a total head of 40 *m*. The velocity of flow through the impeller is constant and equal to 2.5 *m/s*. The vanes are set back at an angle of 40° at outlet .If the outer diameter of the impeller is 50 *cm* and width at outlet is 5 *cm*. determine (i) vane angle at inlet (ii) work done by the impeller on water per second (iii) manometric efficiency. (16)

20. (a) A single acting reciprocating pump, running at 50 *r.p.m*. delivers 0.01 m^3/s of water the diameter of the piston is 200 *mm* and stroke length 400 *mm*. Determine

(i) The theoretical discharge of the pump

(ii) Co-efficient of discharge

(iii) slip and percentage of slip of the pump. (16)

Or

(b) Explain about working principle of reciprocating pump with neat sketch. (16)

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