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

Question Paper Code: 43704

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

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. Capillary rise or fall

   (a) are noticed only in very smooth tubes
   (b) are due to surface tension of the liquid and the tube material
   (c) depends upon the pressure of the surroundings
   (d) does not depend upon the tube material

2. A stream line is a line

   (a) which is along the path of a particle
   (b) which is always parallel to the main direction of flow
   (c) across which is no flow
   (d) on which tangent drawn at any point gives the direction of velocity

3. The Bernoulli's equation refers to conservation of

   (a) Mass (b) Linear momentum (c) Angular momentum (d) Energy

4. The following instruments are used in the measurement of discharge through a pipe: 1. Orifice meter, 2. Flow nozzle and 3. Venturimeter. Decreasing order of use

   (a) 1, 3, 2 (b) 1, 2, 3 (c) 3, 2, 1 (d) 2, 3, 1

5. The square root of the ratio of inertia force to gravity force is called

   (a) Reynold number (b) Froude number (c) Mach number (d) Euler number

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. The use of a draft tube in a reaction type water turbine helps to

(a) Prevent air from entering
(b) Increase the flow rate
(c) Convert the kinetic energy to pressure energy
(d) Eliminate eddies in the downstream

9. Which one of the following pumps is not a positive displacement pump?

(a) Reciprocating pump
(b) Centrifugal pump
(c) Vane pump
(d) Lobe pump

10. Which of the following pump is preferred for flood control and irrigation purpose?

(a) centrifugal pump
(b) axial flow pump
(c) mixed flow pump
(d) reciprocating pump

PART - B (5 x 2 =10 Marks)

11. List the types of fluid flow.

12. Define boundary layer thickness.

13. State Reynold's model law.

14. Classify hydraulic turbine with respect to head available at inlet.

15. Define net positive suction head.

PART - C (5 x 16 = 80 Marks)

16. (a) A plate having an area of 0.6 m^2 is sliding down the inclined plane at 30° to the horizontal with a velocity of 0.36 *m/s*. There is a cushion of fluid 1.8 *mm* thick between the plane and the plate. Find the viscosity of the fluid if the weight of the plate is 280 *N*. (16)

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) Oil with specific gravity of 0.85 with a kinematic viscosity of 6×10^{-4} m^2/s flows in a 15 *cm* pipe at a rate of 0.020 m^3 *s*. What is the head loss per 100 *m* length of pipe? (8)

(ii) A Pipe (1) 450 *mm* in diameter branched in to two pipes (2 and 3) of diameters 300 *mm* and 200 *mm* respectively as shown in Figure 1. If the average velocity in 450 *mm* diameter pipe is 3 *m/s*. Find

(1). Discharge through 450 *mm* diameter pipe

(2). Velocity in 200 *mm* diameter pipe if the average velocity in 300 *mm* pipe is 2.5 *m/s*. (8)

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 size of droplet(*d*) produced by liquid spray nozzle depends up on the nozzle diameter *D*, jet velocity *V*, liquid density ρ and viscosity μ and surface tension σ. Using Buckingham's pi theorem, obtain the dimensionless parameters. (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 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 deflects the jet by 165°. Also find the diameter of the runner and jet. Assume C = 0.97 and f = 0.46, Blade velocity coefficient is 0.9. (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) Explain the working principle of lobe pump and vane pump with a neat sketch. (16)

Or

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

———————