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Question Paper Code: 43704

B.E. / B.Tech. DEGREE EXAMINATION, NOV 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. 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. Navier stokes equation represents the conservation of

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

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. Reynold's number is given by

(a) Viscous force / Inertial force (b) Inertial force / Viscous force
(c) Gravitational force / Viscous force (d) Pressure force / Viscous force

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. A hydraulic turbine working under a head of 16 m develops 640 *kW* power. The unit power of the turbine is

(a) 10 *kW* (b) 40 *kW* (c) 60 *kW* (d) 160 *kW*

9. Cavitation can take place in case of

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

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

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

PART - B (5 x 2 =10 Marks)

11. List the types of fluid flow.

12. Define boundary layer thickness.

13. State Buckingham's π theorem.

14. Define hydraulic efficiency of a turbine.

15. What is meant by priming?

PART - C (5 x 16 = 80 Marks)

16. (a) What are the gauge pressure and absolute pressure at a point 3 m below the free surface of a liquid having a density of 1.53 X 10^3 kg/m^3, if the atmospheric pressure is equivalent to 750 mm of mercury? The specific gravity of mercury is 13.6 and density of water is 1000 kg/m^3. (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) State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's equation and state the assumptions made. (16)

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) Using Buckingham's π- theorem, show that the velocity through a circular orifice in a pipe is given by $v = \sqrt{(2gH)}\ f\{d/H, \mu/\rho vH\}$ where v is the velocity through orifice of diameter d and H is the head causing the flow and ρ and μ are the density and dynamic viscosity of the fluid passing through the orifice and g is acceleration due to gravity. (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 deflect the jet by 165°. Also determine the diameter of the runner and jet. Assume C_v = 0.97 and Φ = 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) The following details refer to a centrifugal pump. Outer diameter: 30 cm, Eye diameter: 15 cm, Blade angle at inlet: 30°, Blade angle at outlet: 25° and Speed 1450 rpm. The flow velocity remains constant. The whirl at inlet is zero. Determine the work done per kg. If the nanometric efficiency is 82%, determine the working head. If width at outlet is 2 cm, determine the power η_o = 76%. (16)

Or

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