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

Question Paper Code: 41374

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2016

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. For a Newtonian fluid

   (a) shear stress is proportional to shear strain
   (b) shear stress is proportional to rate of shear strain
   (c) rate of shear stress is proportional to shear strain
   (d) rate of stress is proportional to rate of shear strain

2. Local atmospheric pressure is measured by

   (a) thermometer (b) manometer
   (c) barometer (d) hydrometer

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. The dimension for torque is

(a) ML^2T^{-2} (b) $ML^{-2}T^{-2}$ (c) $ML^{-1}T^{-2}$ (d) $ML^{-1}T^{-2}$

7. Francis.kaplan and propeller turbines fall under the category of

(a) impulse turbine (b) reaction turbine
(c) axial flow turbine (d) impulse reaction turbine

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. If pump NPSH requirement are not satisfied

(a) it will consumes excess power (b) it will not develop head
(c) it will cavitate (d) efficiency will be low

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. Explain no slip condition of viscous fluid.

12. State the Bernoulli's equation and explains its terms.

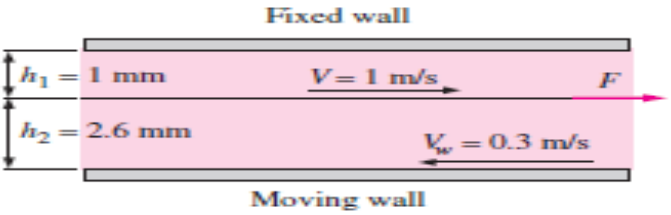
13. Differentiate between kinematic similarity and dynamic similarity.

14. Differentiate between impulse turbine and reaction turbine.

15. Define net positive suction head.

PART - C (5 x 16 = 80 Marks)

16. (a) A thin 20*cm* x 20*cm* flat plate is pulled at 1 *m/s* horizontally through a 3.6 *mm* thick oil layer sandwiched between two plates, one stationary and the other moving at a constant velocity of 0.3 *m/s*, as shown in below figure. The dynamic viscosity of oil is 0.027 *Pa s*. Assuming the velocity in each oil layer to vary linearly, (*a*) plot the velocity profile and find the location where the oil velocity is zero and (*b*) determine the force that needs to be applied on the plate to maintain this motion.

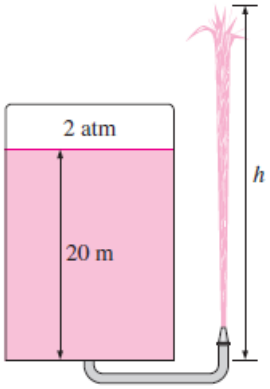


(16)

Or

(b) The dynamic viscosity of oil, used for lubrication between a shaft and sleeve is 6 *poise*. The shaft is of diameter 0.4 *m* and rotates at 190 *rpm*. Calculate the horse power lost in the bearing for a sleeve length of 90 *mm*. The thickness of the oil film is 1.5 *mm*. (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) An oil of specific gravity 0.9 and viscosity 0.06 *poise* is flowing through a pipe of diameter 20 *cm* at the rate of 60 *lit/sec*. Find the head lost due to friction for a 500 *m* length of pipe and power required to maintain the 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) The efficiency η of a fan depends on density ρ, dynamic viscosity μ, angular velocity ω, diameter D of the rotor and discharge Q Express the efficiency in terms of dimensionless parameters. (16)

19. (a) A pelton wheel is required to develop 8000 *kW* when working under a head of 350 *m* at a speed of 550 *rpm*. If the overall efficiency is 86 %, find (i) quantity of water required (ii) diameter of wheel (iii) number of jets (iv) number of size of the bucket on runner. Assume a jet ratio of 10, coefficient of viscosity as 0.98 and speed ratio is 0.46. (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) What is reciprocating pump? Describe the principle and working of a reciprocating pump with neat sketch. (16)

Or

(b) A single acting reciprocating pump is to raise a liquid of density 1200 kg/m^3 through a vertical height of 11.5 *m*, from 2.5 *m* below pump axis to 9 *m* above it. The plunger, which moves with S.H.M has a diameter of 12.5 *cm* and stroke 22.5 *cm*. The suction and delivery pipes are 7.5 *cm* diameter and 3.5 *m* and 13.5 *m* long respectively. There is a large air vessel placed on the delivery pipe near pump axis. But there is no air vessel on the suction pipe. If separation takes place at 0.9 kg/cm^2 below atmosphere pressure. Fine maximum speed with which pump can run without separation taking place and power required to drive the pump if $f = 0.02$. Neglect slip for the pump. (16)