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

Question Paper Code: 51734

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

Third Semester

Mechanical Engineering

15UME304 - FLUID MECHANICS AND MACHINERY

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The SI unit of kinematic viscosity (υ) is

   (a) m^2/s (b) kg/m-s (c) m/s^2 (d) m^3/s^2

2. An ideal fluid is defined as a fluid which

   (a) is compressible (b) is incompressible
   (c) is incompressible and non-viscous (d) has negligible surface tension

3. Bernoulli's theorem deals with the law of conservation of

   (a) mass (b) momentum (c) energy (d) none of these

4. Which of the following is not a dimensionless parameter

   (a) Reynolds number (b) friction factor
   (c) pressure coefficient (d) kinematic viscosity

5. Froude number is the ratio of inertia force to

   (a) gravitational force (b) surface tension
   (c) elasticity (d) viscosity

6. Dynamic similarity between model and prototype means

(a) the similarity of forces (b) the similarity of motion
(c) the similarity of shape (d) none of these

7. Francis turbine is a

(a) radial flow turbine (b) axial flow turbine
(c) mixed flow turbine (d) inward flow radial type turbine

8. In Kaplan turbine, the number of blades is generally of the order

(a) 2-4 (b) 4-8 (c) 8-16 (d) 16-24

9. Casting of centrifugal pump is designed so as to minimize

(a) friction loss (b) cavitation
(c) static head (d) loss of kinetic energy

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

(a) Centrifugal Pump (b) Reciprocating Pump
(c) Turbine Pump (d) Screw Pump

PART - B (5 x 2 = 10 Marks)

11. Define viscosity.

12. State Bernoulli's theorem.

13. What are the types of fluid flows?

14. What is priming?

15. How will you classify the reciprocating pump?

PART - C (5 x 16 = 80 Marks)

16. (a) Determine the torque, power required to turn 0.12 *cm* long 6 *cm* diameter shaft at 500 *rpm* in a 6.2 *cm* concentric bearing flooded with a lubricating oil of viscosity 0.1 Ns/m^2. (100centipoise). (16)

Or

(b) A hot plate of area 0.125 m^2 is pulled at 0.25 *m/s* with respect to another stationery parallel plate 1*mm* distant from it. The space between the plates containing water of viscosity 0.001 Ns/m^2, find the force necessary to maintain this velocity and also the power required. (16)

17. (a) Derive Hagen-Poiseuille equation and state the assumptions made. (16)

Or

(b) A main pipe divides into two parallel pipes which again form one pipe. The length and diameter for the first parallel pipe are 2000 *m* and 1.5 *m* respectively, while length and diameter of second parallel pipe are 2000 *m* and 1.25 *m*. Find the rate of flow in each parallel pipe if total in main is 34 *m/S*. Coefficient of friction for each parallel pipe is same and equal to 0.008. (16)

18. (a) The efficiency η of a fan depends on the diameter *D* of the rotor, kinematic viscosity γ of the fluid, the angular velocity ω and the discharge *Q*. Using Buckingham's π theorem, show that the discharge *Q* through a centrifugal pump can be expressed as $\eta\ \varphi\ [Q/\omega D^3, \omega D^2/\gamma]$. (16)

Or

(b) An oil of specific gravity 0.92 and viscosity 0.03 Poise is to be transported at the rate of 2500 *l/s* through a pipe of 1.2 *m*. Tests are conducted on a 12 *cm* pipe using water at 20°*C*. If viscosity water at 20°*C* is 0.01 Poise, find (i) velocity of flow in model (ii) rate of flow in the model. (16)

19. (a) Explain the working principle of centrifugal pump with neat sketch. (16)

Or

(b) A Pelton wheel is to develop 13250 *kW* under a net head of 800 *m* while running at a speed of 600 *rpm*. If co efficient of velocity = 0.97, speed ratio = 0.46 and the ratio of jet diameter is 1/15 of wheel diameter. Calculate (i) number of jets (ii) diameter of jets (iii) diameter of wheel (iv) quantity of water supplied to wheel. Assume η_o=85%. (16)

20. (a) Illustrate the working principle of external gear pump with a neat sketch. Also mention its advantages and disadvantages. (16)

Or

(b) A single acting reciprocating pump has a stroke of 30 *cm*, piston diameter 150 *mm* and the speed is 50 *rpm*. The pump is required to lift water to the height of 18 *m*. Find theoretical discharge if the actual discharge is 4 *litre/sec* and mechanical efficiency is 80 %. Find volumetric efficiency, slip, theoretical power and actual power required. (16)