A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 53704

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

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 property of a liquid which offers resistance to the movement of one layer of liquid over another adjacent layer of liquid, is called CO1- R

   (a) Surface tension (b) Compressibility (c) Capillarity (d) Viscosity

2. A flow in which the quantity of liquid flowing per second is constant, is called CO1- R

   (a) Steady flow (b) Streamline flow (c) Turbulent flow (d) Unsteady flow

3. The hydraulic mean depth for a circular pipe of diameter(d) is CO2- R

   (a) d/6 (b) d/4 (c) d/2 (d) d

4. The total energy line lies over the hydraulic gradient line by an amount equal to the CO2- R

   (a) Pressure head (b) Velocity head

   (c) Pressure head + velocity head (d) Pressure head-velocity head

5. The square root of the inertia force of a flowing fluid to the elastic force called CO3- R

   (a) Mach number (b) Reynolds number

   (c) Weber number (d) Froude number

6. The dimension of velocity is CO3- R

   (a) LT^{-1} (b) T^{-1} (c) LT^{-2} (d) $L^{3}T^{-1}$

7. A pelton wheel is CO4- R

(a) Tangential flow impulse turbine (b) Inward flow impulse turbine

(c) Outward flow impulse turbine (d) Inward flow reaction turbine

8. Multi-stage centrifugal pumps are used to CO4- R

(a) Give high discharge (b) Produce high heads

(c) Pump viscous fluids (d) All of the above

9. If the net positive suction head requirement for the pump is not satisfied, then CO5- R

(a) No flow will take place (b) Cavitation will be formed

(c) Efficiency will be low (d) Excessive power will be consumed

10. Which of the following pump is preferred for flood control and irrigation applications? CO5- R

(a) Centrifugal pump (b) Axial flow pump

(c) Mixed flow pump (d) Reciprocating pump

PART – B (5 x 2= 10 Marks)

11. Distinguish between ideal and real fluids. CO1- R

12. List out the minor losses. CO2- R

13. State the Buckingham π theorem. CO3- R

14. Define hydraulic efficiency. CO4- R

15. When will you select a reciprocating pump? CO5- R

PART – C (5 x 16= 80 Marks)

16. (a) Determine the viscous drag torque and power observed one surface of a collar bearing half 0.2 m ID and 0.3 m OD with an oil film thickness of 1 mm and a viscosity of 30centi-poise if it rotates at 500 rpm. CO1- App (16)

Or

(b) Calculate the capillary rise in glass type of 2.5 mm diameter when immersed vertically in
(a) Water
(b) Mercury
Take surface tension σ = 0.0725 N/m for water and σ =0.52 N/m for mercury. The specific gravity for mercury 13.6 and angle of contact =130^o. CO1- App (16)

17. (a) Calculate the discharge through a pipe of diameter 200 mm when the difference of pressure head between the two ends of pipe 500 m apart is 4 m of water. Take value of f = 0.009 and $h_f = 4fLV^2 / 2gd$. CO2- App (16)

Or

(b) A horizontal pipe of 400 mm diameter is suddenly contracted to a diameter of 200 mm. The pressure intensities in the large and small pipe are given as 15 N/cm^2 and 10 N/cm^2 respectively. Find the loss of head due to contractio0n, if C_c = 0.62, determine also the rate of flow of water. CO2- App (16)

18. (a) Find an expression for the drag force on smooth sphere of diameter D moving with uniform velocity v in fluid density ρ and dynamic viscosity μ. CO3- Ana (16)

Or

(b) A 7.2 m high and 15 m long spillway discharges 94 m^3/s under a head of 2 m. If a 1:9 scale model of this spillway is to be constructed, determine the model law to be used, model dimensions, head at spillway and discharge in the model. If model experiences a force of 764 N, determine force on prototype. CO3- Ana (16)

19. (a) A francis turbine has an inlet diameter of 2 m and an outlet diameter of 1.2 m. The breath of the blades is constant at 0.2m. The runner rotates at a speed of 250 rpm with a discharge of 8 m^3 per sec. The vanes are radial at the inlet and the discharge is radially outwards at the outlet. Calculate the angle of guide vane at the inlet and blade at the outlet. CO4- App (16)

Or

(b) A centrifugal pump runs at 1000 rpm with their vane angles at inlet and outlet as 20^0 and 35^0 respectively. The internal and external diameters are 25 cm and 50 cm respectively. Find the work done per N of water assuming velocity of flow as constant. Water enters radially through the pump. CO4- App (16)

20. (a) A double acting reciprocating pump, running at 50 rpm is discharging 900 liters of water per minute. The pump has a stroke of 400 mm. The diameter of piston is 250 mm. The delivery and suction heads are 25 m and 4 m respectively. Find the slip of the pump and power required to drive the pump. CO5- App (16)

Or

(b) A double acting reciprocating pump has a cylinder of 250 mm diameter and stroke of 450 mm. The pump delivers water to a height of 15 meters through a pipe 40 meters long and 125 mm diameter at 35 rpm. Find the pressure head in the cylinder at the beginning of the delivery stroke, if a large air vessel is fitted in the delivery pipe at the same level of the pump, but 4 meters from the cylinder. Take f= 0.008. CO5- App (16)