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

Question Paper Code: 33704

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

Third Semester

Mechanical Engineering

01UME304 – FLUID MECHANICS AND MACHINERY

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Define viscosity. Specify its unit in SI & MKS systems.
2. Determine the surface tension acting on the surface of a vertical thin plate of 1m length when it is lifted vertically from a liquid using a force of 0.3*N*.
3. What is the importance of Reynolds number in pipe flow?
4. List few minor losses in flow through pipes.
5. State the principle of dimensional homogeneity.
6. List any two dimensionless parameters and their field of application.
7. State the momentum equation. When can it be applied?
8. Define specific speed of a turbine.
9. Define “slip” in reciprocating pump. What is percentage slip?
10. Compare positive displacement pumps with dynamic Pumps.

PART - B (5 x 16 = 80 Marks)

11. (a) (i) The velocity distribution over a plate is given by $u = 2y - y^2$, where u is the velocity in m/sec at a distance of y metre above the plate. Determine the velocity gradient and shear stress at the boundary and 1.5 m from it. Dynamic viscosity of the fluid is 0.9 Ns/m^2. (8)

(ii) Two large plane surfaces are 125 mm apart. The space between the surfaces is filled with oil of viscosity 0.972 Ns/m^2. A flat thin plate of 0.5 m^2 area moves through the oil at velocity of 0.3 m/s. Calculate the drag force

(a) When the plate is in the middle of the two plane surface and

(b) When the thin plate is at a distance of 30 mm from one of the planes. (8)

Or

(b) In a two dimensional incompressible flow the fluid velocities are given by $u = x - 4y$ and $u = -y - 4x$. Show that velocity potential exists and determine its form. Find also the stream function. (16)

12. (a) (i) List out the assumptions involved in Euler's equation of motion. Derive the Bernoulli equation from Euler's equation in the case of incompressible flow.(10)

(ii) A tap discharges water evenly in a jet at a velocity of 2.6 *m/s* at the tap outlet, the diameter of the jet at this point being 15 *mm*. The jet flows down vertically in a smooth stream. Determine the velocity and the diameter of the jet at 0.6 *m* below the tap outlet. (6)

Or

(b) List out the assumptions involved in Euler's equation of motion. Derive the Bernoulli equation from Euler's equation in the case of incompressible flow. (16)

13. (a) Using Buckingham's π Theorem, show that the velocity through circular orifice is given by: $V = \sqrt{2gH}\, f\left[\frac{D}{H}, \frac{\mu}{\rho V H}\right]$

where, H = Head causing flow
D = Diameter of orifice
μ = Coefficient of viscosity
ρ = Mass density
g = Acceleration due to gravity. (16)

Or

(b) The efficiency η of a fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ω, diameter D of the rotor and the discharge Q. Express the efficiency η in terms of dimensionless parameter. (16)

14. (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) (i) What is axial flow turbine? Name the types of axial flow turbine. (4)

(ii) Explain about the axial flow reaction turbine with neat sketch. (8)

(iii) Give the importance points to be remembered for an axial flow turbine. (4)

15. (a) (i) Explain the construction and working of a single acting reciprocating pump with air vessels fitted. (8)

(ii) Sketch the various types of indicator diagrams of a reciprocating pump. (8)

Or

(b) (i) The plunger diameter and stroke length of a single-acting reciprocating pump are 300 mm and 500 mm respectively. The speed of the pump is 60 rpm. The diameter and length of delivery pipe are 150 mm and 60 m respectively. If the pump is equipped with an air vessel on the delivery side at the centre lane of the pump, find the power saved in overcoming friction in the delivery pipe. Assume Darcy's friction factor as 0.04 and the plunger undergoes a simple harmonic motion. (8)

(ii) Compare the characteristics of Centrifugal Pump and Reciprocating Pump. (8)