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

Question Paper Code: 1143244

B.E. / B.Tech. DEGREE EXAMINATIONS, NOV/ DEC 2024
Third Semester
Mechanical Engineering
CE8394 – FLUID MECHANICS AND MACHINERY
(Regulation 2017)
(Common to Aeronautical Engineering)

Time: Three Hours | Maximum: 100 Marks

Answer ALL questions

PART – A (10 x 2 = 20 Marks)

1. Define specific volume of a fluid and write its unit.
2. What are the assumptions made in the derivation of Euler's equation?
3. List the major and minor losses encountered in pipe flow.
4. Define Boundary Layer Thickness.
5. Write the dimension of surface tension and vapour pressure in MLT system.
6. Define Mach Number.
7. Classify pumps on the basis of transfer of mechanical energy.
8. What is Indicator diagram?
9. Differentiate the impulse and reaction turbine.
10. What is hydraulic efficiency?

PART – B (5 x 13 = 65 Marks)

11. (a) Calculate the specific weight, mass density, specific gravity and specific volume of oil having a volume of $4.5m^3$ and weight of 40kN. (13)

(OR)

(b) State Bernoulli's theorem for a steady flow of an incompressible fluid and construct the expression for Bernoulli's equation. (13)

12. (a) A pipeline carrying oil of specific graving 0.85 changes in diameter from 350 mm at position 1 to 550 mm diameter to a position 2 which is at 6 m at a higher level. If the pressure at position 1 and 2 are taken as 20 N/cm^2 and 15 N/cm^2 respectively and the discharge through the pipe is 0.2 m^3/s. Determine the loss of head and direction of flow. (13)

(OR)

(b) A liquid flows through a short pipe which branches into two parallel pipes A and B each with a length of 50 m and with inside diameter of 25 mm and 50 mm respectively. The ends of the pipes are connected together by another short pipe. Determine the flow through each pipe if they have a drop in elevation of 3 m. Assume a constant Fanning friction factor in both pipes of 0.005. (13)

13. (a) A partially submerged body is towed in water. The resistance R to its motion depends on the density ρ, the viscosity μ of water, length l of the body, velocity V of the body and acceleration due to gravity g. Show that the resistance to motion can be expressed in the from $R = \rho l^2 V^2 \emptyset \left[\left(\frac{\mu}{\rho LV}\right), \left(\frac{lg}{V}\right)\right]$. (13)

(OR)

(b) A 7.2 m high and 15 m long spillway discharge 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 the model experiences a force of 746 N, determine the force on prototype. (13)

14. (a) A centrifugal pump runs at 1000 rpm with their vane angle at inlet and outlet as 20° and 35° respectively. The internal and external diameter are 25 cm and 50 cm respectively. Find the work done per N of water assuming velocity of flow as constant. Assume the water radially entering the pump. (13)

(OR)

(b) Construct the diagram and explain the working principles of types of rotary pumps. (13)

15. (a) Explain the working principle of Kaplan turbine and construct the working proportion of its design. (13)

(OR)

(b) A Pelton wheel has a mean bucket speed of 12 m/s and supplied with the water at the rate of 0.7 m^3/s under a head of 300 m. If the buckets deflect the jet through an angle of 160°, find the power developed and hydraulic efficiency of the turbine. (13)

PART – C (1 x 15 = 15 Marks)

16. (a) A U-tube manometer is used to measure the pressure of oil of specific gravity 0.95 flowing in a pipe line. Its left end is connected to the pipe and the right limb is open to atmosphere. The centre of the pipe is 110 mm below the level of mercury in right limb. If the difference of meucury level in the two limbs is 170 mm. Determine the absolute pressure of the oil in the pipe. (15)

(OR)

(b) A Francis turbine developing 16120 kW under a head of 260m runs at 600rpm. The runner outside diameter is 1500mm, width 135mm, flow rate $7m^3/s$. The exit velocity of draft tube outlet, whirl velocity is 0 at exit. Neglect blade thickness. Determine overall and hydraulic efficiency and rotor blade angle at inlet. Also find guide vane outlet angle. (15)

--------xxxx-------