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Question Paper Code : 71847

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Third Semester

Mechanical Engineering

ME 2204/CE 3213/ME 34/CE 1208/080180007/IE 41/10122 ME 305 — FLUID MECHANICS AND MACHINERY

(Common to Aeronautical Engineering, Automobile Engineering, Production Engineering, Mechatronics Engineering, Mechanical and Automation Engineering and Fourth Semester Manufacturing Engineering, Industrial Engineering and Industrial Engineering and Management)

(Regulation 2008/2010)

(Common to PTME 2204/10122 ME 305 – Fluid Mechanics and Machinery for B.E. (Part-Time) Third Semester – Mechanical Engineering Regulation 2009/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. If a liquid has a viscosity of 0.051 poise and kinematic viscosity of 0.14 stokes, calculate its specific gravity.
2. Define control volume.
3. Mention the use of moody diagram.
4. Differentiate laminar and turbulent flow.
5. State Buckingham's π theorem
6. Define Reynolds number and state its significance.
7. List the range of head for various turbines.
8. Why not the specific speed of a hydraulic turbine be calculated using watts, instead of metric horse power?
9. Tabulate the causes and remedies for a centrifugal pump, when pump fails to pump the fluid.
10. What is a pump turbine? Is it the same as turbine pump?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Classify the fluids according to the nature of variation of viscosity. Give examples. (6)

(ii) Explain the practical significance of the following liquid properties : surface tension, capillarity, and vapour pressure. (10)

Or

(b) Two points (1) and (2) which are at the same level in the body of water in a whirlpool are at radial distances of 1.2 m and 0.6 m respectively from the axis of rotation. The pressure and velocity of water at point (1) and 15 KPa (gauge) and 2 m/s respectively. What are the pressure and velocity at point (2)? What is the difference in water surface elevations above points (1) and (2)? What is the radial distances of a point on the water surface which is at the same level as (1) and (2)?

12. (a) (i) In a City water Supply system, water is flowing through a Pipe line 30 cm in diameter. The Pipe diameter is Suddenly reduced to 20 cm. Estimate the discharge through the Pipe if the difference in pressure across the sudden contraction is 5 kPa. (8)

(ii) A 100 m long pipeline of 300 mm in diameter Contains two 90° elbows and two gate valves (wide open). Calculate the equivalent pipe length and total loss of head when the flow rate is $0.5\ m^3/s$, $f = 0.005$, and the pipe has a sharp entry and exit. (8)

Or

(b) If the velocity distribution in a laminar boundary layer over a flat plate is given by $u/U_\infty = \sin(\pi/2\ y/\delta)$, calculate the value of δ, δ^*, θ and the shear stress. (16)

13. (a) The pressure difference Δp in a pipe of diameter D and length l due to viscous flow depends on the velocity V, viscosity μ and density ρ. Using Buckingham's π - theorem, obtain an expression for Δp. (16)

Or

(b) The characteristics of the spillway are to be studied by means of a geometrically similar modal constructed to the scale ratio of 1:10.

(i) If the maximum rate of flow in the prototype is 28.3 m^3, what will be the corresponding flow in model?

(ii) If the measured velocity in the model at a point on the spillway is 2.4m/s, what will be the corresponding velocity in prototype?

(iii) If the hydraulic jump at the foot of the model is 50 mm high, what will be the height of jump in prototype?

(iv) If the energy dissipated per second in the model is 3.5 Nm, what energy is dissipated per second in the prototype? (16)

14. (a) (i) Enumerate the differences between an impulse turbine and reaction turbine. (10)

(ii) Mention three to four most striking characteristics of: Pelton wheel, Francis turbine and Kaplan turbine. (6)

Or

(b) Determine the rpm, work done per second, power and overall efficiency of a Pelton wheel from the following data. Head = 150 fm, wheel diameter = 0.75 m, jet diameter = 4 cm, deflection angle of buckets = 172°, C_v of nozzle = 0.98, speed ratio = 0.42 and surface roughness factor of vanes = 0.97. (16)

15. (a) Determine the maximum speed in rpm at which a single acting reciprocating pump without an air vessel of the following details can be operated without causing separation at any stage during the operation of the pump. Compute the discharge at this speed. What would be the speed and discharge if air vessel is fitted near the pump on the suction side? The fluid is water. Assume f = 0.01 for the pipes. Diameter of plunger = 15 cm, stroke = 22.5 cm. suction pipe diameter = 10 cm. length 50 m, static suction head = 4 m, static delivery head = 25 m, atmospheric pressure = 101 KPa and vapour pressure of water = 25.5 KPa (abs). (16)

Or

(b) Write a short note on following types of rotary pumps:

(i) Internal gear pump (4)

(ii) External gear pump (4)

(iii) Vanes pumps (4)

(iv) Roots pump. (4)