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Question Paper Code : 70060

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third Semester

Mechanical Engineering

CE 3391 – FLUID MECHANICS AND MACHINERY

(Common to: B.E. Aeronautical Engineering/B.E. Aerospace Engineering/B.E. Industrial Engineering/B.E. Industrial Engineering and Management/B.E. Manufacturing Engineering/B.E. Mechanical Engineering(Sandwich)/B.E. Mechanical and Automation Engineering/B.E. Production Engineering/B.E. Safety and Fire Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the Uses of the Continuity Equation.
2. What are the types of pressure measurements?
3. What do you mean by flow through parallel pipes?
4. What is meant by boundary layer separations?
5. Define undistorted model.
6. Mention the types of similarities.
7. Define specific speed.
8. Give two comparison between impulse and reaction turbine.
9. Define hydraulic efficiency.
10. When will you select a reciprocating pump?

PART B — (5 × 13 = 65 marks)

11. (a) (i) A soap bubble is formed when the inside pressure is 5 N/m² above the atmospheric pressure. If surface tension in the soap bubble is 0.0125 N/m, find the diameter of the bubble formed. (8)

(ii) Where do you observe Venturi effect? (5)

Or

(b) (i) Water is flowing through a pipe of diameter 5 cm under a pressure of 29.43N/cm² (gauge) and with mean Velocity of 2 m/s. Find the total energy per unit weight of the water at a cross-section, which is 5 m above the datum line. (6)

(ii) A Conical tube of length 2 m is fixed vertically with its smaller end upwards. The velocity of flow at the smaller end is 5 m/s while at the lower end it is 2m/s. The pressure head at the smaller end is 2.5 m of liquid. The loss of head in the tube is $0.35(v_1-v_2)^2/2g$, where V_1 is the velocity at smaller end and V_2 at the lower end respectively. Determine the pressure head at the lower end. Flow takes place in the downward direction. (7)

12. (a) In a pipe of diameter 350 mm and length 75 m water is flowing at a velocity of 2.8 m/s. Find the head lost due to friction using:

(i) Darcy – Weisbach formula;

(ii) Chezy's formula (Take C=55)

Assume kinematic viscosity of water as 0.012 stoke.

Or

(b) Two reservoirs have 6 m difference in water levels, and are connected by a pipe 60 cm diameter and 3000 m long. Then, the pipe branches into two pipes each 30 cm diameter and 1500 m long. The friction coefficient is 0.01.

Neglecting minor losses, determine the flow rates in the pipe system?

13. (a) (i) Under laminar conditions, the volume of flow Q through a small triangular-section pore of width b and length L is a function of viscosity μ pressure drop per unit length $\Delta p/L$. and b. Using the pi theorem, rewrite this relation in dimensionless form. How does the volume flow change if the pore size b is doubled? (5)

(ii) Classify the types of similarities (8)

Or

(b) (i) Classify various types of Models. (5)

(ii) What are the use of similitude? (8)

14. (a) (i) Discuss the efficiency of turbine. (7)

(ii) Explain Francis turbine working principle with neat sketch. (6)

Or

(b) The impeller of a centrifugal pump having external and internal diameters 500 mm and 250 mm respectively, width at outlet 50 mm and running at 1200 r.p.m. works against a head of 48 m. The velocity of flow through the impeller is constant and equal to 3 m/s. the vanes are set back at an angle of 40° at outlet. Determine: (i) Inlet vane angle, (ii) Work done by the impeller on water per second and (iii) manometric efficiency.

15. (a) A centrifugal pump running at 920 rpm and delivering 0.32m³/s of water against a head of 28m, the flow velocity being 3m/s. if the manometric efficiency is 80% determine the diameter and width of the impeller. The blade angle at outlet is 25°.

Or

(b) (i) Differentiate the working Principles of centrifugal pump and reciprocating pump. (7)

(ii) How does a rotary vane pump work? (6)

PART C — (1 × 15 = 15 marks)

16. (a) Derive Darcy-Weisbach equation for loss of head due to friction in pipes.

Or

(b) A single acting reciprocating pump running at 50 rpm, delivers 0.01 m³/s of water. The diameter of the piston is 200 mm and stroke length 400 mm. Determine the theoretical discharge of the pump, coefficient of discharge and slip and the percentage slip of the pump.