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

Question Paper Code : 30096

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third/Fourth Semester

Aeronautical Engineering

CE 3391 – FLUID MECHANICS AND MACHINERY

(Common to : Aerospace Engineering/Industrial Engineering/ Industrial Engineering and Management/Manufacturing Engineering/ Materials Science and Engineering/Mechanical Engineering/ Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering/Production Engineering/Safety and Fire Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the Newton's Law of Viscosity.

2. What are the assumption made in continuity equation?

3. Write the expression for head loss due to friction.

4. Define the term "hydraulic gradient line".

5. Define dimensional homogeneity.

6. State Buckingham's π –theorem.

7. What is meant by NPSH?

8. What is draft tube? Why it is used in reaction turbine?

9. Mention the components of the centrifugal pump.

10. Write the advantages of using air vessel?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Calculate the specific weight, density and specific gravity of 1.5 litre of liquid which weighs 10 N. (8)

(ii) Find the surface tension in a soap bubble of 40 mm diameter when the inside pressure is 12 N/m^2 above atmospheric pressure. (5)

Or

(b) A 30 cm diameter pipe, conveying water, branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15 cm pipe, if the average velocity in 20 cm diameter pipe is 2 m/s.

12. (a) Write the short notes on :

(i) Moody's diagram (8)

(ii) Displacement thickness. (5)

Or

(b) (i) List out the types of minor head losses in pipes. (5)

(ii) A pipe, 40 m long, is connected to a water tank at one end and flows freely in atmosphere at the other end. The diameter of pipe is 15 cm for first 25 m from the tank and then the diameter is suddenly enlarged to 30 cm. Height of water in the tank is 8 m above the center of pipes. Darcy's coefficient is 0.01. Determine the discharge neglecting minor losses? (8)

13. (a) The resisting force of (R) of a supersonic flight can be considered as dependent upon the length of aircraft "l", velocity 'V', air viscosity 'μ', air density 'ρ' and bulk modulus of air 'k'. Express the functional relationship between these variables and the resisting force. (13)

Or

(b) (i) What are distorted models? State its merits and demerits. (5)

(ii) What are the advantages of model and dimensional analysis? (4)

(iii) List the primary and derived quantities. (4)

14. (a) Explain the working of Kaplan turbine. Construct its velocity triangles. (13)

Or

(b) Explain the head and efficiencies of Pelton wheel with the help of neat sketch. (13)

15. (a) A centrifugal pump runs at 1000 rpm with their vane angles at inlet and outlet are 20° and 35° 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 is constant. Water enters radially through the pipes. (13)

Or

(b) Explain the working principle of reciprocating pump with neat sketch.(13)

PART C — (1 × 15 = 15 marks)

16. (a) (i) A single-acting reciprocating pump running at 50 r.p.m delivers 0.01 m^3/s of water. The diameter of the piston is 200 mm and Stroke length 400 mm. Determine (1) the theoretical discharge of the pump (2) Co-efficient of discharge (3) Slip and percentage of slip of the pump. (6)

(ii) A pipe of diameter 20 cm and length 2000 m connects two reservoir, having difference of water level as 20. Determine the discharge through the pipe. If an additional pipe of diameter 20 cm and length 2000 m is attached to the last 1200 m length of the existing pipe find the increase in discharge. Take f = 0.015 and neglect minor losses. (9)

Or

(b) The reaction turbine (inward flow turbine) works at 450 rpm under ahead of 115 m. The diameter of the inlet is 1.2 m and the flow area is 0.4 m^3. At the inlet, absolute and the relative velocities make angles of 20° and 60° respectively with tangential velocity of whirl at the outlet to be zero. Determine hydraulic efficiency and power developed. (15)