



B.Tech IV Semester Regular/Supplementary Examinations, September 2023

**Fluid Mechanics and Hydraulic Machines
(Mechanical Engineering)**

Maximum Marks: 70

Date: 15.09.2023 Duration: 3 hours

- Note:
1. This question paper contains two parts A and B.
 2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
 3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
 4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks

(10x2M=20 Marks)

1. Compare the behavior of solids and liquids.
2. A soap bubble, 50 mm in diameter contains a pressure (in excess of atmospheric) of 2 bar. Find the surface tension in the soap film.
3. List the characteristics of laminar flow.
4. Compare rotational and irrotational flow.
5. Write the expression for loss of head at entrance of a pipe.
6. What is hydraulic gradient line?
7. Give example for a low head, medium head and a high head turbine.
8. What is the significance of specific speed?
9. Mention main components of Centrifugal pump.
10. Define slip.

Part-B

Answer All the following questions.

(5X10M=50Marks)

11. (a) Explain the different types of fluids. (4)
(b) Discuss the various properties of fluids. (6)

OR

12. (a) Draw a neat sketch of simple manometer and discuss its working. (4)
(b) A U-tube differential manometer connects two pressure pipes A and B. Pipe A contains carbon tetrachloride having a specific gravity 1.594 under a pressure of 11.772 N/cm^2 and pipe B contains oil of specific gravity 0.8 under a pressure of 11.772 N/cm^2 . The pipe A lies 2.5 m above pipe B. Find the difference of pressure measured by mercury as a fluid filling U-tube. (6)

13. State Bernoulli theorem for steady flow of incompressible fluid. Derive an expression for Bernoulli equation from Eulers equation of motion and state the assumption made in derivation. (10)

OR

14. The water is flowing through a pipe having diameter of 20 cm and 10 cm at section-1 and section-2 respectively. The rate of flow through the pipe is 35 litres per sec. The section-1 is 4 m above the datum line and section-2 is 2 m above datum line. If the pressure at section -1 is 27.27 N/cm^2 . Find the intensity of pressure at section-2. (10)

- 15 Describe boundary layer and the methods of preventing the separation of boundary layer. (10)
OR
- 16 Determine the rate of flow of water through a pipe of diameter 20 cm and length 50 cm, when one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of water in the tank is 4 m above the center of the pipe. Consider the minor losses and take $f = 0.009$. (10)
- 17 Design a Pelton wheel for a head of 60 m, while running at 180 rpm. The Pelton wheel develops a shaft power of 98 kW. The velocity of bucket is 0.45 times the velocity of jet, overall efficiency is 0.85 and coefficient of the velocity is equal to 0.98. (10)
OR
- 18 Discuss the construction and working of a Kaplan turbine with a necessary sketch. (10)
- 19 A centrifugal pump delivers 25 litres of water per second against a head of 10 meters, while running at 1300 rpm, requiring 10 kW of power. Determine the discharge, head of the pump and power required, if the pump runs at 1500 rpm. (10)
OR
- 20 The diameter and stroke of a single acting reciprocating pump are 200 mm and 300 mm respectively. The pump runs at 80 rpm and lifts 15 liters of water per second through a height of 25 m. The delivery pipe is 20 m long and 150 mm in diameter. Find (i) Theoretical power required to run the pump. (ii) Percentage of slip. (iii) Acceleration head at the beginning and middle of delivery stroke. (10)