



III B.Tech I Sem Regular End Examination, December 2022

Fluid Mechanics and Hydraulics Machinery

(Mechanical)

Time: 3 Hours.**Max. Marks: 70**

Note: 1. Question paper consists: Part-A and Part-B.

2. In Part – A, answer all questions which carries 20 marks.

3. In Part – B, answer any one question from each unit.

Each question carries 10 marks and may have a, b as sub questions.

PART- A**(10*2 Marks = 20 Marks)**

- | | | | | |
|-------|--|----|-----|-----|
| 1. a) | Define fluid properties : surface tension & capillarity | 2M | C01 | BL1 |
| b) | Explain the difference between simple and differential manometer | 2M | C01 | BL2 |
| c) | Define steady, unsteady flow & laminar, turbulent flow | 2M | C02 | BL1 |
| d) | Draw the schematic diagram of venturi meter. | 2M | C02 | BL1 |
| e) | Draw a neat sketch of Reynolds experiment. | 2M | C03 | BL1 |
| f) | Define Hydraulic gradient line and Total energy line. | 2M | C03 | BL1 |
| g) | Find the force exerted by a jet of water of diameter 70mm on a stationary flat plate, normally with a velocity of 25m/s. | 2M | C04 | BL3 |
| h) | What are minor losses in pipe flow? | 2M | C04 | BL2 |
| i) | Explain the terms unit power, unit speed and unit discharge | 2M | C05 | BL1 |
| j) | What is cavitation in centrifugal pump? | 2M | C05 | L2 |

PART- B**(10*5 Marks = 50 Marks)**

- | | | | | |
|------|---|----|-----|-----|
| 2 a) | Draw U-tube Differential Manometer with a neat sketch and derive the expression for pressure difference between points in a pipe. | 5M | C01 | BL2 |
| b) | Calculate the shear stress developed in oil of viscosity 1.4 poise, used for lubricating the clearance between a shaft of diameter 15 cm and its journal bearing. The shaft rotates at 175 rpm and clearance is 1.5 mm. | 5M | C01 | BL3 |

OR

- | | | | | |
|------|--|-----|-----|-----|
| 3 a) | In a mercury differential manometer the mercury deflection is 20 cm. Find the difference of pressure in 'kpa' if the liquid flowing in the pipe is oil of sp. gr. 0.8. | 5M | C01 | BL3 |
| b) | Differentiate between: (i) Liquids and gases, (ii) Real fluid and ideal fluids, (iii) Specific weight and specific mass of a fluid. | 5M | C01 | BL1 |
| 4 | Obtain Euler's equation of motion along a stream line & hence derive Bernoulli's equation for steady incompressible fluid flow. | 10M | C02 | BL2 |

OR

- 5 a) Give the classification of flows with governing equations. 5M C02 BL2
 b) Derive continuity equation. 5M C02 BL3
- 6 a) Derive an expression for major losses in the pipe. 5M C03 BL1
 b) Explain boundary layer Separation with a neat sketch. 5M C03 BL1
- OR**
- 7 a) Derive an expression for minor losses due to sudden expansion. 5M C03 BL2
 b) At a sudden enlargement of a water main from 240 mm to 480 mm diameter, the hydraulic gradient rises by 10 mm. Estimate rate of flow. 5M C03 BL3
- 8 a) Derive equation for work done and efficiency for a jet impinging on series of vanes. 5M C04 BL2
 b) Differentiate between: (i) The impulse and reaction turbines, (ii) Radial and axial flow turbines and (iii) Kaplan and propeller turbines. 5M C04 BL2
- OR**
- 9 a) Write a short note on draft tube 5M C04 BL1
 b) A pelton wheel has a tangential velocity of buckets of 15 m/s. The water is being supplied under a head of 150 meters at the rate of 200 liters/s. The buckets deflect the jet through an angle of 160° . If the coefficient of velocity for the nozzle is 0.98, find the power produced by the wheel and hydraulic efficiency 5M C04 BL4
- 10 a) With a neat sketch, explain the elements of centrifugal pump. 5M C05 BL4
 b) What is specific speed? Derive an expression for it. 5M C05 BL2
- OR**
- 11 a) A centrifugal pump is to discharge $0.118 \text{ m}^3 / \text{sec}$ at a speed of 1450 rpm against a head of 25m. The impeller diameter at outlet is 250mm and its width at outlet is 50mm and manometric efficiency is 75%. Determine vane angle at outer periphery of the impeller. 5M C05 BL4
 b) A Kaplan turbine develops 15000 kW power with a head of 30 m. Hub diameter of runner is 0.35 times the outer diameter of runner. Find the diameter of the runner, rotational speed of turbine and Specific speed. Take the speed ratio 2.0, flow ratio 0.65 and overall efficiency 90%. 5M C05 BL2

---oo0oo---