

Fluid Mechanics and Machinery (313309)

MSBTE Diploma · K-Scheme · Model Question Paper — Set B

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

1. All questions are compulsory.
2. Answer each next main question on a new page.
3. Illustrate your answers with neat sketches wherever necessary.
4. Figures to the right indicate full marks.
5. Assume suitable data, if necessary.
6. Use of Non-programmable Electronic Pocket Calculator is permissible.
7. Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Q.1 Attempt any FIVE of the following:**10**

- a) Define: (i) Surface tension (ii) Capillarity.
- b) Find the height of a column of (i) oil of specific gravity 0.8 and (ii) mercury, equivalent to a pressure head of 25 m of water.
- c) State Bernoulli's theorem and write Bernoulli's equation.
- d) State the working principle of a Bourdon tube pressure gauge.
- e) State any two causes and any two effects of water hammer.
- f) Classify hydraulic turbines (any four bases of classification).
- g) Draw a neat labelled ideal indicator diagram of a reciprocating pump.

Q.2 Attempt any THREE of the following:**12**

- a) A rectangular plate 1.5 m wide and 2.5 m deep is immersed vertically in water with its upper edge horizontal and 1 m below the free surface. Find the total pressure on one face of the plate and the depth of the centre of pressure.
- b) Explain atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure with a neat sketch showing their relation.
- c) A differential manometer is connected at two points A and B as shown in Fig. 1. Pipe A carries water and pipe B carries oil of specific gravity 0.8. Find the difference of pressure ($p_A - p_B$).

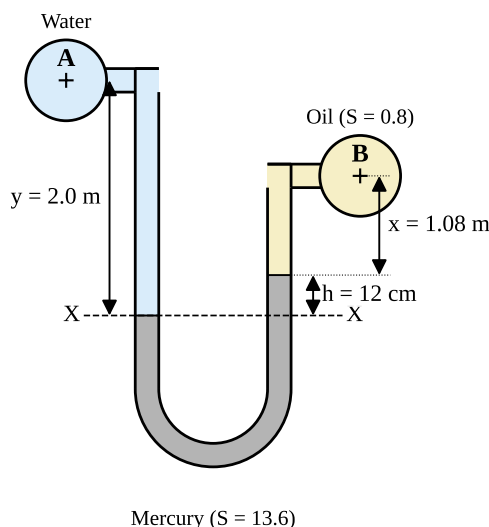


Fig. 1

- d) Explain the construction and working of a Pitot tube with a neat sketch.

Q.3 Attempt any THREE of the following:

12

- An orifice meter with an orifice of 120 mm diameter is fitted in a pipe of 240 mm diameter carrying water. The mercury differential manometer connected across the orifice meter reads 25 cm. Find the discharge if $C_d = 0.62$.
- State the laws of fluid friction for laminar flow and for turbulent flow.
- Draw the HGL and TEL for a pipe connecting two reservoirs and having a sudden enlargement and a sudden contraction. Name the minor losses in pipes and write their formulae.
- Explain the construction and working of a Kaplan turbine with a neat sketch.

Q.4 Attempt any THREE of the following:

12

- A jet of water 60 mm in diameter moving with a velocity of 22 m/s strikes a symmetrical curved vane at its centre and is deflected through 160° . Find the force exerted by the jet in the direction of the jet when (i) the vane is fixed (ii) the vane moves at 8 m/s in the direction of the jet. Also find the work done per second and the efficiency in case (ii).
- State the need of a draft tube. Draw neat sketches of any four types of draft tubes.
- Explain the following types of flow with one example each: (i) one, two and three dimensional flow (ii) compressible and incompressible flow.
- Explain the working of a double acting reciprocating pump with a neat sketch.
- What is priming of a centrifugal pump? Why is it necessary? State the methods of priming.

Q.5 Attempt any TWO of the following:

12

- A pipe line 2.5 km long is used to transmit 180 kW of power by water. The pressure at the inlet of the pipe is 4500 kN/m^2 and the pressure drop due to

friction over the length of the pipe is 900 kN/m^2 . Taking $f = 0.0065$, find (i) the diameter of the pipe (ii) the efficiency of transmission.

- b) Explain the construction and working of a venturimeter with a neat sketch and derive the expression for the discharge through it.
- c) A Pelton wheel is to be designed for a shaft power of 9000 kW under a head of 320 m at a speed of 600 rpm . The overall efficiency is 85% and the jet diameter is not to exceed one-eighth of the wheel diameter. Taking $C_v = 0.98$ and speed ratio $= 0.46$, find (i) the wheel diameter (ii) the diameter of the jet (iii) the number of jets required.

Q.6 Attempt any TWO of the following:

12

- a) A centrifugal pump impeller has an outer diameter of 500 mm and a width of 60 mm at outlet. The vanes are set back at 35° at outlet. The pump runs at 1200 rpm and delivers $0.22 \text{ m}^3/\text{s}$ of water against a manometric head of 70 m . Water enters the impeller radially. If the shaft power supplied by the motor is 230 kW , find (i) the manometric efficiency (ii) the mechanical efficiency (iii) the overall efficiency.
- b) Draw and explain the main characteristic curves of a Pelton wheel.
- c) Explain multistage centrifugal pumps with impellers in series and pumps in parallel. State their applications.

Note: This is a **model question paper prepared by Ananda Technologies** only for practice and exam preparation, based on the pattern of previous MSBTE question papers and the K-scheme syllabus. It is **not an official MSBTE paper**, and it does **not** mean that these questions will come in the exam. Answers follow standard textbook points; marks shown are indicative. Free for students — anandatechnologies.in