7456

BOARD DIPLOMA EXAMINATION, (C-20)

OCTOBER/NOVEMBER—2023

DME – FOURTH SEMESTER EXAMINATION

HYDRAULICS AND FLUID POWER SYSTEMS

Time : 3 Hours] [*Total Marks* : 80

PART—A 3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

1. Determine the dynamic viscosity of benzene if its kinematic viscosity is 7.42×10^{-3} Stokes and mass density 860 kg/m^3. 3

2. Define the following : 1+1+1

   (a) Absolute pressure

   (b) Gauge pressure

   (c) Vacuum pressure

3. State Bernoulli's theorem. Give any two practical applications of Bernoulli's theorem. 2+1

4. Define the following : 1½+1½

   (a) Compressible flow

   (b) Incompressible flow

5. List out any six minor energy losses in pipe flows. 3

6. Find the force exerted by water jet with diameter 20 mm moving with 25 m/sec strikes normally on a fixed vertical plate. 3

7. Define following terms used in hydraulic turbines : 1½+1½

   (a) Gross head

   (b) Net head

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8. What is priming? 3

9. State any three differences between Kaplan and Francis turbine. 3

10. What is an actuator? State its function. 3

PART—B 8×5=40

Instructions : (1) Answer **all** questions.

(2) Each question carries **eight** marks.

(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. *(a)* A simple manometer (U-tube) containing mercury is connected to a pipe in which an oil of specific gravity 0.8 is flowing. The pressure in the pipe is vacuum. The other end of the manometer is opened to the atmosphere. Find the vacuum pressure in pipe, if the difference of mercury level in the two limbs is 20 cm and height of oil in the left limb from the centre of the pipe is 15 cm below. 8

(OR)

(b) Explain the differential manometer with a neat sketch and derive the expression for pressure head. 8

12. *(a)* A pipe 300 m long has a slope of 1 in 75 taper from 1.4 m diameter at the higher end to 0.7 m diameter at the lower end. The discharge of water through the pipe is 5000 litre/min. If the pressure at the higher end is 100 kPa, then find the pressure at the other end. 8

(OR)

(b) A Venturimeter is installed in a horizontal pipeline of 300 mm diameter. The pressure differential at inlet and throat, read by a mercury manometer is 50 mm, when the water is flowing at the rate of 50 lit/sec. The coefficient of discharge is 0.96. Find the diameter of the venturimeter at throat. 8

13. *(a)* Water flows through a pipe of 250 mm diameter and 70 m long with velocity of 3 m/sec. Find the loss of head due to friction by using the following :

(i) Darcy's formula, f = 0.006

(ii) Chezy's formula, C = 60 4+4

(OR)

(b) Water is supplied from a reservoir through a 300 mm diameter pipe 600 m long to a turbine which is situated 108 m below the free surface. Discharge through the pipe is 81 lit/sec. Find the head lost and the power transmitted by the pipe. Darcy's factor, f = 0.01. 4+4

14. *(a)* A jet of water moving with a velocity of 25 m/sec strikes on a single vane. The vane is moving with a velocity of 6 m/sec in the direction of jet and transmits the power P_1. If the same jet strikes a series of similar vanes mounted on a wheel under the same velocity conditions, transmits a power P_2. Find the ratio between P_1 and P_2. 8

(OR)

(b) Explain the construction and working of double acting reciprocating pump with a neat sketch. 8

15. *(a)* State any five advantages and three disadvantage of fluid power system. 5+3

(OR)

(b) Explain the pneumatic system with schematic diagram. 8

PART—C 10×1=10

Instructions : (1) Answer the following question.

(2) The question carries **ten** marks.

(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

16. A Pelton wheel operates under a head of 600 m, out of which one third is lost due to friction in the penstock. Mean dia of wheel is 3.5 m and runs at 200 rpm. Discharge is 100 lit/sec. Assume C_v = 0.98. Bucket angle at outlet is 15°. Find the following : 3+3+2+2

(a) Power developed

(b) Hydraulic efficiency

(c) Shaft power if mechanical efficiency is 90 %

(d) Overall efficiency

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