

IV/SEM/MECH/2016 (S) New
FLUID MECHANICS AND HYDRAULIC MACHINES

Sub Code-MET-404

Full Marks : 70

Time : 3 hours

Answer any **five** questions

The figures in the right-hand margin indicate marks

1. (a) Define specific weight and state its unit. 2
- (b) Convert intensity of pressure of 20 kPa into equivalent pressure head of oil of specific gravity 0.9. 5
- (c) Write different types of fluid pressure measuring instruments. Explain the function of differential manometer with a neat sketch. 7
2. (a) Write Archimedis' principle. 2
- (b) Explain the concept of buoyancy and floatation. 5
- (c) A rectangular lamina is 1.2 m wide and 2.2 m deep is held vertically immersed in water so that its upper edge is horizontal and 1.6 m below the free water surface. Determine the

(Turn Over)

(2)

total pressure on the lamina and depth of centre of pressure. 7

3. (a) What is difference between laminar and turbulent flow ? 2

(b) Establish relation between C_d , C_v and C_c . 5

(c) A venturimeter having diameter of 100 mm at the throat and 175 mm at the enlarged end is installed in a horizontal pipeline of 175 mm in diameter carrying an oil of sp. gravity 0.95. The difference of pressure head is 180 mm of Hg. Determine the discharge through the pipe, if $C_d = 0.97$. 7

4. (a) State Darcy's formula for loss of head in pipe. 2

(b) Explain hydraulic gradient and total gradient line. 5

(c) A jet of water 40 mm diameter moving with a velocity of 120 m/sec impinging on a series of vanes moving with a velocity of 5 m/sec. Find the force exerted, work done and efficiency. 7

5. (a) Classify hydraulic turbines. 2

- (b) Give layout and features of a hydroelectric power plant. 5
- (c) A Pelton wheel has a mean bucket speed of 25 m/sec with a jet of water flowing at a rate of $1.2 \text{ m}^3/\text{sec}$ under a head of 250 m. The buckets deflects through an angle of 170° . Calculate power delivered to the runner and the hydraulic efficiency. 7
6. (a) What is reaction turbine ? 2
- (b) Explain the working of a Kaplan turbine. 5
- (c) In an inward flow reaction turbine of inner and outer diameters of the wheel as 0.75 m and 1.25 m respectively, the vanes are radial at inlet and discharge is radial at outlet and water enters the vane at an angle of 12° . If the velocity of flow is 3.5 m/sec find the speed of the wheel and vane angle at outlet. 7
7. (a) Define Slip. 2
- (b) Explain the working of single acting reciprocating pump. 5
- (c) A centrifugal pump having outer diameter twice

(4)

the inner diameter running at 1100 rpm works against a head of 180 m. The velocity of flow through the impeller is constant at 3 m/sec. The vanes are set back at angle of 30° at outlet. If the outer diameter of the impeller is 60 cm and the width at outlet is 6 cm, determine (i) vane angle at inlet (ii) work done/sec and (iii) manometric efficiency.

7

