Printed Pages – 6 Roll No. : .....

337554(37)

B. E. (Fifth Semester) Examination
April-May 2021

(New Scheme)

(Mech. Engg. Branch)

FLUID MACHINERY

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Attempt all questions. Part (a) of each question is compulsory. Answer any two parts from (b), (c) and (d) in each question.*

Unit-I

1. (a) Define Laminar Sublayer. 2

(b) Derive expression for displacement thickness (δ^*) and momentum thickness (θ) for a boundary layer. 7

(c) For the velocity profile of laminar boundary layer flow is given as

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$

Find the expression for boundary layer thickness (δ). 7

(d) A man weighing 981 N, descends to the ground from an aeroplane with the help of a parachute against the resistance of air. The shape of parachute is hemispherical of 2 m diameter. Find the velocity of the parachute with which it comes down. Assume $C_d = 0{\cdot}5$ and ρ for air = 0·00125 gm/cc and γ = 0·015 stokes. 7

Unit-II

2. (a) Define the impulse turbine. 2

(b) Water is flowing through a pipe at the end of which a nozzle is fitted. The diameter of the is 100 mm and the head of water at the centre nozzle is 100 m. Find the force exerted by the jet of water on a fixed vertical plate. The coefficient of velocity is given as 0·95. 7

(c) Explain various efficiencies of a turbine. 7

(d) A pelton wheel has a mean bucket speed of 10 m/s with a jet of water flowing at the rate of 700 litres/s under a head of 30 metres. The buckets deflect the jet through an angle of 160°. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assuming $C_v = 0{\cdot}98$. 7

Unit-III

3. (a) Differentiate between the turbines and pumps. 2

(b) A reaction turbine works at 450 rpm under a head of 120 metres. Its diameter at inlet is 120 cm and flow area is 0·4 m^2. The angles made by absolute

and relative velocities at inlet are 20° and 60° respectively with the tangential velocity.

Determine : 7

(i) The volume flow rate

(ii) The power developed

(iii) Hydraulic efficiency

(c) Explain Kaplan turbine with neat sketch in detail. 7

(d) A turbine develops 500 kW power under a head of 100 m and 200 rpm. What would be its normal speed and output under a head of 81 m? 7

Unit-IV

4. (a) Define suction head and delivery head. 2

(b) Explain main parts of a centrifugal pump with neat sketch. 7

(c) A centrifugal pump delivers water against a head of 14·5 m and a design speed of 1000 rpm. The vanes are curved back to an angle of 30° with the periphery. The impeller diameter is 300 mm and outlet width is

50 mm. Determine the discharge of the pump if manometric efficiency is 95%. 7

(d) The diameters of an impeller of a centrifugal pump at inlet and outlet are 30 cm and 60 cm respectively. The velocity of flow at outlet is 2 m/s and the vanes are set back at an angle of 45° at the outlet. Determine the minimum starting speed of the pump if the manometric efficiency is 70%. 7

Unit-V

5. (a) What is slip of a reciprocating pump? 2

(b) A double acting reciprocating pump running at 40 rpm is discharging 1 m^3 of water per minute. The pump has a stroke of 400 mm. The diameter of the piston is 200 mm. The delivery and suction head are 20 m and 5 m respectively. Find the slip of the pump and power required to drive the pump. 7

(c) Explain working of air vesels filled to a reciprocating pump. 7

(d) Explain indicator diagram of a reciprocating pump. Also explain effect of acceleration in suction and delivery pipes on indicator diagrams. 7