

Total No. of Questions :6]

SEAT No. :

P5060

[Total No. of Pages : 2

T.E./Insem.-609
T.E.(Mechanical) (Semester - I)
TURBO MACHINES
(2015 Pattern)

Time : 1 Hour]

[Max. Marks :30

Instructions to the candidates:

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4 & Q.5 or Q.6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of scientific calculator is allowed.*
- 4) *Assume data wherever necessary and mention it.*
- 5) *Draw neat and suitable figures wherever necessary.*

- Q1) a)** A 7.5 cm diameter jet having velocity of 12 m/s impinges on a smooth plate at an angle of 60° , to the normal to the plate. What will be the force when (I) the plate is stationary and (II) when the plate is moving in the direction of jet at 6 m/s. Determine also the work done per second on the plate in each case. **[6]**
- b) Derive the expression for the force exerted by a jet of water on an inclined fixed plate in the direction of jet. **[4]**

OR

- Q2) a)** Derive the expression of work done per sec for symmetrical moving curved vane with tangential entry of jet. **[4]**
- b) A circular jet of water having velocity of 60 m/s impinges tangentially on a series of curved vanes moving uniformly at 25 m/s. The jet makes an angle of 30 degrees with the direction of motion of the vanes. Relative to a vane, the jet turns through an angle of 100 degrees as it flows over the vane. The flow speed along the vane drops by 15% due to frictional loss. Draw neat inlet and outlet velocity triangles showing all the relevant details and determine: **[6]**
- i) Vane tip angles at inlet and outlet for the smooth flow,
 - ii) Absolute velocity of water leaving the vanes.

P.T.O.

- Q3)** a) Sketch Pelton wheel bucket giving its approximate dimensions and answer question in brief: The ideal jet deflection angle is 180 degree, however bucket deflects the jet through 160 to 165 degree. [4]
- b) A Pelton wheel of 2.5 m diameter operates under the following conditions: Net available head = 300m; Speed = 300r.p.m.; Blade angle at outlet = 165°; C_v of nozzle = 0.98; Mechanical Efficiency = 95%. Determine: i) The Power developed ii) Specific speed iii) Hydraulic Efficiency. [6]

OR

- Q4)** a) Define
1) Gross head 2) Jet ratio 3) Hydraulic efficiency 4) Mechanical Efficiency. [4]
- b) Show that the maximum efficiency of the Pelton wheel is given by $(1+k \cos\phi)/2$ where K = Bucket friction factor, Φ = Bucket outlet angle. [6]

- Q5)** a) Compare Francis turbine & Kaplan turbine. [4]
- b) Design a Francis turbine runner with the following data.
Net Head = 68 m ; Speed=750RPM Power output = 330 kW; Hydraulic efficiency = 94 %; Overall Efficiency = 85%; Flow ratio = 0.15: Ratio of breadth to diameter = 0.1; Inner diameter of the runner is half of outer diameter of the runner. 6% of circumferential area of the runner is occupied by the thickness of the vanes. Assume velocity of flow remains constant and flow is radial at exit. [6]

OR

- Q6)** a) In an inward flow reaction turbine the head on the turbine is 32 m. The external and internal diameters are 1.44 m and 0.72 m. The velocity of flow through the runner is constant and equal to 3 m/s. The guide blade angle is 10 degree and the runner vanes are radial at inlet. If the discharge at outlet is radial. Determine: [6]
- i) The speed of the turbine
ii) The vane angle at outlet of the runner and
iii) Hydraulic efficiency.
- b) What is the significance of specific speed? Derive the relation for the same. [4]

