Total No. of Questions : 8]

SEAT No. :

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B.E. (Mechanical Engg.) (End Sem.)

TURBOMACHINERY

(2019 Pattern) (Semester - VII) (402043)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be draw wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data, if necessary.***

UNIT - I

Q1) a) Explain the functions of following 1. casing of Pelton wheel 2. Notch of bucket 3. Governing mechanism **[6]**

b) A jet of water moving with V m/s strikes at the centre of a curved vane which is moving with u m/s. If the outgoing jet makes an angle θ with the incoming jet, prove that **[8]**

i) Maximum efficiency, $\eta_{max} = \frac{8}{27}(1+\cos\theta)$

ii) Blade speed, $u = \frac{V}{3}$

OR

Q2) a) Compare Francis and Kaplan Turbine. **[6]**

b) The extemal and internal diameters of an inward flow reaction turbine are 2m and 1m respectively. The head on the turbine is 60 m. the width of the vane at inlet and outlet are same and equal to 0.25 m. The runner vanes are radial at inlet and discharge is radial at outlet. The speed is 200 rpm and the discharge is 6 m^3/sec. Determine : **[8]**

i) The vane angle at outlet of the runner and guide blade angle at inlet.

ii) The hydraulic efficiency.

P.T.O.

UNIT - II

Q3) a) Explain in brief different losses in steam turbine. **[4]**

b) Following data refer to the single row of impulse steam turbine mean diameter of the blade ring = 1.4 m, Speed = 3000rpm, Nozzle angle = 17 deg., ratio of blade velocity to the steam velocity = 0.45, blade friction factor = 0.82, Blade angle at exit is less by 3 deg to that at inlet, steam mass flow rate = 10.2 kg/s. Draw a velocity diagram and find the following: **[8]**

i) Blade angles at inlet and outlet

ii) Tangential force

iii) Axial force

iv) Power developed.

OR

Q4) a) Explain nozzle governing with sketch. **[4]**

b) Steam enters an impulse wheel having a nozzle angle of 20° at a velocity of 450 m/s. The exit angle of moving blades is 20° and relative velocity of steam may be assumed to remain constant over the moving blades. If the blade speed is 180 m/s, determine : **[8]**

i) Blade angle at inlet,

ii) Work done/kg of steam,

iii) Power developed when the turbine is supplied with 1.8 kg/s of steam

iv) Diagram efficiency

UNIT - III

Q5) a) Explain different types of impellers used for centrifugal pumps. **[6]**

b) A Centrifugal pump having outer diameter equal to two times inner diameter and running at 1200 rpm works against a total head of 75 m. The velocity of flow through the impeller is constant and is equal to 3 m/s. The vanes are set back at width at an angle of 30° at outlet. If the outer diameter of the impeller is 600 mm and width at outlet is 50 mm. Determine : **[6]**

i) Vane angle at inlet

ii) Work done per second by impeller.

iii) Manometric efficiency

OR

Q6) a) What do you mean by cavitation? Explain the phenomenon of cavitation in centrifugal pump. **[6]**

b) A Centrifugal pump running at 900 rpm is working against a head 20m. The external diameter of the impeller is 460 mm and outlet width is 50 mm. If the vane angles at outlet is 40°and manometric efficiency is 70%. Determine the following : **[6]**

i) Flow velocity at outlet

ii) Absolute velocity of water leaving the vane

iii) Angle made by the absolute at outlet with the direction of motion at outlet.

iv) Rate of flow through the pump.

UNIT - IV

Q7) a) Explain Construction and working of centrifugal compressor with neat diagram. **[6]**

b) A centrifugal compressor delivers 16.5 kg/s of air with a total head pressure ratio of 4:1. The speed of the compressor is 15000 rpm. Inlet total head temperature is 20 C, slip factor 0.9, power input factor 1.04 and 80% isentropic efficiency. Calculate : **[6]**

i) Overall diameter of impeller

ii) Power Input

OR

Q8) a) Explain in detail surging and choking phenomenon in centrifugal compressor. **[6]**

b) The impeller of the centrifugal compressor has the inlet and outlet diameter of 0.3 and 0.6 m respectively. The intake is from the atmosphere at 100 kPa and 300 K, without any whirl component. The outlet blade speed is 10000 rpm and velocity of flow is constant at 120 m/s. If the blade width at inlet is 6 cm, calculate : **[6]**

i) Specific work

ii) Exit pressure, outlet Blade Angle = 75°

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