Total No. of Questions : 8]

SEAT No. :

P-718

[Total No. of Pages : 4

[6004]-721

B.E. (Mechanical) (Semester - VII)

TURBO MACHINERY

(2019 Pattern) (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.7or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right of each question indicate full marks.***
4) ***Assume suitable data wherever necessary and mention the same clearly.***
5) ***Use of steam tables, Mollier chart and calculator is allowed.***

Q1) a) Sketch Pelton wheel bucket and explain the effect of its size, shape and number on its function. **[6]**

b) The external and internal diameters of an inward flow reaction turbine are 2m and lm respectively. The head on the turbine is 65 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 220 rpm and the discharge is 6 m^3/sec. **[8]**

Determine :

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

OR

Q2) a) Explain the following terms. **[6]**

i) Specific speed

ii) Run away speed

iii) Degree of reaction

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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 = V/3

Q3) a) What is compounding of steam turbine? Explain any one of the following. **[5]**

i) Velocity compounding

ii) Pressure compounding

b) Steam enters an impulse wheel having a nozzle angle of 20º at a velocity of 450 m/s. The exit angle of moving blades is 20º and relative velocity of steam may be assumed to remain constant over the moving blades. If the blade speed is 185 m/s, **[7]**

determine:

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

OR

Q4) a) Show that for Parson's Reaction turbine, the degree of reaction is 50%. **[5]**

b) Following data refer to the single row of impulse steam turbine mean diameter of the blade ring = 1.1 m, Speed = 3000rpm, Nozzle

angle = 17deg., 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. **[7]**

i) Blade angles at inlet and outlet

ii) Tangential force

iii) Axial force

iv) Power developed.

Q5) a) Explain NPSH in centrifugal pump. **[4]**

b) A Centrifugal pump running at 950 rpm is working against a head 20 m. 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 75 %. Determine the following : **[8]**

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

v) Specific speed.

OR

Q6) a) Explain various efficiencies of a centrifugal pumps. **[4]**

b) A Centrifugal pump having outer diameter equal to two times inner diameter and running at 1250 rpm works against a total head of 80 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 30º at outlet. If the outer diameter of the impeller is 600 mm and width at outlet is 50 mm. Determine the following: **[8]**

i) Vane angle at inlet

ii) Work done per second by

iii) Manometric efficiency

Q7) a) Differentiate between centrifugal compressor and axial flow compressor. **[4]**

b) Air at a temperature of 300 K flows in a centrifugal compressor running at 18500 rpm. The other data is given as follows :

i) Isentropic total head efficiency = 75%

ii) The temperature rise of air passing through the compressor

iii) The static pressure ratio

Assume that the absolute velocities of air at inlet and exit of compressor are same. Take Cp = 1.005 kJ/kg K. **[8]**

OR

Q8) a) Explain Construction and working of centrifugal compressor with neat diagram. **[4]**

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 11000 rpm and velocity of flow is constant at 125 m/s. If the blade width at inlet is 6 cm, determine the following : **[8]**

i) Specific work

ii) Exit pressure

iii) Mass flow rate

iv) Power required to compressor if the overall efficiency is assumed to be 75%.

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