Total No. of Questions : 8]

SEAT No. :

PD-4699

[Total No. of Pages : 3

[6404]-205

B.E. (Mechanical Engineering)

TURBO MACHINERY

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

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

Instructions to the candidates :

1) ***Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Use of logarithmic tables, slide rule and electronic pocket calculator is allowed.***
4) ***Figures to the right indicate full marks.***
5) ***Assume suitable data, if necessary.***

Q1) a) Compare Francis Turbine with Kaplan Turbine. **[6]**

b) A Pelton wheel is to be designed for the following specifications. **[8]**

Power developed = 9650 kW, Head = 350 m, Speed = 750 rpm,

Speed ratio = 0.45, Jet diameter not to exceed 1/6 th of the wheel diameter.

Overall efficiency = 85%.

Determine the following.

i) The wheel diameter

ii) Diameter of the jet

iii) No. of jets required.

Take Cv = 0.985

OR

Q2) a) Explain the functions of following: **[6]**

i) Casing of Pelton wheel

ii) Notch of bucket

iii) Governing mechanism

P.T.O.

b) The external 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 the 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 (i) The vane angle at outlet of the runner and guide blade angle at inlet. (ii) The hydraulic efficiency. **[8]**

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

OR

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

b) In a single stage impulse turbine the mean diameter of the blade ring is 1m and the rotational speed is 3000 rpm. The steam issued from the nozzle at 300 m/sec and nozzle angle is 20°. The blades are equiangular. If the friction loss in the blade channel is 19% of the kinetic energy corresponds to relative velocity at the inlet to the blades. What is the power developed in the blading when the axial thrust on the blades is 98 N. Solve the problem graphically or analytically. **[8]**

Q5) a) What do you mean by cavitation? Explain the phenomenon of cavitation in 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 75m. 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° is at the outlet. If the outer diameter of the impeller is 600 mm and width at outlet is 50 mm. **[6]**

Determine:

i) Vane angle at inlet

ii) Work done per second by impeller

iii) Manometric efficiency

OR

Q6) a) Explain different types of impellers used for centrifugal pumps. **[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 angle at outlet is 40° and manometric efficiency is 70 %. Determine the following **[6]**

i) Flow velocity at outlet

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

Q7) a) Explain construction and working of Axial flow Compressor with a neat diagram. **[6]**

b) A centrifugal compressor running at 9000 rpm delivers 600 m^3/min of free air. The air is compressed from 1 bar and 20 C to a pressure ratio of 4 with isentropic efficiency of 82 %. **[6]**

Calculate

i) Final temperature of air

ii) Theoretical power

OR

Q8) a) Explain surging and choking phenomenon in centrifugal compressors with neat diagram. **[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 outlet Blade Angle = 75º **[6]**

Calculate

i) Specific work

ii) Exit pressure