Total No. of Questions : 10]

SEAT No. :

P2552

[Total No. of Pages : 3

[5153]-518
T.E.(Mechanical)
TURBO MACHINES
(2012 Pattern) (Semester-II) (End Sem.)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.***
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) Prove that the force exerted by jet of water on semi-circular curve plate is two times the force exerted by jet of water on flat vertical plate. **[4]**

b) The mean velocity of the bucket of the Pelton wheel is 10 m/s. The jet supplies the water at 0.7 m³/s under the head of 30 m. The jet is deflected through an angle of 160° by the bucket. Find the Power developed by the Pelton wheel and Hydraulic efficiency. Take Cv=0.98 & neglect the losses in the bucket. **[6]**

OR

Q2) a) How do you classify water turbines? What is the difference between the impulse & reaction turbine? **[4]**

b) The external and internal diameters of an inward flow reaction turbine are 100 cm and 50 cm respectively. The head available is 45 m and velocity of the flow through the runner 3.5 m/s and it is constant. The guide vane angle at inlet is 10° and runner vanes are radial are inlet. Assuming the discharge at the outlet of the runner is radial,

Determine:-

i) Speed of the turbine

ii) Power developed

iii) Hydraulic Efficiency. **[6]**

P.T.O.

Q3) a) Explain the necessity of draft tube in reaction turbines? **[2]**

b) Steam issues from the nozzle of an impulse steam turbine with a velocity of 1200 m/s. The nozzle angle is 20°. The mean blade speed is 400 m/s and inlet & outlet angles of moving blades are equal. The mass of steam flowing through the turbine is 900 kg/hr. Assume friction factor =0.8 **[8]**

Determine:

i) Blade angles

ii) Power developed

iii) Blade efficiency

OR

Q4) a) Derive an expression of Specific speed of hydraulic turbines. **[6]**

b) Explain: **[4]**

i) Blade efficiency

ii) Stage efficiency

Q5) a) Explain the different types of casing used for centrifugal pump. **[6]**

b) Derive an expression of minimum starting speed of centrifugal pump. **[6]**

c) Discuss the influence of blade angle on the performance of centrifugal pump. **[6]**

OR

Q6) a) An impeller of inside diameter 15 cm and outside diameter 40 cm having a width at inlet 4 cm and width at outlet 2 cm is running at 1440 rpm. The inlet and outlet blade angles are 25° and 15° respectively. The whirl velocity at inlet is zero. Determine: **[10]**

i) Flow rate in LPM

ii) Power of impeller

iii) Absolute velocity at outlet.

b) Write a short note on Priming & Cavitation of Centrifugal pump. **[8]**

Q7) a) Represent and explain the process involved in a centrifugal compressor on (T-S) and Derive an expression for isentropic efficiency based on total values. **[8]**

b) Write a short note on Surging & Choking of Centrifugal compressor. **[8]**

OR

Q8) a) Discuss the dimensionless parameters used to predict the performance of centrifugal compressor. **[6]**

b) A centrifugal compressor delivers 10 m^3/s of air when running at 9000 rpm. The air is drawn in at 1 bar and 300 k and delivered at 4 bars. The isentropic efficiency is 80%. Blades are radial at outlet and constant velocity of flow is 64 m/s. The outer diameter of impeller is twice the inner diameter and slip factor may be taken as 0.9. Determine: **[10]**

i) Temperature of air at outlet

ii) Power required to drive the compressor

iii) Impeller diameter at inlet & outlet

iv) Impeller blade angle at inlet

v) Diffuser blade angle at inlet

Q9) a) Write a short note on: **[4]**

i) Fan

ii) Blower

b) Explain the construction and working of an axial flow compressor. **[6]**

c) Define slip coefficient, work factor and pressure coefficient. **[6]**

OR

Q10)a) Compare axial flow compressor & centrifugal compressor. **[4]**

b) Write a short note on losses in axial flow compressor. **[4]**

c) An axial compressor has a mean diameter of 60 cm and runs at 15000 rpm. if the actual temperature rise and pressure ratio developed are 30° C and 1.3 respectively, **[8]**

Determine:

i) Power required to drive the compressor while delivering 57 kg/s of air, assuming mechanical efficiency 86% and initial temperature of 35°C

ii) The degree of reaction if the temperature at rotor exit is 55°C

iii) Stage efficiency