

Total No. of Questions : 10]

SEAT No. :

**P2552**

**[5153]-518**

[Total No. of Pages : 3

**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 m<sup>3</sup>/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 at 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  $20^\circ$ . 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  $25^\circ$  and  $15^\circ$  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  $10 \text{ m}^3/\text{s}$  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  $30^\circ \text{C}$  and 1.3 respectively, **[8]**

Determine:

- i) Power required to drive the compressor while delivering  $57 \text{ kg/s}$  of air, assuming mechanical efficiency 86% and initial temperature of  $35^\circ \text{C}$
- ii) The degree of reaction if the temperature at rotor exit is  $55^\circ \text{C}$
- iii) Stage efficiency

