Total No. of Questions : 8]

SEAT No. :

PA-962

[Total No. of Pages : 3

[5927]-414
B.E. (Mechanical Engineering)
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 drawn wherever necessary.***
3) ***Use of logarithmic tables, slide rule, and electronic pocket calculator is allowed.***
4) ***Figure to the right indicate full marks.***
5) ***Assume Suitable data, if necessary.***

Q1) a) Classify Turbo machines. **[2]**

b) State Impulse Momentum Principle. Derive an expression for force exerted by jet of water on flat inclined plate. **[6]**

c) A Pelton wheel is to be designed for the following specifications: Shaft Power = 11,772kW; Head = 380 meters; Speed = 750 r.p.m; Overall efficiency = 86%; Jet diameter is not to exceed one sixth of the wheel diameter. Determine: **[6]**

i) The wheel Diameter
ii) The number of jets required, and
iii) Diameter of the jet.
Take $Kv_1 = 0.985$ and $Ku_1 = 0.45$

OR

Q2) a) Explain construction and working of Kaplan Turbine with neat sketch. **[6]**

b) What is the need of draft tube? Enlist types of draft tube with neat diagram. **[4]**

c) The external and internal diameters of inward flow reaction turbines are 1.20 m and 0.6 m respectively. The head on the turbine is 22 m and velocity of flow through the runner is constant and equal to 2.5 m/s. The guide blade is given as10° and runner vanes are radial at inlet. If the discharge at outlet is radial, determine: **[4]**

i) The speed of the turbine
ii) The vane angle at the outlet of the runner

P.T.O.

Q3) a) What do you mean by compounding of steam turbines? Explain any one suitable example with neat sketch. **[6]**

b) In a De Laval Steam turbine steam issues from the nozzle with a velocity of 1200 m/s. The nozzle angle is 20°, the mean blade velocity is 400 m/s, the inlet and outlet angles of blades are equal. The mass of steam flowing through turbine per hour is 1000 kg. Determine the following by graphical method **[6]**

i) Tangential Force

ii) Power Developed

iii) Blade Efficiency

Take Velocity blade coefficient as 0.8

OR

Q4) a) Explain governing of steam turbine with any one method. **[6]**

b) Following data refers to particular stage of Parson's reaction turbine. **[6]**
The speed of turbine = 1500 rpm
Mean Diameter of rotor = 1m
Stage efficiency = 0.8
Blade outlet angle = 20°
Speed Ratio = 0.7
Determine the available enthalpy drop in the stage by graphical method.

Q5) a) State & explain: **[6]**

i) Unit Speed

ii) Unit Discharge

iii) Unit Power

b) A centrifugal pump delivers water against a net head of 14.5 meters and a design speed of 1000 r.p.m. The vanes are curved back to an angle of 30° with the periphery. The impeller diameter is 300 mm and outlet width is 50 mm. Determine the discharge of the pump if manometric efficiency is 95%. **[6]**

OR

Q6) a) Explain the following: **[6]**

i) Priming of Centrifugal Pump

ii) Net Positive Suction Head

iii) Cavitation

b) A centrifugal pump discharges 0.15 m^3/s of water against head of 12.5m, the speed of impeller being 600 r.p.m. The outer and inner diameters of impeller are 500 mm and 250 mm respectively and the vanes are bent back at 35° to the tangent at exit. If the area of flow remains 0.07 m^2 from inlet to outlet, Calculate: **[6]**

i) Manometric Efficiency of pump

ii) Vane angle at inlet

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

b) A centrifugal compressor develops a pressure ratio of 5 and an air consumption of 30 kg/s. The inlet temperature and pressure are 15°C and 1 bar respectively. If isentropic efficiency is 0.85, Calculate **[6]**

i) Work done

ii) Exit total temperature

iii) The power required

OR

Q8) a) Explain surging and chocking phenomenon in centrifugal compressors with neat diagram. **[6]**

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

c) Give classification of centrifugal compressors. **[2]**