

“Please check whether you have got the right question paper.”

- i) Answer three questions from each section.
- ii) Use of Steam tables, Mollier charts, non-programmable calculator is allowed.
- iii) Assume suitable data, if necessary.

SECTION-A

- Q.1 a) Define turbo machine. Explain the principle components of a turbo machine. 05
 b) Distinguish between a turbo machine and positive displacement machine. 05
 c) Define the terms (a) impact of jet and (b) jet propulsion. 04
- Q.2 a) Show that the force exerted by jet of water on moving inclined plate in the direction of jet is given by 07

$$F_x = \rho a(V - u)^2 \sin^2 \theta$$
 Where a = area of jet,
 θ = inclination of the plate with the jet, and
 V = velocity of jet
- b) A nozzle of 60 mm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 7 m/s find. 06
 a) The force on the plate,
 b) The work done, and
 c) The efficiency of jet
- Q.3 a) What is cavitation? How can it be avoided in reaction turbines? What are the factors on which cavitation in water turbines depends explain in brief. 07
 b) State the advantages and disadvantages of a Francis turbine over a Pelton wheel. 06
- Q.4 An inward flow reaction turbine has an exit diameter of 1 metre and its breadth at inlet is 2 m/s. find the mass of water passing through the turbine per second. Assume 12% of the area of flow is blocked by blade thickness. If the speed of the runner is 210 r.p.m. and guide blades make an angle of 10° to the wheel tangent, draw inlet velocity triangle, and find: 13
 i) The runner vane angle
 ii) Velocity of wheel at inlet
 iii) The absolute velocity of water leaving the guide vanes and
 iv) The relative velocity of water entering the runner blade.
- Q.5 Write short notes on any three of followings 13
 1) Kaplan turbine
 2) Performance characteristics of hydraulic turbine
 3) Draft tube
 4) Propeller turbine

SECTION-B

- Q.6 a) What is the difference between single-stage and multistage pump? Describe multistage pump with (i) impellers in series, and (ii) impellers in parallel 07
b) A centrifugal pump is to discharge $0.118\text{m}^3/\text{s}$ at a speed of 1450 r.p.m. against a head of 25 m. the impeller diameter is 250 mm. its width at the outlet is 50 mm and manometric efficiency is 80%. Determine the vane angle at the outer periphery of the impeller. 07
- Q.7 In a De Laval turbine, steam issues from the nozzles with velocity of 1250 m/s. the nozzle angle is 20° and the mean blade velocity is 400 m/s and inlet and the outlet angles of the blades are equal. The mass of steam flowing through the turbine per hour is 1000kg. calculate: 13
1) Blade angle
2) Relative velocity of blade entering the blade
3) Tangent force on the blades
4) Power developed
5) Blade efficiency
Take blade velocity coefficient as 0.8
- Q.8 In an ideal Brayton cycle used for gas turbine plant, the air is taken in at 1 bar and 30°C . the pressure ratio used is five. The maximum temperature of the cycle is limited to 1000°C . find out followings: 13
1) The efficiency of the cycle
2) Work developed by the system if the or flow is 5070 kg/hr
3) The mean effective pressure (MEP)
4) If the heat exchanger is added in the system, find out the percentage improvement in the cycle efficiency assuming its effectiveness is one
- Q.9 a) Why is compounding of steam turbine necessary? Describe with neat sketch the compounding of steam turbine. 06
b) Discuss the influence of reheating, regeneration and intercooling on the performance of gas turbine cycle. 07
- Q.10 Write short notes on any three of followings 13
1) Stirling cycle
2) Classification of steam turbine
3) Nozzles and diffusers
4) Governing of steam turbines