

Duration : 3Hrs

Marks : 80

Instructions:

- Question No.1 is compulsory.
- Solve ANY THREE questions from the remaining five questions.
- Figure to the right indicates full marks.
- Assume suitable data wherever required, but justify the same.
- Use of standard steam table is permitted.

Q. 1 Solve ANY FOUR questions from following. (Each question carries 5 marks) (20)

- a) Describe working of Double acting air compressor with the help of P-V diagram.
- b) Describe working of Regenerative Gas Turbine cycle with the help of T-S diagram.
- c) Illustrate working of Francis turbine.
- d) Illustrate impulse momentum principle and reaction principle in Hydraulic turbines.
- e) State the role of Steam stop valve, Economizer, Blow off cock, Air preheater and Water level indicator in Boiler.

Q. 2 a) At a stage in a reaction turbine, the mean blade ring diameter is 1 m. The turbine runs at 3000 rpm. The blades are designed for a degree of reaction of 50 % with exit angles of 30° and the inlet angles of 50° . The turbine is supplied with a steam at 10000 kg/hrs and the stage efficiency is 85 %. (10)

Calculate:

- i. Power output of the stage
- ii. Specific enthalpy drops in kJ/kg
- iii. The specific steam consumption.

b) Differentiate between Fire Tube and Water Tube boiler. (05)

c) Differentiate between Steam turbine and Gas turbine. (05)

Q. 3 a) The pressure ratio of an open cycle gas turbine power plant is 5.6. Air is taken at 30°C and 1 bar. The compression is carried out in two stages with perfect intercooling in between. Assuming the isentropic efficiency of each compressor stage as 85% and that of turbine as 90%, determine the power developed and efficiency of the power plant. If the air flow is 1.2 kg/sec. The mass of the fuel may be neglected, and assumed $C_p = 1.02 \text{ kJ/kgK}$ and $\gamma = 1.41$. (10)

b) Draw a general layout of a hydroelectric power plant using a Pelton turbine and define the following: (a) Gross head, (b) Net head, (c) Mechanical efficiency (d) Overall efficiency of the Pelton turbine. (05)

c) Describe working of Turbojet Engine. (05)

- Q. 4**
- a) The following reading were obtained during a boiler trial of 6 hours' duration: (10)
Mean steam pressure = 12 bar; mass of steam generated = 40000Kg; mean dryness fraction = 0.85; mean feed water temperature = 30°C; Coal used = 4000kg; Calorific value of coal = 33400 kJ/Kg. Determine Factor of equivalent evaporation, Equivalent evaporation from & at 100°C and Efficiency of the boiler.
 - b) Define degree of reaction. Draw velocity triangle diagram for 50% reaction turbine (05)
 - c) Describe cavitation in pumps and state its drawbacks. (05)

- Q. 5**
- a) The impeller of a centrifugal pump having external and internal diameters 500 mm and 250 mm respectively, width at outlet 50 mm and running at 1200 r.p.m. works against a head of 48 m. The velocity of flow through the impeller is constant and equal to 3 m/s. The vanes are set back at an angle of 40° at outlet. Determine:
(i) Inlet vane angle,
(ii) Work done by the impeller on water per second, and
(iii) Manometric efficiency (10)
 - b) What is surging and choking in compressor. (05)
 - c) Describe working of reciprocating pump with the help of neat sketch. (05)

- Q. 6**
- a) A reaction turbine works at 450 rpm under a head of 120 m. Its diameter at inlet is 1.2 m and the flow area is 0.4 m². The angles made by absolute and relative velocities at inlet are 20° and 60° respectively with the tangential velocity. Determine the volume flow rate and The power developed by the turbine. (10)
 - b) Describe Pressure-velocity compounding of Impulse turbine (06)
 - c) Define priming and state it's importance (04)

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