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 of 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 %. Calculate: **(10)**

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 kJ/kgK and γ = 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: 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. **(10)**

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 40º at outlet. Determine: **(10)**

(i) Inlet vane angle,
(ii) Work done by the impeller on water per second, and
(iii) Manometric efficiency

b) What is surging and chocking 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 m^2. 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)**

----------xx----------xx----------xx----------