

Time: 3 Hours

Max. Marks: 80

Note:

1. Question No.1 is compulsory.
2. Attempt any three questions from the remaining.
3. Assume suitable data if required.

Q1. Solve any four out of five.

5 marks each

- a What is air compressor and why it is needed for multi staging?
- b What are the methods to improve efficiency of Gas Turbine?
- c State the role of Injector, Super heater, fusible plug and Steam stop valve in Boiler.
- d Write detail classification of Pump.
- e Define Boiler as per ASME.

Q2.

A Parson reaction turbine running at 400 rpm with 50% reaction develops 75 kW per kg of the steam. The exit angle of the blade is 20° and the steam velocity is 1.4 times the blade velocity. Determine

- a (a) Blade velocity,
(b) Blade inlet angle.

10 marks

- b What is the difference between fire tube and water tube boiler? Give proper examples of these two.

5 marks

- c What is the difference between Impulse and Reaction steam turbine?

5 marks

Q3.

Air enters the compressor of a gas turbine plant operating on air-standard cycle at 100 kPa and 300 K with a volumetric flow rate of $5 \text{ m}^3/\text{s}$. The compressor pressure ratio is 10. The turbine inlet temperature is 1400 K. The turbine and compressor each has an isentropic efficiency of 80%. Calculate the thermal efficiency of the cycle, back work ratio and the net power developed in kW. assume density of air = 1.2 kg/m^3

8 marks

Draw a general layout of a hydroelectric power plant using an impulse turbine and define the following:

- b (a) Gross head, (b) Net head, (c) Hydraulic efficiency, and
(d) Overall efficiency of the impulse turbine.

6 marks

- c Write short note on Ram Engine.

6 marks

Q4.

Calculate equivalent evaporation and efficiency of the boiler for the following data:
Pressure of steam = 9 bar, Quality of steam = 0.97 dry, Quantity of steam = 5600 kg/hr, Temperature of feed water = 36°C, Coal consumption = 700 kg/hr, C.V. of coal = 31380 kJ/kg of fuel. What will be the saving in coal consumption per hour if by putting an economizer the temperature of feed water is raised to 100°C and other data remains same except the increase in boiler efficiency by 5 %.

a **10 marks**

b Write Short note on compounding of Impulse turbine.

5 marks

c What is priming? Why is it necessary?

5 marks

Q5.

A centrifugal pump is to discharge 0.118 m³/sec at a speed of 1450 r.p.m. against a head of 25 m. The impeller diameter is 250 mm, its width at outlet is 50 mm and manometric efficiency is 75 percent. Determine the vane angle at the outer periphery of the impeller.

a **10 marks**

b What is surging and choking in compressor.

6 marks

c What are the different component of centrifugal pump, describe the significance of all the components and working of centrifugal pump with the help of neat sketch.

4 marks

Q6.

A Pelton wheel is to be designed for the following specifications:

Power (Brake or Shaft) = 9560 kW;

Head = 350 m;

Speed = 750 rpm;

a Overall efficiency = 85%;

Jet diameter is limited to 1/6th of the wheel diameter.

Determine the wheel diameter, diameter of jet and number of jets required.

Take Cv = 0.985 and speed ratio = 0.45

10 marks

b What is degree of reaction? Draw velocity triangle diagram for 50% reaction turbine.

5 marks

c What is cavitation in pump and what is the role of NPSH in cavitation?

5 marks