3 Hours **80 Marks**

NOTE:

- Question No 1 is **COMPULSORY**.
- Attempt any **THREE** questions from question number 2 to 6.
- Assume suitable data wherever required.
- Illustrate answers with sketches wherever required.
- Use of steam table is permitted.

1. Solve the following **(any Five)** **20**

   (a) Explain nozzle efficiency with the help of h-s diagram.

   (b) Write applications of gas turbine.

   (c) Differentiate between impulse and reaction type steam turbines.

   (d) State the purpose of draft tube incase of water turbine.

   (e) Write the detail classification of jet propulsion engine.

   (f) Define unit speed and specific speed.

2. (a) What are the different methods used to improve efficiency of gas turbine plant? **4**

   (b) Write the comparison between closed and open cycle gas turbine for the following criteria: type of working fluid, type of fuel, efficiency and size of plant. **4**

   (c) The following reading were recorded during two hour trial on a boiler :

Feed water supplied	= 14000 kg
Boiler working pressure	= 10 bar
Dryness fraction of steam	= 0.96
Temperature of feed water entering	= 35 °C
Temperature of feed water leaving	= 90 °C
Coal burnt	= 1500 kg
Temp of steam leaving superheater	= 335 °C
C V of coal	= 25000 kJ/kg

   Find:

   i) Enthalpy received by feed water in economizer, boiler and super heater. **6**

   ii) percentage of heat supplied in boiler & superheater **4**

   iii) Overall thermal efficiency of plant **2**

Turn Over

3. (a) Explain the construction and working of once through boiler with neat sketch. 8

(b) In an impulse turbine, steam issues from the nozzle with a velocity of 850 m/s. The nozzle angle is 20°. Mean blade velocity is 350 m/s and blades are equiangular. Mass flow rate of steam is 1000 kg/min. The friction factor is 0.8 determine: 12

i) Blades angles
ii) Power developed in kW
iii) Blade efficiency
iv) Stage efficiency if nozzle efficiency is 93%.

4. (a) What is the purpose of compounding of steam turbine? Explain pressure compounding method with neat sketch. 8

(b) In a gas turbine plant compressor takes in air at a temperature of 15°C and compresses it to four times the initial pressure with an isentropic efficiency of 85%. The air is then passed through a heat exchanger, heated by turbine exhaust before combustion chamber. Turbine inlet temperature is 600 °C and its efficiency is 80%. Neglecting all losses except mentioned and considering air as the working fluid calculate thermal efficiency and work ratio of the cycle if (i) heat exchanger is perfect (ii) effectiveness of heat exchanger = 0.85. 12

5. (a) Explain 'cavitation' in hydraulic turbines. What are its effects? How it can be reduced? 6

(b) Explain the difference between mountings and accessories. 4

(c) A turbine is to operate under a head of 25 m at 200 rpm. If the discharge is 9 m^3/s and turbine efficiency is 90%, calculate power generated by turbine, specific speed of the turbine and performance of the turbine under a head of 20 m. 10

6. (a) A Pelton wheel has to be designed for the following data. Power developed = 6000 kW, net head available = 300 m, speed = 550 rpm, ratio of jet diameter to wheel diameter = 1/10 and overall efficiency = 85%. Find number of jets, diameter of jet, diameter of wheel and quantity of water required. Assume K_v= 0.98 and K_u = 0.46 10

(b) Explain construction and working of ramjet. Write its applications also. 6

(c) Write the working principle of rocket engine. 4