



- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Solve Question 9 OR Questions No. 10.
 7. Solve Question 11 OR Questions No. 12.
 8. Due credit will be given to neatness and adequate dimensions.
 9. Assume suitable data whenever necessary.
 10. Illustrate your answers whenever necessary with the help of neat sketches.

1. In a gas turbine plant of 6 Mw capacity, air enters the compressor of at 100 kPa, 300K and is compressed to a pressure of 600 kPa in one stage. The temperature at the inlet to first turbine is 1000 k. The expansion takes place in two stages with reheat to 1000 K between the two stages. The isentropic efficiency of the compressor is 80% and that of both turbine is 85%. A regenerator having an effectiveness of 0.72 is also incorporated in the cycle to heat the compressed air before entering into combustion chamber. The C.V of fuel is 18500 kJ/kg. Determine the following. **14**
- a) A/F ratio.
 - b) Thermal efficiency of the cycle.
 - c) Air supply to plant.
 - d) Fuel consumption of plant per hour. Take for air $C_p = 1.0 \text{ kJ/kg.K}$, $r = 1.4$ & for gases $C_p = 1.15 \text{ kJ/kg K}$, $r = 1.34$.

OR

2. a) Prove that for gas turbine, pressure ratio for maximum work is a function of limiting temperature ratio. $r_p = \left(\frac{T_{\text{maxi}}}{T_{\text{min}}} \right)^{\frac{1}{2Z}}$ **7**
- Where
- r_p – Pressure ratio
- $$z = \frac{r}{r-1}$$
- b) Give the various methods to improve specific power output and thermal efficiency of constant pressure gas turbine plant. **7**

3. a) A turbojet engine develops a thrust power of 750 kw, when flying at an altitude of 9200m at a velocity of 220 m/s. The following data refers to the design conditions. **13**
- Compressor Pressure ratio = 5
 Compressor efficiency = 85%
 Turbine efficiency = 85%
 Nozzle efficiency = 90%
 Inlet pressure and temperature = 0.306 bar and 227.5 K respectively.
 Temperature of gas leaving the combustion chamber = 943 K.
 Calorific value of fuel = 42500 kJ/kg
 Velocity in duels = 200 m/s.
 For air, $C_p = 1.005$ kJ / kg. K, $r = 1.4$
 For combustion gases $C_p = 1.087$ kJ / kg. k, $r = 1.33$.
- Calculate.
- Air fuel ratio.
 - Overall thermal efficiency of unit.
 - Rate of air consumption.
 - Power developed by the turbine.
 - Outlet area of the jet.
 - Specific fuel consumption.

OR

4. a) Classify the nuclear reactor in detail. **7**
- b) Explain in detail the site selection criteria for Nuclear power plant and name at least two nuclear power stations in India. **6**
5. a) Classify the solar collector in detail and draw the neat sketch of at least one collector from each classification. **9**
- b) Explain the solar thermal electric conversion system in detail with neat sketch. **5**

OR

6. a) Explain with neat sketch closed cycle seeded inert gas MHD plant with neat sketch. **7**
- b) Explain the concept of solar furnace with neat sketch stating advantages and limitations both. **7**
7. a) Enlist the various instruments used for energy Auditing. Explain any one in detail. **7**
- b) What is Sankey diagram? Explain it in detail with any practical example. **6**

OR

- 8.** Write short note on **any four**. **13**
- a) Payback period.
 - b) Return on investment (ROI)
 - c) Life cycle cost.
 - d) Need and Importance of energy conservation.
 - e) Energy Audit.

- 9.** a) Classify hydraulic pumps in detail and explain any one with neat sketch. **7**
- b) Explain the working of 3/2 DCV for forward movement of the piston in a cylinder. Draw the symbol for the same. **6**

OR

- 10.** a) Draw and explain the various neutrals used in 4/3 Directional control valve. **7**
- b) Draw and explain regenerative circuit with neat sketch. **6**
- 11.** a) Classify the various compressors used in pneumatic system in detail and explain any one with neat sketch. **7**
- b) Differentiate between seat type and spool type of valve used in pneumatic system. **3**
- c) Explain the working of Time delay valve with neat sketch. **3**

OR

- 12.** a) Draw and explain material pneumatic circuit with neat sketch. **6**
- b) Explain the FRL unit used in pneumatic circuit with neat sketch. **7**
