Applied Thermodynamics-II
(ME-210, Dec-07)

Note: Section A is compulsory. Attempt any four questions from Section B and any two from Section C.

Section-A

1. a) What is Supercharging?
   b) What is octane number?
   c) What is polytrophic work?
   d) What is turbojet engine?
   e) What is stalling?
   f) What is propulsion Efficiency?
   g) Draw Brayton cycle.
   h) Define turbine efficiency.
   i) Why intercooling is done?
   j) What is Turbojet?

Section-B

2. What are the three methods of generating swirl in CI engine combustion chamber?
3. Explain the stages of combustion in a CI engine.
4. A gas turbine plant works between the fixed adiabatic temperature limits 3000°K and 900°K, the absolute pressure limits being 1 kgf/cm^2 and 4kgf/cm^2. The isentropic efficiency of the blower is 0.8 and that of turbine is 0.85. Estimate the actual thermal efficiency of the plant. Calorific value is 10,000 kcal/kg.
5. The air enters the compressor of a gas turbine at atmospheric pressure and 30°C and is compressed to 6kgf/cm^2 with an isentropic efficiency of 85%. The turbine inlet temperature is 500°C. The isentropic efficiency of the turbine is 80%. Estimate the flow of air in kg/s for a net h.p. of 2000.
6. What are the various methods which are used to improve the efficiency and output of a gas turbine?

Section-C

7. Explain the working principle of centrifugal compressor with the help of h-s chart. What do you mean by diffuser efficiency?
8. (a) The following data are given for a centrifugal compressor and it is required to find the impeller tip diameter:
   N = 1500 rpm, G=22.5 kg/sec, Ambient temperature = 21°C, Atmospheric pressure = 1 kgf/cm^2, pressure ratio = 4, adiabatic efficiency = 0.76, Double side impeller, slip factor = 0.9, work input factor = 1.04. Assume inlet velocity of flow = exit flow from diffuser = 140 m/s.
   (b) Discuss the surging in the case of centrifugal and axial flow compressor.
9. (a) Air at temperature of 15°C enters a gas turbine plant working at pressure ratio of 5. Turbine inlet temperature is 800°C. Polytropic efficiency of compressor and turbine is 0.87. Assume c_p = 0.24 for air and gases and calorific value of fuel used = 10,000 kcal/kg of fuel. Calculate overall efficiency and specific output.
   (b) Differentiate between reciprocating and rotary compressor.