Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(AUE)/SEM-3/AUE-303/2009-10

2009

ENGINEERING THERMODYNAMICS

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives of the following : 10 × 1 = 10

i) An open thermodynamic system is

a) manual ice-cream freezer

b) centrifugal pump

c) pressure cooker

d) automobile storage battery.

ii) All of the following are the intensive properties of a system *except*

a) Viscosity b) Temperature

c) Density d) Potential Energy.

iii) Water flows through a turbine in which temperature increases from 35°C to 36°C. If there is no heat transfer, how much entropy would be changed ?

(considering constant volume process)

a) 22 J/K b) 23 J/K

c) 24 J/K d) None of these.

iv) Which one of the following gases has maximum value of gas constant "R" ?

a) Nitrogen b) Carbon dioxide

c) Sulphur dioxide d) Oxygen.

v) 10 kg of a substance receives heat 450 kJ and undergoes temperature changes from 100°C to 250°C. Average specific heat during the process is

a) 0.6 kJ/kg K b) 0.5 kJ/kg K

c) 0.4 kJ/kg K d) 0.3 kJ/kg K.

vi) Compressor is a device that can be considered under

a) Steady flow b) Non-flow

c) Turbulent flow d) Laminar flow.

vii) When steam enters into turbine from boiler through heat exchanger, the normal desirable condition of steam is

a) dry steam

b) mixture of wet & dry steam

c) superheated steam

d) none of these.

viii) Diesel cycle may be considered under
  a) Constant pressure cycle
  b) Constant volume cycle
  c) Carnot cycle
  d) none of these.

ix) Which one of the following quantities presents the property of a system ?
  a) pdV b) Vdp
  c) (pdV + Vdp) d) none of these.

x) Otto cycle may be considered under
  a) Constant volume cycle
  b) Constant Pressure cycle
  c) Carnot cycle
  d) none of these.

GROUP – B

(Short Answer Type Questions)

Write short notes on any *three* of the following. 3 × 5 = 15

2. Closed & Isolated systems.
3. Refrigerants.
4. Nozzle.
5. Isothermal Process & Adiabatic Process.
6. Diffuser.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. Explain diesel cycle with both *p-v* and *T-s* diagrams. Write the value of efficiency for diesel cycle.

   For the air standard diesel cycle, compression ratio is 16, heat added is 2200 kJ/kg, temperature at the end of isometric expansion is 1500 K, lowest temperature in the cycle is 310 K. Calculate thermal efficiency and power output.

8. What is a compressor ? Write how many types of compressors are there ? What do you mean by multi-stage compression ? Write at least three points on advantages of multi-stage compression.

   A single acting reciprocating air compressor has cylinder dia. and stroke of 150 mm & 200 mm respectively. Compressor sucks air at 1 bar and 25°C & delivers at 10 bar, while running at 150 rpm. Find the indicated power of the compressor. The compression follows the law

   $pV^{1.3}$ = Constant.

9. Define Entropy. Derive entropy in the form of heat and temperature. Steam undergoes a cyclic process. 100 kJ of heat are supplied to the system during constant volume process, the system rejects 85 kJ of heat at constant pressure, & 20 kJ of work is done on it. System is brought to original state by adiabatic process. Determine the adiabatic work and also the values of internal energies at all the end states, if the initial value is 100 kJ.

10. What is a refrigerator ? Draw schematic layout of a cyclic refrigeration plant. A refrigerator under Carnot Cycle requires 1.3 kW per ton of refrigeration to maintain a temperature of – 40°C. Determine

    i) the temperature at which heat is rejected.

    ii) amount of heat rejected in kJ/min.

11. Define C.O.P.

    A Carnot refrigerator operates between temperature – 50°C and 50°C. Determine COP of the refrigerator. If the COP is to be made 5 by changing the temperatures such that increase or decrease in upper temperature is equal to decrease or increase in the lower temperature. Determine new temperature.