



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech(AUE-OLD)/SEM-3/AUE-303/2012-13

2012

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 for the following : $10 \times 1 = 10$
 - 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.



GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following.

3 × 5 = 15

2. Explain the working principle of a feed pump. Discuss their application area.
3. What are the desirable properties of refrigerant ? Name some popular refrigerants for industrial purpose.
4. Explain Clausius inequality.
5. Differentiate between Isothermal and Polytropic processes. Explain how the above processes differ from adiabatic process.
6. What is a diffuser ? For what purpose is it used and where ?

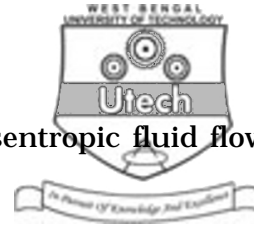
GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following.

3 × 15 = 45

7. 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 done on it. System is brought to original state by adiabatic process. Determine the adiabatic work and also the values of internal energy at all the end states, if the initial value is 100 kJ.
8.
 - a) Explain the phenomenon of multistaging in a compressor. Why is multistaging done ? Discuss.
 - b) A single stage reciprocating air compressor is required to compress 1 kg of air from 0.98 bar to 6.5 bar. The initial temperature of air is 30°C. Compare the work requirement in the following cases :
 - i) Isothermal compression
 - ii) Isentropic compression.
 - c) Draw the process in each case in P-V diagram.



9. What is nozzle ? State the equation for isentropic fluid flow through it.

Under specific thermal arrangement, air at temperature of 730°C and 70 m/s enters into a nozzle. The same air is expanded inside and fallen to a temperature of 490°C . If the air flow rate is 2 kg/s , calculate the velocity at exit from the nozzle. Assume no heat loss and specific heat of air $C_p = 1.005\text{ kJ/kg K}$.

10. What is COP in refrigeration ? Draw schematic layout of a cyclic refrigeration plant. A Carnot refrigeration cycle operates between temperature of -50°C and 50°C . Determine COP of the cycle. If the COP is to be made of by changing the temperature such that increase or decrease in upper temperature is equal to decrease or increase in lower temperature, determine the new temperature.
11. Explain with neat sketch, the vapour absorption cycle used in a refrigeration system.

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 .

=====