Roll No. | | | | | | | | | | | | |  Total No. of Pages : 02

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B.Tech.(Aerospace Engg.) (2012 Onwards)/B.Tech.(ANE) (Sem.–4)

# THERMODYNAMICS

Subject Code : ANE-205

M.Code : 60513

Time : 3 Hrs. Max. Marks : 60

**INSTRUCTION TO CANDIDATES :**

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

## SECTION-A

**1. Answer briefly :**

a) State zeroth law of thermodynamics.

b) State first law of thermodynamics.

c) Define Cyclic Process.

d) Write the Relation for Thermal efficiency of a heat engine.

e) Define Thermal Reservoir.

f) Is workdone a property of a system?

g) What is a heat pump?

h) State Carnot's principle.

i) Write any 2 causes for irreversibility.

j) What is throttling?

## SECTION-B

2) A site evaluated for a wind farm is observed to have steady winds at a speed of 8.5 m/s. Determine the energy :

   (a) per unit mass

   (b) for a mass of 10 kg and

   (c) for a flow rate of 1154 kg/s for air [2+1+2]

3) Air enters an adiabatic turbine at 5 MPa and 550°C and leaves at a pressure of 1.4 MPa. Determine the work output of the turbine per unit mass of steam if the process is reversible. Consider Cp = 1005 J/kg.K, $C_v$= 717.8 J/kg.K. [5]

4) Obtain a relation for workdone in [5]

   a) an isentropic process

   b) polytropic process

   c) Isothermal process

5) Obtain a relation for thermal efficiency of an ideal Diesel cycle. How can you increase the efficiency of a Diesel cycle? [5]

6) An insulated $8m^3$ rigid tank contains air at 600 kPa and 400 K. A valve connected to the tank is now opened, and air is allowed to escape until the pressure inside drops to 200 kPa. The air temperature during the process is maintained constant by an electric resistance heater placed in the tank. Determine the electrical energy supplied to air during this process. [5]



## SECTION-C

7) A gas-turbine power plant operating on an ideal Brayton cycle has a pressure ratio of 8. The air temperature is 300 K at the compressor inlet and 1300K at the turbine inlet. Utilizing the Air-standard assumptions, determine (a) the gas temperature at the exits of the compressor and the turbine, (b) the thermal efficiency. [2+2+6]

8) Refrigerant-134a is to be cooled by water in a condenser. The refrigerant enters the condenser with a mass flow rate of 6 kg/min at 1 MPa and 70°C and leaves at 35°C. The cooling water enters at 300 kPa and 15°C and leaves at 25°C. Neglecting any pressure drops, determine (a) the mass flow rate of the cooling water required and (b) the heat transfer rate from the refrigerant to water. [5+5]

9) Obtain a relation for thermal efficiency of an ideal Rankine cycle. How can you increase the efficiency of this cycle? [5+5]

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**