

Registration No. :

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Total number of printed pages – 3

B. Tech
BE 2103

First Semester (Back/ Special) Examination – 2013

THERMODYNAMICS

QUESTION CODE : D 179

Full Marks – 70

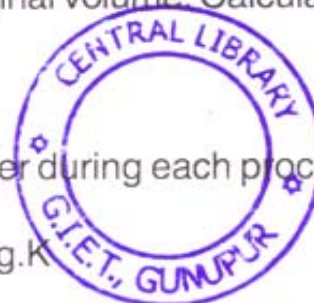
Time : 3 Hours

*Answer Question No. 1 which is compulsory and any **five** from the rest.
The figures in the right-hand margin indicate marks.*

1. Answer the following questions : 2×10
- Write two thermodynamic systems with one example on each.
 - Write two differences between isentropic and adiabatic processes.
 - What is the principle of temperature measurement by a thermocouple. Give one example of it.
 - Name and state the law of partial volume for a gas mixture.
 - Derive the energy equation for an isothermal process.
 - Write two reasons 'why Carnot cycle is not practically possible'.
 - Explain the critical point of water vapour and show it on h-s plain.
 - All forms of energy are equivalent in their ability to do work, is it true ? Explain.
 - What is the function of a compression ring in an I.C. engine ?
 - What do you mean by 1.5 Ton Air conditioner ?

P.T.O.

2. (a) Explain the phase transformation of water from freezing state to superheated state. 4
- (b) Steam at 15 bar and 0.9 dry is supplied to a super heater at the rate of 5000 kg/h, the temperature of the steam coming out of the super heater is 300° C. the temperature of feed water supplied to the boiler at 45° C. Calculate :
- (i) heat supplied in the boiler.
- (ii) heat supplied in the super heater. 6
3. (a) Show that for an ideal gas, $C_p - C_v = R$. 4
- (b) 0.4 kg of air at 6 bar receives an amount of heat at constant value, so that its temperature rises from 383 K to 923 K. It is then expanded polytropically according to $pV^{1.32} = \text{constant}$ to initial temperature and finally, it is compressed isothermally to its original volume. Calculate 6
- (i) pressure at end states, and
- (ii) work transfer and heat transfer during each process.
- Take : $C_v = 0.718$ and $R = 0.287$ kJ/kg.K
4. Steam at 5 MPa and 500° C enters a nozzle steadily at a velocity of 80 m/s and it leaves at 2 MPa and 400° C. The inlet area of the nozzle is 38 cm² and the heat is being lost at a rate of 8 kJ/s. Determine 10
- (a) mass flow rate of the steam
- (b) the exit velocity of the steam and
- (c) the exit area of the nozzle.
5. Two carnot refrigerators A and B are arranged in series. Prove that the overall COP of the combined system is given by $\{(COP)_A \times (COP)_B\} / \{1 + (COP)_A + (COP)_B\}$ 10



6. (a) State and prove the Carnot theorem. 5
(b) Determine the minimum heat input to a heat engine that operates between 350°C and 25°C and produces 100 kJ of work. 5
7. Describe a thermal power plant with a neat schematic diagram and explain the function of each component. 10
8. Write notes on the following : 2.5×4
- (a) Throttling calorimeter
 - (b) Principle of entropy increase
 - (c) Bourden pressure gauge
 - (d) Heat transfer by radiation.

