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Printed Pages : 2

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BT-3 / D-17

BASIC THERMODYNAMICS

Paper–ME-201 N

Time allowed : 3 hours] *[Maximum marks : 75*

Note : *(1) Use of steam table Permitted.*

*(2) Attempt **five** questions at least **one** question from each unit.*

Unit–I

1. (a) Explain the terms state, path, process and cycle. 7

   (b) Define thermodynamic system and hence define thermodynamic equilibrium. 8

2. (a) How will you differentiate between heat energy and work energy? Are they properties of a thermodynamic system?8

   (b) What is characteristic gas equation? How is it different than universal gas equation? 7

Unit–II

3. (a) Define first law of thermodynamics for a close cycle and hence modify it for a general reversible process. 8

   (b) A gas contained in a piston cylinder arrangement expand from 0.75m^3 volume to 1.25m^3 while the pressure remains constant at 200Kpa. If the gaseous system receives 80KJ of work from a paddle wheel, determine net work done by the system. 7

4. (a) Define Kelvin Planck statement of second law of thermodynamics and hence define PMMSK. 4

(b) A reversible engine operates between a source of 1200 K at two sinks, one at 400 K and other at 300K. The heat rejected to both the sinks is same. Determine thermal efficiency of the engine. 11

Unit–III

5. (a) What is principle of entropy increase? Derive an expression for entropy change of an isothermal process. 12

   (b) What do you mean by High and Low grade energy? 3

6. (a) Derive an expression for availability of a steady flow process. 8

   (b) 5kg of air at 1.5 bar and 27° C is heated reversibly at constant pressure to 227°C and the lowest available temp is 20°C how much is the available energy? C_p = 1.00KJ/kgK 7

Unit–IV

7. (a) Determine the state of steam i.e. wet, dry or superheated at following conditions:

   (i) p = 10 bar and v = 0.17m^3/kg

   (ii) p = 12 bar and t = 200°C

   Also locate the state points on rough mollier diagram. 4

   (b) Steam initially at 6 Mpa and 450°C is allowed to cool to 200°C at constant pressure. Find the final condition and heat transfer if the mass of steam is 0.75kg. 11

8. By using thermodynamic relations derive two Tds equations. 15