Code No. : 6163

FACULTY OF ENGINEERING
B.E. II/IV (Mech. and Prod.) II – Semester (Supple.) Examination, December 2009
THERMODYNAMICS

Time: 3 Hours] [Max. Marks: 75

*Note : i) Answer **all** questions from Part – **A** and **any five** questions from Part – **B**.*
*ii) Missing data if any may suitably be **assumed**.*

PART – A **(25 Marks)**

1. Distinguish between microscopic and macroscopic approaches of thermodynamics.
2. Distinguish intensive property from extensive property with suitable examples.
3. Define Zeroth law of thermodynamics and explain its significance.
4. How first law of thermodynamics is applicable to constant pressure process and what is the conclusion ?
5. Define Planck law of thermodynamics.
6. State Helmholtz function.
7. State Clausius-Claperyon equation.
8. Steam at 185°C and pressure 15 bar is expanded isentropically to 2 bar. Calculate enthalpy difference.
9. Draw Sterling cycle on pressure-volume diagram.
10. State advantages and disadvantages of liquid fuels over solid fuels.

PART – B **(50 Marks)**

11. a) Prove that difference of specific heat is equal to gas constant. **3**
    b) Define : (i) system (ii) surroundings (iii) process (iv) reversibility. **2**
    c) A fluid at a pressure of 3 bar with a specific volume of 0.18 kg/m^3 contained in a cylinder behind the piston expands reversibly to a pressure of 0.6 bar according to the law $p = C/v^2$ were C is constant. Calculate the work done by the fluid on the piston. **5**

12. 90 kJ of heat is applied to a system at constant volume. The system rejects 95 kJ of heat at constant pressure and 18 kJ of work is done on it. The system is brought to the original state by adiabatic process. Determine adiabatic work, the values of internal energy at all end states, if initial value is 105 kJ. **10**

13. a) Define and prove Carnot Theorem.

    b) Air at 20°C and 1.05 bar occupies 0.025 m^3. The air is heated at constant volume till its pressure is 4.5 bar and then cooled at constant pressure back to original temperature. Calculate the net heat flow form air, net entropy change.

14. a) Draw P-V-T diagram for a pure substance and what is its significance. **3**

    b) A vessel having a volume of 0.6 m^3 contains 3.0 kg of water and water vapor mixture in equilibrium at a pressure of 0.5 MPa. Calculate i) Mass and volume of liquid and ii) Mass and volume of vapor. **7**

15. a) Explain the working principle of Bomb calorimeter with neat sketch. **5**

    b) Derive an expression for air standard efficiency of Otto cycle. **5**

16. a) Derive an expression for Stoichiometric air fuel ratio requirement for diesel fuel. **5**

    b) Prove that internal energy is a point functions. **5**

17. a) Air expands from 3 bar to 1 bar in a nozzle. The initial velocity is 90 m/s and the initial temperature is 150°C. Determine the final velocity. Assume adiabatic conditions and $C_p = 1.005$ k J/kg-K.

    b) A reversible engine of 40% efficiency discharges 1600 kJ of heat per minute at 300 K to a pond. Find the temperature of the source which supplies the heat to the engine and power developed by the engine.
