53 (ME 301) BATD

2019

BASIC THERMODYNAMICS

Paper : ME 301

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer ***any five*** *questions.*

1. *(a)* Define : isothermal, isobaric, isochoric processes. 5

   (b) What are the parameters needed to be specified to define a thermodynamic system ? 4

   (c) A system can be characterized by specifying P, V and T. Are they independent of one another ? 3

   (d) Distinguish between intensive and extensive properties of a system. 3

Contd.

(e) Distinguish between stored energy and energy in transit. What is the difference between gauge pressure and absolute pressure? 2·5×2=5

2. (a) What do you mean by positive and negative work interactions? 3

(b) Distinguish between a path function and a point function. 3

(c) Define work and what is its unit? 2

(d) Give the relationship between the gauge, atmospheric and absolute pressure. 2

(e) The pressure measured by a pressure gauge is $5000 kN/m^2$. Barometric pressure of the atmosphere is $760 mm$ of mercury. Find the absolute pressure. 5

(f) What do you mean by pure substance? Give examples. 3

(g) Explain briefly Zeroth law of thermodynamics. 2

3. (a) An artificial satellite revolves round the earth with a relative velocity of $800 m/s$. If acceleration due to gravity is $9 m/s^2$ and gravitational force is $3600 N$, calculate its kinetic energy. 5

(b) What is PMM1? Justify with reasons whether it is feasible or not. 4

(c) A tube contains an oil of specific gravity 0·9 to a depth of $120 cm$. Find the gauge pressure at this depth (in kN/m^2). 4

(d) To a closed system, $150 kJ$ of work is supplied. If the initial volume is $0{\cdot}6 m^3$ and pressure of the system changes as $P = 8 - 4V$, where (P) is in *bar* and (V) is in m^3, determine the final volume and pressure of the system. 7

4. (a) Explain the following terms : 2×5=10

(i) Triple point

(ii) Latent heat of steam

(iii) Dryness fraction of steam

(iv) Superheated steam

(v) Sensible heat of water.

(b) A vessel having a volume of $0{\cdot}6m^3$ contains $3kg$ of liquid water and water vapour mixture in equilibrium at a pressure of $0{\cdot}5MPa$.
Calculate :

(i) Mass and volume of liquid

(ii) Mass and volume of vapour. 10

5. (a) Define heat engine, refrigerator and heat pump. 5

(b) What is the perpetual motion machine of the second kind? 3

(c) State the limitations of First law of thermodynamics. 3

(d) Describe the working of a Rankine cycle. 9

6. (a) Compare external combustion and internal combustion engine. 5

(b) What are the important basic components of an IC engine? Explain them briefly. 8

(c) Write short notes on : 3·5×2=7

(i) Thermodynamic equilibrium

(ii) Pressure measuring instruments.