Indian Maritime University

(A Central University, Govt of India)

May-June 2018 End Semester Examinations

B. Tech (Marine Engineering)

Semester-I

Basic Thermodynamics (UG11T3103)

Date: 07.07.2018 Max Marks:100 Marks

Time: 3 Hrs Pass Marks:50 Marks

PART-A

(All questions are compulsory)

1. (10 × 3=30)

a) State first law of thermodynamics.

b) Define point function and path function.

c) Define compressibility factor.

d) Give the Virial equation of state.

e) Define the term enthalpy.

f) Define internal energy of a system.

g) Define perpetual motion machine of second kind.

h) What is the difference between heat engine and refrigerator.

i) Define Exergy and reversible work.

j) State kelvin Planck statement of second law of thermodynamics.

PART-B

ANSWER ANY 5 FROM THE FOLLOWING 7 QUESTIONS

(5×14=70)

2. Derive the steady flow energy equation. Explain the significance of the each term involved in it. (14)

3. 50 kg/min of air enters the control volume in a steady flow system at 2 bar and 100°C and at an elevation of 100 m above the datum. The same mass leaves the control volume at 150 m elevation with a pressure of 10 bar and temperature of 300°C.The entrance velocity is 2400 m/min and the exit velocity is 1200 m/min.During the process, 50000 kJ/hr of heat is transferred

to the control volume and the rise in enthalpy is 8 kJ/kg.calculate the power developed. (14)

4. a)5 kg of air at 40°C and 1 bar is heated in a reversible non flow constant pressure until the volume is doubled. find a)change in volume b)work done c)change in internal energy d) change in enthalpy. (8)

b) During the compression stroke of reciprocating compressor, the work done to the air in the cylinder is 95 kJ/kg and 43 kJ/kg of heat is rejected to the surroundings. Determine the change in internal energy. (6)

5. A vessel of volume 0.3 m^3 contains 15 kg of air at 303 K. determine the pressure exerted by the air using

a) Perfect gas equation
b) Vander waals equation.

Take critical temperature of air is 132.8 K, critical pressure of air is 37.7 bar. (14)

6. a)Find the internal energy of unit mass of steam at a pressure of 7 bar i)when its quality is 0.8

ii) when it is dry and saturated and

iii) superheated ,the degree of superheat being 65°C .

The specific heat of super-heated steam at constant pressure is 2.277 kJ/kg K. (10)

b) Write down the characteristic equation of state for a perfect gas. Brief about each parameter of the equation. (4)

7. Draw P-V diagram and T-S diagram for carnot cycle. Explain all the processes involved in the cycle. Derive the thermal efficiency of the carnot cycle. (14)

8.a)Explain thermodynamic temperature scale. (6)

b) Determine whether the following cases represent the reversible,irreversible or impossible heat engines.

1)900 kW of heat rejected
2)560 kW of heat rejected.
3)108 kW of heat rejected.

In each case the engine is supplied with 1120 kJ/sec of heat. The source and sink temperature are maintained at 560 K and 280K. (8)

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