INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

End Semester Examination Dec 2019/Jan 2020
B.Tech (Marine Engineering)
Semester -I
UG11T2103/UG11T1103- Basic Thermodynamics

Date: 14.12.2019	Max Marks: 70
Time: 3 Hours	Pass Marks: 35

(Use of approved Steam Tables permitted in Examinations)

Part – A (compulsory)

Answer the following (10x2=20 Marks)

1. What is microscopic approach in thermodynamics?

2. Compare heat transfer with work transfer

3. Define second law efficiency

4. Write Carnot theorem and its corollaries.

5. An inventor claims to have developed an engine which absorbs 100 KW of heat from a reservoir at 1000 K produces 60 KW of work and rejects heat to a reservoir at 500K. Will you advise investment in its development?

6. Define a pure substance?

7. State the phase rule for pure substance

8. What is meant by dryness fraction or quality of steam? What are the methods of determining the quality of steam?

9. Define Avogadro's law.

10. What is known as equation of state and when it can be used for engineering calculations?

Part – B

Answer any 5 out of 7 questions (5 x 10= 50 marks)

11. A mass of air is initially at 260°C and 700kPa, and occupies $0.028m^3$. The air is expanded at constant pressure to $0.084m^3$. A polytrophic process with n=1.5 is then carried out followed by a constant temperature process which completes a cycle. All the processes are reversible.

    a)   Sketch the cycle in T-S and P-V diagram.   (2 mark)

    b)   Find the heat received and heat rejected in the cycle.   (4 mark)

    c)   Find the efficiency of the cycle.   (4 mark)

12. Derive the steady flow energy equation. Explain the significance of the each term involved in it.   (10 mark)

13. Air enters the compressor of a gas- turbine plant at ambient conditions of 100KPa and 250^0C with a low velocity and exits at 1MPa and 347^0C with a velocity of 90 m/s .The compressor is cooled at a rate of 1500KJ/min and the power input to the compressor is 250KW. Determine the mass flow rate of air through the compressor. Assume Cp = 1.005KJ/KgK. (10 marks)

14. a. What are the effects of contaminated feed in boilers? (5marks)
b. Relation between Cp and Cv? (5 marks)

15. A vessel of volume 0.04 m^3 contains a mixture of saturated water and steam at a temperature of 250°C. The mass of the liquid present is 9 kg. Find the pressure, mass, specific volume, enthalpy, entropy and internal energy. (10 marks)

16. Determine the pressure of nitrogen gas at T=175 K and v=0.00375m^3/kg on the basis of
a) The ideal gas equation of state. (5 mark)
b) The Vander Waals equation of state. (5 mark)
For Nitrogen.a =0.175m^6kPa/kg2 ; b= 0.00138m^3/kg.

17. Explain with a neat diagram, the working of four stroke diesel engine. (10 marks)