

# Indian Maritime University

( A Central University, Govt of India)

May-June 2018 End Semester Examinations

## B. Tech (Marine Engineering)

Semester-I

### Basic Thermodynamics (UG11T2103/1103)

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Date: 07.07.2018

Max Marks:100 Marks

Time: 3 Hrs

Pass Marks: 50 Marks

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#### PART-A

**(All questions are compulsory)**

(10 × 3=30)

1. a) Define perpetual motion machine of first kind.
- b) Define internal energy of a thermodynamic system.
- c) Define isolated system.
- d) Define "triple point " of a pure substance.
- e) Give the limitations of Vander waal's equation of state.
- f) What is the function of economizer in boilers?
- g) Define boiler efficiency.
- h) Define mean effective pressure as applied to gas power cycles.
- i) Define indicated power as applied to I.C engines.
- j) State Virial equation of state.

#### PART-B

Answer any 5 from the following 7 questions (5×14=70)

2. A certain gas of volume  $0.4 \text{ m}^3$ , pressure of 4.5 bar and temperature of  $130^\circ\text{C}$  is heated in a cylinder to 9 bar when the volume remains constant. Calculate a) temperature at the end of the process b)the heat transferred c)change in internal energy d)work done by the gas e)change in enthalpy f)mass of the gas. Assume  $C_p=1.005 \text{ kJ/kg K}$  and  $C_v = 0.71 \text{ kJ/kg K}$  (14)

3. Derive the Steady flow energy equation.

Explain the significance of the each term involved in it. (14)

4.a) Steam is contained in a closed vessel of 30 litres capacity at a pressure of 10 bar with dryness fraction 0.95. Calculate its internal energy. Due to loss by radiation, the pressure of steam falls to 7 bar. Calculate the total loss of heat and final quality of steam. (7)

b) 2 kg of steam is initially at 5 bar and 0.6 dry is heated at constant pressure until the temperature becomes 350°C. Find the change in entropy and internal energy. (7)

5.a) Derive the relation between specific heat constants  $C_p$  and  $C_v$ . (7)

b) Compute the specific volume of steam at 0.9 bar and 550 K. using vanderwaals equation, take critical temperature of steam is 647.3 K and critical pressure is 220.9 bar. (7)

6.a) What are the effects of contaminated feed in boilers?. (7)

b) The following observations were made in a boiler plant calorific value of a coal = 30,000 kJ/kg

Mass of coal used = 300 kg.

Mass of water evaporated = 2200 kg

Steam pressure = 12 bar

Dryness fraction = 0.95

Feed water temperature = 34°C

Calculate the equivalent evaporation from and at 100°C per kg of coal and the efficiency of the boiler. (7)

7. An engine working on constant volume cycle has the following data.

Clearance volume = 0.04 m<sup>3</sup>

Swept volume = 0.13 m<sup>3</sup>

Pressure and temperature at the beginning of the cycle are 1.15 bar and 120°C. Maximum pressure of the cycle is limited to 23 bar. Calculate air standard efficiency, maximum temperature of the cycle and mean effective pressure. (14)

8. Explain with a neat diagram, the working of four stroke diesel engine. (14)