INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

December 2016 End Semester Examinations
B.Tech. (Marine Engineering) First Semester

Basic Thermodynamics (UG11T1103/ UG11T2103)

Date : 19.12.2016 **Maximum Marks: 100**
Time: 3 Hrs **Pass Marks : 50**

PART-A 10×3=30 Marks)

(Answer the compulsory question)

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 Vanderwaal'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 (5×14=70 Marks)

(Answer any five of the following)

2. a) State the first law of thermodynamics applied to closed system process and steady flow process. Derive steady flow energy equation. (10 marks)

   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. (4 marks)

3. a) 0.25 kg of air at a pressure of 1 bar occupies a volume of 0.3 m^3.if this air expands isothermally to a volume of 0.9 m^3.find a)initial temperature b)final temperature c)external work done d)heat absorbed by the air e)change in internal energy. assume R=0.29kj/kg-k. (10 marks)

b) Define point function and path function. (4 marks)

4. a) With a neat sketch explain Mollier Chart of steam. (8 marks)

b) Determine the condition of steam whether it is wet, dry or superheated for the following cases by using steam tables only.
i) Steam has a pressure of 10 bar and specific volume 0.22 m^3/kg.
ii) Steam has a pressure 15 bar and temperature 225°C.
iii) Steam has a temperature 200°C and enthalpy 2790.9 KJ/kg.
iv) Steam has a temperature of 120°C and entropy 7 KJ/Kg-K. (6 marks)

5. a) Derive the relation between the specific heat constants Cp and Cv. (10 marks)

b) Determine the molecular volume of any perfect gas at 600 N/m^2 and 30°C.universal gas constant may be taken as 8314 J/kg mole-K. (4 marks)

6. a) What are the effects of impure feed in boilers. (4 marks)

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. (10 marks)

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

Clearance volume = 0.04 m^3
Swept volume =0.13 m^3

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 marks)

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

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