

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
Time: 3 Hrs

Maximum Marks: 100
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 $R=0.29\text{kJ/kg-k}$. (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.
- Steam has a pressure of 10 bar and specific volume $0.22 \text{ m}^3/\text{kg}$.
 - Steam has a pressure 15 bar and temperature 225°C .
 - Steam has a temperature 200°C and enthalpy 2790.9 KJ/kg .
 - 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 C_p and C_v . (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= $30,000 \text{ kJ/kg}$
- 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)
