# INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

**End Semester Examinations December 2018**

## B. Tech (Marine Engineering)

**Semester – I**

**Basic Thermodynamics (UG11T2103)**

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Date: 02.01.2019 Maximum Marks: 100

Time: 3Hrs Pass Marks: 50

**Note:** i. Use of approved type of scientific calculator is permitted.
ii. The symbols have their usual meanings.

**Part –A** **10 x 3 = 30 Marks**

**(All Questions are compulsory)**

1. a. Define path function & point function.

   b. State first law of thermodynamics.

   c. Distinguish between ideal gas & real gas.

   d. State joule's law related to internal energy.

   e. Define critical point of a pure substance.

   f. Define specific volume of steam.

   g. Define equivalent evaporation of a boiler.

   h. Define boiler thermal efficiency.

   i. Define Mean effective pressure and air standard efficiency.

   j. Draw the T-S diagram for the dual cycle.

**Part – B** **5 x 14 = 70 Marks**

**(Answer any 5 of the following 7 Questions)**

2. The initial pressure, volume and temperature of air in a cylinder fitted with a movable piston are 10 bar,0.04 $m^3$ and 400 K respectively. If air expands according to the law $PV^{1.3}$ = constant to a final volume of 0.2 $m^3$ calculate the work done, change in internal energy and heat transferred.

(14 marks)

3. Derive the Steady flow energy equation. Explain the significance of the each term involved in it. (14 marks)

4. a) Establish relations among Cp,Cv,R and ¥ of perfect gas. (10 marks)

   b) Determine the molecular volume of any perfect gas at 600 $N/m^2$ and $30^0$C.universal gas constant may be taken as 8314 J/kg mole-K. (4 marks)

5. a) Explain Mollier diagram in detail. (8 marks)

   b) One kg of steam contains 1/3 liquid and 2/3 vapour by volume. the temperature of the steam is $150^0$C.find the quality, specific enthalpy of mixture. (6 marks)

6. a) What are the effects of impure feed in boilers. (6 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 = $34^0$C

   Calculate the equivalent evaporation from and at $100^0$C per kg of coal and the efficiency of the boiler. (8 marks)

7. Derive an expression for thermal efficiency of four stroke Diesel cycle along with p-v and T-S diagrams. (14 marks)

8. 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 $120^0$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)

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