INDIAN MARITIME UNIVERSITY

(A Central Univesity, Government of India)

May/June 2018-End Semester Examination

B.Tech(Marine Engineering)

Semester II

Applied Thermodynamics I (UG11T2203/1203)

Date: 14-06-2018 Maximum Marks:100

Time: 3 Hrs Pass Mark : 50

PART-A

(All questions are compulsory)

(10 × 3=30)

1.a)State clausius statement of second law of thermodynamics.

b)Define entropy and change in entropy.

c)Mention the improvements made to increase the ideal efficiency of rankine cycle.

d)What are the effects of condenser pressure on the rankine cycle.

e)Define Specific steam consumption of an ideal rankine cycle.

f)What are the factors that affect the volumetic efficiency of a reciprocating compressor.

g) What is compression ratio.

h) What is meant by free air delivered.

i)What is the difference between air conditioning and refrigeration.

j)State Amagat's law of partial volume.

PART-B

ANSWER ANY 5 FROM THE FOLLOWING 7 QUESTIONS

(5×14=70)

2.a)1 Kg of steam at 7 bar, entropy 6.5 Kj/Kg K ,is heated reversibly at constant pressure until the temperature is 250^0C.Calculate the heat supplied.

(8)

b)A rigid cylinder of volume 0.025 m^3 contains steam at 80 bar and 350^0C. The cylinder is cooled until the pressure is 50 bar. Calculate the state of the steam after cooling and the amount of heat rejected by the steam. (6)

3.a)A mass of 5 kg air is compressed from 0.9 bar, 32°c to 6 bar in a polytropic process $PV^{1.3}$ = constant. Find the change in entropy. (6)

b)Establish the general expression for the change in entropy of an ideal gas from the first law of thermodynamics.i)in terms of volume and absolute temperature ii)in terms of pressure and volume. (8)

4. Determine the rankine cycle efficiency working between 6 bar and 0.4 bar when supplied with dry saturated steam. By what percentage is the efficiency increased by supplying superheated steam of 300°C. (14)

5.Define the following terms as applied to steam engines:

i)Mean effective pressure

ii)Diagram factor

iii)Missing quantity. (14)

6.a)Explain Multi stage air compression in compressors. (6)

b) A single acting air compressor, the clearance volume is 5% of stroke volume. Air is drawn in a constant pressure of 1 bar at a temperature of 37^0C. Compression follows the law $PV^{1.2}$ =constant and the pressure is 7 bar. The compressor delivers 15 kg of air/min. Find the volumetric efficiency and the power required to drive the compressor. (8)

7.a)Derive an expression for volumetric efficiency in compressors . (7)

b) A single cylinder single acting reciprocating compressor is required to compress 0.83m^3 of air From 1.05 bar and 20^0c to 8 bar and

135^0c.Assuming that the compression follows the law $PV^n=C$. Calculate the value of n. (7)

8. 4 kg of carbon dioxide at 40°C and 1.4 bar are mixed with 8 kg of nitrogen at 160°C and 1.0 bar to form a mixture at a final pressure of 0.7 bar. The process form a mixture at a final pressure of 0.7 bar. The process occurs adiabatically in a steady flow apparatus. Calculate

    i)The final temperature of the mixture
    ii)Change in entropy.

Take value of Cp for CO_2 = 0.85 kJ/kg K and N_2=1.04 kJ/kg K. (14)

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