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B. E. (Third Semester) Examination, Nov.-Dec. 2021

(New Scheme)

(Mech., Production & Automobile Branch)

ENGINEERING THERMODYNAMICS

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Part is (a) is compulsory is of 2 marks. Attempt any two from part (b), (c) and (d) 7 marks each. Use of steam table is allowed.*

Unit-I

1. (a) What is the difference between a refrigerator and heat pump? 2

(b) Derive an expression for efficiency of carnot engine. 7

(c) A household refrigerator is maintained at a temp of 2°C. Evertime the door is opened, warm material is placed inside, introducing an avg of 420 kJ, but making only a small change in the temp of refrigerator. The door is opened 20 times a day and the refrigerator operates at 15% of the ideal cop. The cost of work is Rs. 3 per kW. What is the monthly bill for refrigerator? The atmosphere is at 30°C. 7

(d) Two kg of water at 80°C mixed adiabatically with three kg of water at 30°C in a constant pressure process at one atmosphere. Find the increase in entropy of the total mass of water due to mixing process (Assume : $C_p = 4{\cdot}187$ kJ/kg K). 7

Unit-II

2. (a) Define dead state. 2

(b) 20 kg of water at 90°C is mixed with 30 kg of water at 30°C, and the pressure remains constant during the mixing operation. Calculate the decrease in available energy. it may be presumed that the

surroundings are at 10°C temp and for water $C_p = 4{\cdot}18$ kJ/kg K. 7

(c) Derive an expression for availability of a steady flow system. 7

(d) Derive Maxwell's equation and state their importance in thermodynamics. 7

Unit-III

3. (a) What is an ideal gas? How it is differ from perfect gas? 2

(b) Define the terms reduced pressure and reduced volume. Expression the Vander Wall's equation of state in terms of reduced parameter. 7

(c) Define the following : 7

(i) Boyle's Law

(ii) Charle's Law

(iii) Avogadro's Law

(iv) Compressibility factor

(d) State the Dalton's law of partial pressure. On what assumptions this law is based. 7

Unit-IV

4. (a) Define Triple point of substance. 2

(b) A vessel contains wet steam which is 1/3 liquid and 2/3 vapour by volume. The temperature of steam is 151·80°C. Calculate the quality, specific entropy, specific enthalpy and specific volume. 7

(c) 3 kg of steam at 10 bar and 250°C under goes a constant pressure process. The resulting steam is wet having dryness fraction 0·6. Calculate the

(i) Workdone

(ii) Change in enthalpy

Assume non-flow process. 7

(d) Steam at a pressure of 4 bar and 0·7 is allowed to expand at a constant volume untill the pressure rises to 5·5 bar. Find the final condition of steam and the heat absorbed by 1 kg of steam. 7

Unit-V

5. (a) What are the essentials of a good boiler? 2

(b) How the boilers are classified? Compare the fire tube and water tube boilers. 7

(c) Define the term mountings and assessories of boilers. Why the mountings are necessary for a boiler? Name two mountings and three aceessories and discuss their function. 7

(d) Explain construction working and advantages of cochran fire tube boiler. 7