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10NT53

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Basic Thermodynamics

Time: 3 hrs.

Max. Marks:100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART – A

- 1 a. Define thermodynamic system. Explain different types of thermodynamic system. (07 Marks)
b. What is thermodynamics? Distinguish microscopic and macroscopic approaches in the study of thermodynamics. (06 Marks)
c. Write a note on concept of temperature. Explain any two scales of temperature. (07 Marks)
- 2 a. With a proper diagram, explain work done in :
i) Electrical work
ii) Shaft work
iii) Stirring work
iv) Flow work. (08 Marks)
b. With PV diagram derive an expression for work done in :
i) Isochoric process
ii) Isobaric process
iii) Isothermal process
iv) Polytrophic process. (12 Marks)
- 3 a. From first law of thermodynamics show that energy is property of a system. (06 Marks)
b. Write the steady flow energy equation for an open system and explain terms in it. Simplify SFEE for the systems:
i) Air compressor
ii) Nozzle. (06 Marks)
c. Air enters an adiabatic nozzle steadily at 300Kpa, 473K and 30ms^{-1} and leaves at 100KPa and 180ms^{-1} . The inlet area of the nozzle $80 \times 10^{-4}\text{m}^2$, determine :
i) Mass flow rate through the nozzle
ii) Exit temperature of air. (08 Marks)
- 4 a. State Clausius and Planck statement of second law of thermodynamics and prove that they are equivalent. (08 Marks)
b. With the help of PV diagram, explain Carnot cycle. (07 Marks)
c. A heat engine operates between a source at 573K and sink 243K. What is the amount of heat rejected by the engine when developing 100kW? (05 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.

PART – B

- 5 a. State and prove Clausius inequality. (10 Marks)
b. Show that entropy of the universe is continually increasing. (04 Marks)
c. A heat engine absorbs 200kJ/s of heat at 500K and rejects heat at 300K. Three cases of heat rejection are reported :
i) 180 kJ/s
ii) 120 kJ/s
iii) 60kJ/s.
Classify each cycle. (06 Marks)
- 6 a. Explain how dryness fraction of a wet steam is measured by using combined separating and throttling calorimeter. (10 Marks)
b. Explain about saturated vapour and superheated vapour states of pure substance with water as example. (10 Marks)
- 7 a. Explain briefly about evaluation of heat work, change in internal energy, enthalpy and entropy in :
i) Reversible polytropic process
ii) Reversible hyperbolic process (10 Marks)
b. Explain how specific heats of ideal gases are related to gas constant.
i) What is the difference between perfect, semiperfect ideal gases?
ii) Write a brief note on universal and particular gas constant. (10 Marks)
- 8 a. State Dalton's law of additive pressures. Derive the expression for partial pressure of an individual constituent in a mixture of ideal gas. (08 Marks)
b. State Amagat's law of additive volumes. Derive the expression for partial volume of an individual constituent in a mixture of ideal gas. (06 Marks)
c. Explain Vander Waals equation of state, and derive Vander Waals constants. (06 Marks)

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