KUMARAGURU college of technology
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Register Number: ………………..

B.E DEGREE EXAMINATIONS: JUNE 2015

(Regulation 2009)

Third Semester

MEC105: ENGINEERING THERMODYNAMICS

(Common AUE/ME)

(Use of approved thermodynamic tables, Mollier diagram, Psychrometric chart and Refrigerant tables are permitted)

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. First law of thermodynamics deals with

a)	conservation of heat	b)	conservation of momentum
c)	conservation of mass	d)	conservation of energy

2. A definite area or a space where some thermodynamic process takes place is known as

a)	thermodynamic cycle	b)	thermodynamic process
c)	thermodynamic system	d)	thermodynamic law

3. The efficiency of an ideal Carnot engine depends on

a)	working substance	b)	the temperature of the source only
c)	the construction of the engine	d)	the temperatures of both source and the sink

4. In an irreversible process there is

a)	loss of heat	b)	no loss of work
c)	gain of heat	d)	no gain of heat

5. The latent heat of vapourisation at the critical point is

a)	less than zero	b)	greater than zero
c)	equal to zero	d)	equal to unity

6. The specific volume of water when heated at $0^{o}C$

a)	first increases and then decreases	b)	first decreases and then increases
c)	increases steadily	d)	decreases steadily

7. The relation between Cp, Cv and R is given as

a) Cp – Cv = R
b) Cv – Cp = R
c) Cp/Cv = R
d) Cv/Cp = R

8. Which of the following parameter is significant to ascertain chemical equilibrium of the system?

a) Clapeyron relation
b) Maxwell relation
c) Gibbs function
d) Helmholtz function

9. During sensible cooling, dew point temperature

a) Decreases
b) increases
c) remains constant
d) can decrease or increase

10. The difference between dry bulb temperature and wet bulb temperature is called

a) dry bulb depression
b) wet bulb depression
c) dew point depression
d) degree of saturation

PART B (10 x 2 = 20 Marks)

11. Distinguish intensive and extensive properties.
12. List the limitations of First law of thermodynamics.
13. State Kelvin-Plank statement of Second law of thermodynamics.
14. Differentiate heat pump and refrigerator.
15. What is a pure substance? Give examples.
16. What is meant meom by crificar temperature in formation of steam?
17. What is meant by equation of state? Write the same for an ideal gas.
18. Outline the value of the Clapeyron equation in thermodynamics.
19. Differentiate relative humidity and specific humidity.
20. Define Dew point temperature.

PART C (5 x 14 = 70 Marks)

21. a) A system contains 2 kg of ideal gas which is compressed adiabatically from pressure 100 kPa and temperature 220 K to a final pressure of 400 kPa. Make calculations for: (i) initial volume, (ii) final volume and temperature, (iii) work performed, (iv) heat added to or subtracted from the system, and (v) change in internal energy. It may be presumed that for the given ideal gas c_p = 1 kJ/kgK and c_v = 0.707 kJ/kgK.

(OR)

b) Derive the steady flow energy equation and reduce the same for the following thermal power equipments by making suitable assumptions: (i) turbine, (ii) nozzle, (iii) pump and (iv) throttling device.

22. a) Two reversible heat engines A and B are arranged in series. Engine A rejects heat directly to engine B. Engine A receives 200 kJ at a temperature of 421^{o}C from the hot source while engine B is in communication with a cold sink at a temperature of 5^{o}C. If the output of A is twice that of B, find (i) intermediate temperature between A and B, (ii) efficiency of each engine, and (iii) heat rejected to the sink.

(OR)

b) (i) State and prove Clausius inequality. (7)

(ii) A lump of steel of mass 8 kg at 1000 K is dropped in 80 kg of oil at 300 K. Make calculations for the entropy change of steel, the oil and the universe. Take specific heats of steel and oil as 0.5 kJ/kg K and 3.5 kJ/kg K, respectively. (7)

23. a) (i) Explain the process of steam generation at constant pressure and show the various stages on T-S diagram. (7)

(ii) Steam at 1000 kPa and 300^{o}C enters an engine and expands to 20 kPa. If the exhaust steam has a dryness fraction of 0.9, determine the enthalpy drop and change in entropy. (7)

(OR)

b) A steam turbine working on Rankine cycle is supplied with dry saturated steam at 25 bar and the exhaust takes place at 0.2 bar. For a steam flow rate of 10 kg/s, determine: (i) quality of steam at end of expansion, (ii) turbine shaft work, (iii) power required to drive the pump, (iv) work ratio, (v) Rankine efficiency, and (vi) heat flow in the condenser.

24. a) (i) Derive Maxwell’s equations and state their importance in thermodynamics. (9)

(ii) Derive the Tds equation taking T and V as independent variables. (5)

(OR)

b) Deduce the expression for the Joule Thompson co-efficient and hence explain the variation of temperature with pressure for various enthalpies, marking all zones and boundaries in a plot.

25. a) Atmospheric air at 0.965 bar enters the adiabatic saturator. The wet bulb temperature is 20^{o}C and the dry bulb temperature is 31^{o}C during adiabatic saturation process. Determine, (i) humidity ratio of the entering air, (ii) vapour pressure and relative humidity at 30^{o}C, and (iii) dew point temperature.

(OR)

b) Explain the following processes and represent these on a psychrometric chart: (i) Adiabatic mixing of two streams, (ii) Heating and humidification, (iii) Cooling and dehumidification

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