A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 53703

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

Third Semester

Mechanical Engineering

15UME303-ENGINEERING THERMODYNAMICS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

PART A - (10 x 1 = 10 Marks)

1. Which one of the following is the extensive property of a thermodynamic system? CO1- R

   (a) volume (b) pressure

   (c) temperature (d) density

2. The heating and expanding of a gas is called CO1- R

   (a) Thermodynamic system (b) Thermodynamic cycle

   (c) Thermodynamic process (d) Thermodynamic law

3. The second law of thermodynamics defines CO2- R

   (a) Heat (b) Work (c) Enthalpy (d) None of these

4. In an irreversible process, there is a CO2- R

   (a)Loss of heat (b) No loss of heat (c)Gain of heat (d) No gain of heat

5. Thermal power plant works on CO3 -R

   (a) Rankine cycle (b) Carnot cycle (c) Joule cycle (d) Otto cycle

6. Dryness fraction of steam is defined as CO3 -R

(a)Mass of water vapour in suspension/(mass of water vapour in suspension + mass of dry steam)

(b) Mass of dry steam/mass of water vapour in suspension

(c) Mass of dry steam/(mass of dry steam + mass of water vapour in suspension)

(d) Mass of water vapour in suspension/mass of dry steam

7. Which one of the following relations defines the Helmholtz function F? CO4 -R

(a) F = H + TS (b) F = H - TS (c) F = U – TS (d) F = U + TV

8. According to Dalton's law, total pressure of the mixture of gases is equal to CO4 -R

(a) Atmospheric pressure (b) Sum of the Partial pressure of all

(c) Average of the Partial pressure of all (d) Average of the Partial pressure of all

9. In an unsaturated air the state of a vapour is CO5- R

(a) Wet (b) Super heated

(c) Saturated (d) Unsaturated

10. The relative humidity, during heating and humidification CO5- R

(a) Decreases (b) increases

(c) Remains constant (d) Can decrease or increase

PART – B (5 x 2= 10Marks)

11. What do you mean by Quasi-static process? CO1- R

12. Draw a schematic diagram of a heat pump and expression of COP? CO2- R

13. Why is carnot cycle not a realistic model for steam power plant? CO3 -R

14. Write Boyle's law. CO4 -R

15. What is sensible heating process? CO5- R

PART – C (5 x 16= 80Marks)

16. (a) A temperature scale of certain thermometer is given by the relation $T=\alpha \ln p+b$ where α and b are constants and p is thermometric property of the fluid in the thermometer. If at the ice point and steam point the thermometric properties are found to be 1.5 and 7.5 respectively. What will be the temperature corresponding to the thermometric properties of 3.5 on Celsius scale. CO1- App (16)

Or

(b) A gas of mass 1.5kg undergoes a quasi static expansion which follows a relationship P = a + bV where a & b are constants. The initial and final pressures are 100kPa & 200kPa respectively and the corresponding volumes are $0.2m^3$ and $1.2m^3$. The specific internal energy of gas is given by the relation u = 1.5 Pv – 85. Where P is in kPa and 'v' is in m^3/kg. Calculate the net heat transfer and maximum internal energy of the gas attained during expansion. CO1 -App (16)

17. (a) A heat pump is driven by a heat engine. The heat transfer from both the heat engine & pump is used to heat the circulating water in the radiator of the building. The efficiency of the heat engine is 27% & COP of the heat pump is 4. CO2 -App (16)

(i) Draw the neat diagram of the arrangement
(ii) Evaluate the ratio of heat transfer to the circulating water to the heat transfer to the heat engine

Or

(b) Two Carnot engines work in series between the source and sink temperature of 50K and 350K. If both engines develop equal power. Determine the intermediate temperature. CO2 -Ana (16)

18. (a) A vessel of volume of $0.04m^3$ contains a mixture of saturated water and saturated steam at a temperature of 150℃. The mass of the liquid present is 9kg. Find the pressure, the mass, the specific volume, the enthalphy, the entropy and internal energy. CO3- Ana (16)

Or

(b) Steam at a pressure of 2.5MPa &500C is expanded in a steam turbine to a condenser pressure of 0.05 MPa. Determine for Rankine cycle, CO3- Ana (16)

(i) Thermal efficiency of Rankine cycle
(ii) Specific steam consumptiom

If steam pressure is reduced to 1MPa & the temperature is kept same 500C, determine the thermal efficiency & specific steam consumption. Neglect pump work.

19. (a) The volume of a high altitude chamber is 40 m^3. It is put into operation by reducing pressure from 1 bar to 0.4 bar and temperature from 25°C to 5°C. How many kg of air must be removed from the chamber during the process? Express this mass as a volume measured at 1 bar and 25°C. CO4- U (16)

Or

(b) Drive Tds equation when (i) T and V independent (ii) T and P independent and (iii) P and V independent. CO4 -Ana (16)

20. (a) Atmospheric air at 1.0132 bar has a DBT of 32C and a WBT of 26C. Compute (i) The partial pressure of water vapour (ii) Specific humidity (iii) Dew point temperature (iv) the relative humidity (v) the degree of saturation (vi) the density of air in the mixture (vii) the density of vapour in the mixture and (viii) the enthalphy of the mixture. Use thermodynamic table only. CO5 -U (16)

Or

(b) The air supplied to a room of a building in winter is to be at 17°C and have a relative humidity of 60%. If the barometric pressure is 1.01325 bar, find CO5 -U (16)

(i) The specific humidity
(ii) Dew point under these conditions.