Reg. No. : | | | | | | | | | | | | |

Question Paper Code: U3703

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

Third Semester

Mechanical Engineering

21UME303 – Engineering Thermodynamics

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Properties do not change with time in CO1- U

(a) Slush casting (b) Turbulent flow (c) Unsteady flow (d) Steady flow

2. Unit for specific heat CO1- U

(a) KJ/Kg (b) Kg/KJ (c) KJ (d) KJ/KgK

3. Kelvin –Planck's law deals with CO1- U

(a) Conservation of work (b) conservation of heat

(c) conversion of heat into work (d) conversion of work into heat

4. The efficiency of carnot cycle depends upon CO1- U

(a) temperature limits (b) pressure ratio

(c) volume compression ratio (d) cut-off ratio and compression ratio

5. Steam Power Plant is working based on CO1- U

(a) Carnotcycle (b) Otto cycle (c) Joulecycle (d) Rankine cycle

6. In Rankine cycle, heat rejection takesplace at CO1- U

(a) V=C (b) P=C (c) T=C (d) S =C

7. Which of the following relation is correct? CO1- U

(a) dU=TdS-pdV (b) dH=TdS+Vdp (c) dG=Vdp-SdT (d) all of the above

8. Which of the following is not a Maxwell equation? CO1- U

(a) $(\partial T/\partial V) = -(\partial p/\partial S)$ (b) $(\partial T/\partial p) = -(\partial V/\partial S)$

(c) $(\partial p/\partial T) = (\partial S/\partial V$ (d) $(\partial V/\partial T) = -(\partial S/\partial p)$

9. When the adiabatic mixing is carried out, the air having _____ enthalpies and _____ specific humidities are mixed. CO1- U

(a) similar, similar (b) different, similar

(c) similar, different (d) different, different

10. In adiabatic evaporative cooling, heat transfer between chamber and surroundings is CO1- U

(a) zero (b) high (c) low (d) none of the above

PART – B (5 x 2= 10Marks)

11. Explain all assumptions made for SFEE CO1- U

12. Explain dead state CO1- U

13. Explain the term pure substance. Give Examples CO1- U

14. Explain Maxwell's relations? CO1- U

15. Explain Relative Humidity CO1- U

PART – C (5 x 16= 80 Marks)

16. (a) A Fluid is confined in a cylinder by a spring loaded frictionless piston, so that the pressure in a fluid is a linear function of volume P=a+bV. The Internal Energy of the fluid is given by the following equation U= 34+3.15PV Where U is in KJ, P is in KPa, V is in m^3 .If fluid changes from an initial state of 170 KPa, 0.03 m^3 to a final state of 400 KPa, 0.06 m^3 with no work transfer other than that done on the piston. Find the direction and magnitude of work and heat transfer . CO2-App (16)

Or

(b) Derive steady flow energy equation and apply it to deduce an expression for steam turbine. CO2-App (16)

17. (a) Two carnot Engine A and B operated in Series. The first one A receives heat at 870 K and rejects to a reservoir at temperature(T). The second engine receives the heat rejected by the first engine and in turn rejects to a heat reservoir at 300K.Calculate the Intermediate temperature(T) in kelvin between two heat engines for the following cases. i) Two work output of the engines are equal ii) Efficiency of the two heat engines are equal CO2-App (16)

Or

	(b)	A Closed system contains air pressure of 1 bar, temperature 300K,and volume 0.018 m^3 . The system undergoes a thermodynamic cycle consisting of the following three process in series i) Constant volume heat addition till heat pressure becomes 5 bar ii) constant pressure cooling and isothermal heating to initial state . Draw the PV Diagram and find out change in entropy for every process. State Cv= 0.718 KJ/KgK R= 0.287 KJ/KgK.	CO2-App	(16)
18.	(a)	A Vessel of volume 0.04 m^3 contains a mixture of saturated water and saturated steam at a temperature of 250^0 C. The mass of liquid present is 9 Kg. Find the Pressure, Mass, Specific Volume, Specific Entropy , Specific Enthalpy, Specific Internal Energy.	CO4- App	(16)
		Or		
	(b)	A Steam boiler generate 30 bar and 300^0 C at the rate of 2Kg/s. The steam is expanded isentropic in turbine to a condenser in a Pressure of 0.05 bar condense at a constant pressure and pumb back to the boiler. Find the Efficiency of the cycle , heat supplied in the boiler, quality of steam after the expansion.	CO4- App	(16)
19.	(a)	A vessel of volume 0.3m^3 contains 15 kg of air at 303K. Determine the pressure exerted by the air using 1. Perfect gas equation, 2. Vander waals equation, 3. Generalized compressibility chart. Take critical temperature of air is 132.8K ,critical pressure of air is 37.7 bar and Z = 0.99.	CO3- App	(16)
		Or		
	(b)	Derive the Maxwell relations and explain their importance in thermodynamics.	CO3- App	(16)
20.	(a)	Atmospheric air with barometric pressure of 1.0132 bar has 38^0C dry bulb temperature and 28^0C wet bulb temperature without aid of psychometic chart, determine humidity and relative humidity and dew point temperature.	CO4- App	(16)
		Or		
	(b)	An air conditioning system has the following conditions 1)outdoor conditions 15^0C dry bulb temperature and 10^0C wet bulb temperature 2)required conditions 20^0C DBTand 50% relative humidity, amount of pre air circulated 0.25 m^3/min per person 3) seating capacity 50 person to requied conditons is achieved first by heating and then by adaibatic humidification . determine the following 1) capacity of heating coil 2)capacity of humidifier.	CO4- App	(16)