Register No : _____

THE KAVERY ENGINEERING COLLEGE

An Autonomous Institution

B.E / B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

Third Semester

Chemical Engineering

CH3301 - Basic Mechanical Engineering

(Steam Tables Can be Permitted)

Regulations - 2021

Duration : 3 Hrs *Maximum : 100 Marks*

*PART – A ANSWER ALL QUESTIONS (Marks 10*2=20)*

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	What is a thermodynamic system? Explain different classes of systems with suitable examples.	UN	1	2
2.	Define thermal efficiency of a heat engine cycle.	RE	1	2
3.	Define an isentropic process.	RE	2	2
4.	Compare free expansion process and throttling process.	UN	2	2
5.	What are the assumptions made in air standard cycle?	UN	3	2
6.	Define mean effective pressure.	RE	3	2
7.	What are the important basic components of an IC engines?	UN	4	2
8.	Discuss the critical condition of steam.	UN	4	2
9.	List some important inversions of four chain mechanism?	RE	5	2
10.	What is meant compound gear train?	RE	5	2

*PART – B ANSWER ALL QUESTIONS (Marks 5*13 = 65)*

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a	A thermodynamic system operates under steady flow conditions, the fluid entering at 2 bar and leaving at 10 bar. The entry velocity is 30 m/s and the exit velocity is 10m/s. During the process 25 MJ/hr of heat from an external source is supplied and the increase in enthalpy is 5kJ/kg. The exit point is 20m above the entry point. Estimate flow work from the system if the fluid flow rate is 15 kg/min.	AN	1	13
		Or			
	b	A reversible heat engine operates between two reservoirs a temperature of 600^0 C and 40^0 C. the engine drives a reversible refrigerator which operates between the reservoirs at temperatures of 40^0 C and -20^0 C. the heat transfer to the heat engine is 2000 KJ and the network output for the combined engine refrigerator is 30 KJ. Evaluate the heat transfer to the refrigerant and the net heat transfer to the reservoir at 40^0 C.	AN	1	13

12.	a	i	A reversible adiabatic process begins at P_1=10 bar, T_1=300°C and end with P_2=1 bar Find the specific volume and the work done per kg of fluid if the fluid is air.	AP	2	9
		ii	Write a short note on reversibility and irreversibility.	AP	2	4
			Or			
	b		A vessel of constant volume 0.3 m^3 contains air at 1.5 bar and is connected via a valve to a large main carrying air at a temperature of 38^0 C and high pressure. The valve is opened allowing air to enter the vessel and raising the pressure therein to 7.5 bar. Assuming the vessel and valve to be thermally insulated, predict the mass of the air entering the vessel.	EV	2	13
13.	a		Derive the expression for the efficiency of diesel cycle in terms of cycle parameters.	AP	3	13
			Or			
	b		In an SI engine working on the ideal Otto cycle, the compression ratio is 5.5. the pressure and temperature of compression are 1 bar and 27^0 C, respectively. The peak pressure is 30 bar. Determine the pressure and temperature at the salient points, the air-standard efficiency and the mean effective pressure. Assume ratio of specific heats to be 1.4 for air.	AN	3	13
14.	a	i	Explain the working of 4-stroke Diesel engine.	AP	4	9
		ii	What is the difference between S.I and C.I engines?	AP	4	4
			Or			
	b		A vessel having a capacity of 0.05 m^3 contains a mixture of saturated water and saturated steam at a temperature of 245°C. the mass of the liquid present is 10 kg. Calculate the pressure, mass, specific volume, specific enthalpy, specific entropy, and specific internal energy.	AN	4	13
15.	a	i	Classify kinematic pairs based on degrees of freedom.	AP	5	9
		ii	Explain mechanical advantage and transmission angle related to four bar mechanism.	AP	5	4
			Or			
	b		In a Four bar chain ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 R.P.M. clockwise, while the link CD = 80 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD = 60°.	EV	5	13

*PART – C (Marks 1*15 = 15)*

Q.No		*Questions*	*BLT*	*CO*	*Marks*
16.	a	Consider a steam power plant that operates on a reheat Rankine cycle and has a net power output of 80MW. Steam enters the high-pressure turbine at 10 MPa and 500˚C and the low-pressure turbine at 1 MPa and 500˚C. Steam leaves the condenser as a saturated liquid at a pressure of 10 kPa. The isentropic efficiency of the turbine is 80 percent, and that of the pump is 95 percent. Show the cycle on a T-S diagram with respect to saturation lines, and determine, (i) The quality or temperature, if superheated of the steam at the turbine exit, (ii) The thermal efficiency of the cycle, and (iii) The mass flow rate of the steam.	AN	3	15
		Or			
	b	Derive the expression for velocity and acceleration of slider by analytical method.	AN	5	15