Course Code: 1930315 Roll No: MLRS- R19

MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
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II B.Tech I Sem Regular End Examination, March 2021

THERMODYNAMICS
(MECHANICAL)

Time: 3 Hours. **Max. Marks: 70**

Note: 1. Answer any FIVE questions.
2. Each question carries 14 marks and may have a, b as sub questions.

1	a)	What are different thermodynamic systems? Give example for each type with justification.	7M	CO	BL1
	b)	If a gas of volume 6000 cm^3 and at a pressure of 100 kPa is compressed quasistatically according to the law, $Pv^2 = C$, where C is constant. The compression continues till the volume becomes 2000 cm^3. Determine the final pressure and work transfer.	7M	CO	BL2
2	a)	Define : (i) Thermodynamic Equilibrium and (ii) Pure Substance	6M	CO	BL1
	b)	A fluid contained in a cylinder receives 150 kJ of mechanical energy by means of a paddle wheel, together with 50 kJ in the form of heat. At the same time, a piston in the cylinder moves in such a way that the pressure remains constant at 200 kN/m^2 during the fluid expansion from 2 m^3 to 5 m^3. What is the change in internal energy and in enthalpy.	8M	CO	BL2
3	a)	Apply the First Law of Thermodynamics to the following systems, making necessary assumptions. (i) Turbine, (ii) Nozzle, (iii) Air compressor and (iv) Throttling valve	7M	CO	BL2
	b)	Two reversible heat engines A and B are arranged in series, engine A rejecting heat directly to engine B. Engine A receives 200 kJ at a temperature of 421^0C from a hot source, while engine B is in communication with a cold sink at 4.4^0C. If the work out of engine A is twice that of B, find a) Intermediate temperature between A and B, b) efficiency of each engine and c) the heat rejected to the cold sink.	7M	CO	BL3
4	a)	Show that the enthalpy of an ideal gas is a function of temperature only.	6 M	CO	BL2
	b)	A large insulated vessel is divided into two chambers, one containing 5 kg of dry saturated steam at 0.2 MPa and the other contains 10 kg of steam at 0.8 quality and 0.5 MPa. If the partition between the chambers is removed and the steam is mixed thoroughly and allowed to settle, find the final pressure, steam quality and entropy change of process.	8 M	CO	BL2

5	a)	Calculate the changes of entropy per kg of air in the following cases: (i) Air expands isothermally from 6 bar to 3 bar (ii) Air is compressed to half the volume at constant pressure and (iii) Heat is supplied to air at constant volume till the pressure becomes three fold. What would be the change in entropy of the air undergoes the above three processes in sequence. Take C_p = 1.005 kJ/kgK and C_v = 0.720 kJ/kgK.	8M	CO	BL3
	b)	With the help of a schematic diagram, explain the apparatus for the measurement of dryness fraction of steam.	6M	CO	BL1
6	a)	Define the terms: i) Relative Humidity, ii) Wet Bulb Temperature and iii) Adiabatic Saturation Temperature.	6M	CO	BL1
	b)	A gaseous mixture consists of 1 kg of oxygen and 2 kg of nitrogen at a pressure of 150 kPa and at a temperature of 20^{0}C. Determine the changes in internal energy, enthalpy and entropy of the mixture, when the mixture is heated to 100^{0}C at constant volume.	8M	CO	BL2
7	a)	Explain the working of Brayton cycle with the help of neat sketch.	7M	CO	BL2
	b)	Compare the Otto, Diesel and Dual cycles on the basis of same compression ratio.	7M	CO	BL2
8	a)	In an air standard Otto cycle, the compression ratio is 7 and the compression begins at 35^{0}C, 0.1 MPa. The maximum temperature in the cycle is 1100^{0}C. Find, i) the heat supplied per 1 kg of air, ii) the cycle efficiency and iii) mean effective pressure of the cycle.	7M	CO	BL2
	b)	With the help of a schematic diagram, explain the working of Vapor Compression Cycle. Represent the cycle on T-s and p-h charts.	7M	CO	BL1

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