R16

Code No: ME404ES

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, 2019
THERMODYNAMICS

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.

PART A (25 Marks)		
Q.No	**Question**	**Bloom's Level**
1.a)	Define intensive and extensive property.	L1
b)	Explain the concept of thermodynamic equilibrium?	L2
c)	Define Heat engine and Heat pump.	L1
d)	Explain the limitations of First law of thermodynamics.	L2
e)	Explain the similarities between work and heat.	L2
f)	Demonstrate work done equation for non flow reversible constant pressure process.	L2
g)	Define mole fraction and volume fraction of a gas constituent in a mixture.	L1
h)	Explain Dalton's Law of partial pressure.	L2
i)	Outline P-V and T-S diagrams of diesel cycle.	L2
j)	Explain mean effective pressure of otto cycle.	L2
PART B (50 Marks)		
2.	$0.2m^3$ of air at 4 bar and 130^0C is contained in a system. A reversible adiabatic expansion takes place till the pressure falls to 1.02 bar. The gas is then heated at constant pressure till enthalpy increases by 42.5 KJ. Solve: (i) The work done (ii) The index of expansion, if the above process are replaced by a single reversible polytrophic process giving the same work between the same initial and final states.	L3
OR		
3.	A platinum wire is used as a resistance thermometer. The wire resistance was found to be 10Ω and 16Ω at ice and steam points respectively and 30Ω at sulphur boiling point 444.6^0 C. Solve the constants a and b in the equation. $R= R_O (1 + aT +bT^2)$. Where T is in ^{0}C. Also find the resistance of wire at 500^0 C.	L3
4.	A reversible heat engine operates between two reservoirs at temperature 700^0 C and 50^0 C. The engine drives a reversible refrigerator which operates between reservoirs at temperatures of 50^0 C and -25^0 C. The heat transfer to the engine is 2500KJ and the net work output of the combined engine refrigerator plant is 400KJ. (i) Determine the heat transfer to the refrigerant and net heat transfer to the reservoir at 50^0 C; (ii) Reconsider (i) given that the efficiency of the heat engine and the C.O.P. of the refrigerator are each 45 percent of their maximum possible values.	L5

	OR	
5.	A fluid undergoes a reversible adiabatic compression from 4 bar, $0.3m^3$ to $0.08m^3$ according to the law, $pv^{1.25}$ = constant. Determine: (i) change in enthalpy; (ii) change in internal energy; (iii) change in entropy; (iv) heat transfer; (v) work transfer.	**L5**
6.	Steam at a pressure of 5 bar passes in to a tank containing water where it gets condensed. The mass and temperature in the tank before the admission of steam are 50kg and 20^0C respectively. Examine the dryness fraction of steam as it enters the tank if 3kg of steam gets condensed and resulting temperature of the mixture becomes 40^0 C. Take water equivalent of tank as 1.5kg.	**L4**
	OR	
7.	Determine the pressure exerted by CO_2 in a container of $1.5m^3$ capacity when it contains 5kg at 27^0C. (a) Using ideal gas equation (b) Using Vander Wall's equation.	**L5**
8.	Prove that the molar analysis is identical with volumetric analysis, and both are equal to the ratio of the partial pressure to the total pressure.	**L3**
	OR	
9.	A vessel of $0.35m^3$ capacity contains 0.4kg of carbon monoxide (molecular weight = 28) and 1kg of air at 20^0C. Determine: (i) The partial pressure of each constituent (ii) The total pressure in the vessel.	**L5**
10.a)	Explain the significance of Psychrometric charts.	**L2**
b)	Derive an expression for air standard efficiency of otto cycle.	**L3**
	OR	
11.a)	Explain the mean effective pressure of diesel cycle.	**L2**
b)	The compression ratio in an air standard otto cycle is 8. At the beginning of compression process the pressure is 1 bar and the temperature is 300K. The heat transfer to the air per cycle is 1900kj/kg of air. Solve the following: (a) The pressure and temperature at the end of each process of the cycle. (b) Thermal efficiency (c) The mean effective pressure.	**L3**