Q. Code: 473784

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

B.E. / B.TECH. DEGREE EXAMINATION, MAY 2023

Third Semester

ME18301 – Engineering Thermodynamics

(Mechanical Engineering)

(Regulation 2018A)

(Use of Approved Steam Tables, Psychrometric chart and Data Book may be permitted)

TIME: 3 HOURS **MAX. MARKS: 100**

CO 1 Students are able to analyze various Energy Transferring / transforming equipment using First law of thermodynamics

CO 2 Students are able to analyze various Energy Transferring / transforming equipment using Second law of thermodynamics

CO 3 Students are able to analyze the performance of steam power plant cycle with the help of steam table and charts

CO 4 Students are able to obtain different thermodynamic relations and equations for ideal and real gases

CO 5 Students will be able to analyze the various Psychrometric process and its applications and also able to analyze the properties of Gas mixtures

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	How does open system differs from closed system?	**1**	**2**
2.	State zeroth law of thermodynamics.	**1**	**1**
3.	PMM II is impossible. Justify.	**2**	**2**
4.	State principle of entropy increase.	**2**	**1**
5.	What do you mean by pure substance?	**3**	**1**
6.	What is the value of dryness fraction for dry and superheated steam?	**3**	**2**
7.	What is value of Joule Thomson coefficient for ideal gas?	**4**	**2**
8.	State the assumptions of ideal gas.	**4**	**1**
9.	Define relative humidity.	**5**	**1**
10.	State Dalton's law of partial pressure.	**5**	**1**

PART- B (5 x 14 = 70 Marks)

			Marks	CO	RBT LEVEL
11. (a)	Air at 1 bar, 25°C, initially occupying a cylinder volume of 0.015 m^3, is compressed reversibly and adiabatically by a piston to a pressure of 7 bar. Calculate: (a) The final temperature (b) The final volume (c) The work done on the mass of air in the cylinder.		**(14)**	**1**	**3**
	(OR)				
(b)	Applying first law of thermodynamics to an open system, derive the steady flow energy equation. Also obtain the equation for turbine and a heat exchanger.		**(14)**	**1**	**3**
12. (a)	An irreversible heat engine with 60% efficiency of the maximum possible is operating between 1000 K and 300 K. If it delivers 3kW of work, determine the heat extracted from the high temperature reservoir and heat rejected to low temperature reservoir.		**(14)**	**2**	**3**
	(OR)				
(b)	**(i)**	From the principle of Clausius theorem, derive Clausius inequality and mention the criteria for reversibility of a cycle.	**(8)**	**2**	**3**
	(ii)	By applying the principle of Clausius inequality, show that entropy is a point function.	**(6)**	**2**	**3**
13. (a)	A steam power plant uses steam at boiler pressure of 100bar and temperature 400°C at condenser pressure of 0.1bar. Find the quality of steam at turbine exhaust, cycle efficiency and steam rate.		**(14)**	**3**	**3**
	(OR)				
(b)	In a single regenerative cycle, the steam enters the turbine at 30bar and 400°C and the exhaust pressure is 0.1bar. The condensate is heated in a direct contact type heater which operates at 5bar. Find the efficiency and the steam rate of the cycle. Neglect the pump work.		**(14)**	**3**	**3**
14. (a)	**(i)**	Derive Maxwell relations.	**(8)**	**4**	**3**
	(ii)	Derive Tds relations interms of T & V and T & P	**(6)**	**4**	**3**
	(OR)				
(b)	**(i)**	Explain the physical significance of the compressibility factor Z	**(6)**	**4**	**3**
	(ii)	Draw a neat schematic of a generalised compressibility chart and indicate its salient features.	**(8)**	**4**	**3**

15. (a)	A sling psychrometer reads 30°C DBT and 25°C WBT. Find the humidity ratio, relative humidity, dew point temperature, specific volume, and enthalpy of air.	**(14)**	**5**	**3**
	(OR)			
(b)	2 kg of air at 30°C, 65% RH is mixed adiabatically with 5 kg of air at 20°C, 10% RH, determine the specific humidity, relative humidity, and the dry bulb temperature of the mixture.	**(14)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

			Marks	CO	RBT LEVEL
16.	**(i)**	It is planned to construct a Carnot cycle by eliminating any one of the isothermal process. Justify the possibility of the cycle by applying the principle of second law of thermodynamics.	**(5)**	**2**	4
	(ii)	Thermal efficiency of a Rankine cycle operating between a boiler temperature of 750 K and condenser temperatures of 300 K is 40 %. Whether this cycle is possible? Justify through laws of thermodynamics.	**(5)**	**3**	4

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