Q. Code: 615836

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

B.E. / B.TECH. DEGREE EXAMINATIONS, DEC 2019

Third Semester

AE18302 – BASIC AND APPLIED THERMODYNAMICS

(Automobile Engineering)

(Regulation 2016)

Time: Three Hours **Maximum : 100 Marks**

(*Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted***)**

Answer **ALL** questions

PART A - (10 X 2 = 20 Marks)

		CO	RBT
1.	Differentiate between the "specific heat at constant pressure" and "specific heat at constant volume".	1	U
2.	State Zeroth law of thermodynamics and mention its application.	1	U
3.	Define PMM-II. Does it violate First Law of Thermodynamics?	2	U
4.	State Carnot theorem.	2	R
5.	What is compressibility factor?	3	R
6.	Write the condition for exact differential.	3	R
7.	What is the effect of friction in flow of steam through nozzle?	4	U
8.	Define nozzle efficiency.	4	R
9.	Define a Ton of Refrigeration.	5	R
10.	Name any four desirable properties of good refrigerant.	5	R

PART B - (5 X16 = 80 Marks)

11.	(a)		Explain Quasi-static Process and derive an expression for Heat transfer and Work transfer during reversible isothermal process.	(16)	1	AN
			(OR)			
	(b)	(i)	Derive Steady Flow Energy Equation.	(6)	1	AP
		(ii)	Air flows at the rate of 0.5 kg/s through an air compressor, entering at 7 m/s, 100 kPa and 0.95 m^3/kg and leaving at 5 m/s, 700 kPa, and 0.19 m^3/kg. The internal energy of air leaving is 90 kJ/kg greater than that of the air entering. Cooling water in	(10)	1	AN

the compressor jackets absorbs heat from the air at the rate of 58 kW. (a) Compute the rate of shaft work input to the air in kW (b) Find the ratio of the inlet pipe diameter to outer pipe diameter.

12.	(a)		Explain working of a Carnot cycle with help of pV and Ts diagrams and derive its efficiency.	**(16)**	**2**	**U**
			(OR)			
	(b)	(i)	Derive general expression for change of entropy for a non-flow process.	**(6)**	**2**	**AN**
		(ii)	(ii) A perfect gas is compressed according to the law $pV^{1.25} = C$ from an initial pressure of 1 bar and volume of 0.9 m^3 to a final volume of 0.6 m^3. Determine the final pressure and change of entropy per kg of gas during the process. Take $\gamma = 1.4$ and R = 287 J/kg-K.	**(10)**	**2**	**AN**
13.	(a)		A mixture of ideal gases consists of 3 kg of nitrogen and 5 kg of carbon dioxide at a pressure of 300 kPa and a temperature of 30ºC. Find (i) mole fraction of each constituent, (ii) the equivalent molecular weight of the mixture, (iii) the equivalent gas constant of the mixture, (iv) the partial pressures and partial volumes, and (v) the volume and density of the mixture.	**(16)**	**3**	**AN**
			(OR)			
	(b)		Derive Maxwell's equations.	**(16)**	**3**	**R**
14.	(a)		Explain the formation of steam from the water at 10ºC with the help of suitable diagrams.	**(16)**	**4**	**U**
			(OR)			
	(b)		In a steam power plant operating on reheat Rankine cycle, the steam enters the high pressure turbine at 3 MPa and 500ºC. After expansion to 0.6 MPa, the steam is reheated to 500ºC and then expanded in the low pressure turbine to the condenser pressure of 10 kPa. Determine the thermal efficiency of the cycle and the quality of the steam at the outlet of the low pressure turbine.	**(16)**	**4**	**AN**

15. (a) A vapour compression refrigerator uses methyl chloride and operates between temperature limits of – 10ºC and 45ºC. At entry to the compressor, the refrigerant is dry saturated and after compression it acquired a temperature of 60ºC. Find the COP of the refrigerator. Take the following properties: **(16) 5 AN**

Temperature (ºC)	**Specific Enthalpy (kJ/kg)**		**Specific entropy (kJ/kgK)**	
	Liquid	**Vapour**	**Liquid**	**Vapour**
45	133.0	483.6	0.485	1.587
- 10	45.4	460.7	0.183	1.637

(OR)

(b) Explain the working of Ammonia absorption refrigeration system with the help of a neat sketch. **(16) 5 U**