Course Code: 1950323 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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III B.Tech I Sem Supply End Examination, July 2022

Thermal Engineering – II

(MECH)

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

Note: 1. Question paper consists: Part-A and Part-B.
2. In Part – A, answer all questions which carries 20 marks.
3. In Part – B, answer any one question from each unit.
Each question carries 10 marks and may have a, b as sub questions.

PART- A

(10*2 Marks = 20 Marks)

1.	a)	Why condenser is needed for the steam power plant? Justify.	2M	CO1	BL3
	b)	Define and discuss the importance of boiler horse power.	2M	CO1	BL1
	c)	What is velocity coefficient of steam nozzle? Discuss the significance.	2M	CO2	BL3
	d)	Describe the criteria to be considered for the selection of nozzle shape.	2M	CO2	BL4
	e)	How to control the rotor speed of an impulse turbine? Explain.	2M	CO3	BL5
	f)	Explain the influence of degree of reaction on performance of reaction turbine.	2M	CO3	BL3
	g)	Differentiate between jet condensers and surface condensers.	2M	CO4	BL5
	h)	Draw the actual cycle for gas turbine and write salient points.	2M	CO4	BL2
	i)	Define the terms thrust power and propulsive power of a jet engine.	2M	CO5	BL1
	j)	What are different combinations of propellant materials for solid propellant rockets?	2M	CO5	BL5

PART- B

(10*5 Marks = 50 Marks)

2	a)	Draw the schematic diagram of Rankine cycle with regeneration and derive the equation for thermal efficiency.	5M	CO1	BL2
	b)	Differentiate between boiler mountings and boiler accessories.	5M	CO1	BL5
		OR			
3		A chimney of height 30 meters discharging hot gases at a temperature 360 ^{0}C when the outside air temperature is 23 ^{0}C.The air supplied at rate of 16 kg/kg of coal. Determine (i) The draught in mm of water column (ii) The draught produced in terms of column of flue gas (iii) Volume of hot gas passing through chimney per second if coal burnt is 1400 kg per hour. (iv) The base diameter if velocity of chimney is given in relation h= 16 V^2 / 2 g. where h is a equivalent height of column of hot gas.	10M	CO1	BL4
4	a)	Derive the equation for the estimation of velocity and discharge at the exit of the steam nozzle and discuss the assumptions made.	5M	CO2	BL3
	b)	What is the importance of degree of super saturation of nozzle design? Explain.	5M	CO2	BL4

OR

5		A convergent divergent nozzle which has a throat area of 40 cm^2 receives steam at a pressure of 7 bar and 115^{0}C. Approach velocity is negligible and discharges against a pressure of 1.2 bar. The expansion is in equilibrium throughout and loss by fluid friction in the convergent part of the nozzle is negligible. But the loss due to friction in the divergent portion is 10% of the total heat drop. Calculate i) rate of steam flow through the nozzle and the nozzle exit area, ii) moisture of steam leaving the nozzle.	10M	CO2	BL4
6	a)	What are the effects of friction on performance of blade efficiency and power? Derive the equations for blade efficiency of impulse turbine.	5M	CO3	BL3
	b)	Explain the importance of compounding of impulse turbine and discuss different compounding methods.	5M	CO3	BL2

OR

7		A reaction turbine has a speed of 2500 rpm and the mean diameter of blading at a certain pair is 70 cm. The exit angle of the blade is 21^0, both fixed and moving blades being identical. The steam flow rate is 820 kg/min. If the power developed per pair is 234 kW and the steam pressure is 2.7 bar and saturated, calculate the inlet blade angle and blade height.	10M	CO3	BL4
8	a)	Draw the schematic diagram of the steam condenser and derive the equations for vacuum and condenser efficiencies.	5M	CO4	BL4
	b)	Explain the principle of operation of gas turbine cycle with reheating and discuss the salient points.	5M	CO4	BL2

OR

9		Exhaust steam having a dryness fraction of 0.82 enters a surface condenser where the vacuum is 690 mm of Hg and is condensed to water at 34.8^{0}C. The temperature of the hot well is 31.6^{0}C. The circulating water enters the condenser at 14^{0}C and leaves at 34^{0}C. The barometric pressure is 756 mm of Hg, calculate (i) the mass of circulating water required per kg of steam, and (ii) the mass of air extracted per m^3 of condenser volume.	10M	CO4	BL4
10	a)	Write the major requirements for the liquid propellant rocket materials and discuss the principle of operation of liquid propellant rockets.	5M	CO5	BL5
	b)	Draw the schematic representation of turbojet engine and explain the corresponding thermodynamic cycle.	5M	CO5	BL4

OR

11		A turbo-jet has a speed of 750 km/hr, while flying at an altitude of 10000 m. The propulsive efficiency of the jet is 50% and the overall efficiency of the turbine plant is 16%. The density of air at 10000 m altitude is 0.173 kg/m^3. The drag of the plant is 6250 N. The calorific value of the fuel is 48,000 kJ/kg. Calculate: (a) Absolute velocity of the jet, (b) Volume of air compressed per minute, (c) Diameter of the jet, (d) Power output of the unit in kW, (e) Air-fuel ratio.	10M	CO5	BL3

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