Code No: **R2331032**

R23

SET - 1

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURUJADA VIZINAGARAM
III B. Tech I Semester Regular Examinations, November -2025
THERMAL ENGINEERING
(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (Part-A and Part-B)
2. Answer ALL the question in Part-A
3. Answer any **FIVE** Questions, each Question from each unit from **Part-B**
4. All Questions Carry **Equal** Marks

*****

		PART-A (10x2Marks-=20M)	
1.	a)	Mention the processes in an Atkinson Cycle	[2M]
	b)	Draw the actual air cycle for CI engines	[2M]
	c)	List out the advantages of turbo charging of IC engine	[2M]
	d)	Define brake specific fuel consumption and mean effective pressure of IC engine	[2M]
	e)	State the importance adiabatic flame temperature in combustion of fuel	[2M]
	f)	How the thermal effiency of Rankine cycle improves with the change of parameters temperature and pressure	[2M]
	g)	Explain the critical pressure ratio affects the discharge of fluid through the nozzle	[2M]
	h)	Draw the combined velocity diagram for the impulse steam turbine	[2M]
	i)	Interpret the differences between the fan and blower	[2M]
	j)	What is meant by positive displacement compressors	[2M]
		PART-B (5x10Marks-=50M)	
		UNIT-I	
2a)		Derive an expression for thermal efficiency of Brayton cycle by representing the processes on P-v and T-s diagrams.	[10M]
		(OR)	
2b)	i)	How does the fuel air cycles differ from the actual air cycles	[5M]
	ii)	Explain the rubbing loss of engine with a neat sketch	[5M]
		UNIT-II	
3a)		A six cylinder, 4-stroke SI engine having a piston displacement of 900 cm^3 per cylinder developed 78kW at 3600 rpm and consumed 30 kg of petrol per hour. The calorific value of petrol is 46MJ/kg. Estimate (i) The volumetric efficiency of the engine if the air-fuel ratio is 10 and intake air is at 0.8 bar,26^0C (ii) The brake thermal efficiency, and (iii) The brake torque For air R=0.287kJ/kg K	[10M]
		(OR)	
3b)		A trial carried out in a four-stroke single cylinder gas engine gave the following results. Cylinder dia=320 mm, Engine stroke=520mm, Clearance volume=6725cc, Explosions per minute=100, Pmax KN/m^2 = 750, Net work load on the brake=190kg, Brake dia=1.5m, Rope dia=25mm, Speed of the engine=240rpm, Gas used=35 m^3/kghr , Calorific value of gas=20615 KJ/ m^3 . Determine compression ratio, mechanical efficiency, indicated thermal efficiency, air standard efficiency, relative efficiency, assume r=1.4	[10M]
		UNIT-III	

4a)	i)	Derive the thermal efficiency of Rankine cycle by representing the processes on P-v and T-s diagram	[5M]
	ii)	Steam turbine plant operates on Rankine cycle with steam entering turbine at 35 bar, 400ºC and leaving at 0.06 bar. Steam leaving turbine condenses to saturated liquid inside condenser. Feed pump pumps saturated liquid into boiler. Determine the network per kg of steam, the cycle efficiency and work ratio assumed to be all processes ideal. Show cycle on T-s and H-s diagrams. Also, determine pump work per kg of steam considering linear variation of specific volume.	[5M]
		(OR)	
4b)		Explain the regenerative cycle with neat sketch. Show the processes on P-v and T-s diagram. Derive the thermal efficiency of regenerative cycle steam power	[10M]
		UNIT-IV	
5a)		At a stage in a reaction turbine the pressure of steam is 0.34 bar and the dryness 0.95. For a flow rate of 36000 kg/h, the stage develops 950 kW. The turbine runs at 3600 r.p.m and the velocity of flow is 0.72 times the blade velocity. The outlet angle of both stator and rotor blades is 200.Determine at this stage. Mean rotor diameter (ii) Height of the blades	[10M]
		(OR)	
5b)	i)	Show that degree of reaction of Parson's reaction turbine is 50%	[5M]
	ii)	Calculate the vacuum efficiency of a condenser from the following data: Vacuum at steam inlet to condenser=710 mm of Hg: barometer reading=760 mm of Hg: Hot well temperature =32^0 C	[5M]
		UNIT-V	
6a)		A two-stage centrifugal compressor delivers 140 m^3 of free air per minute. The suction condition of air is 1 bar and 17^0C.The air is passed to intercooler after first stage of compression and cooled to 22^0C.If the pressure ratio to each stage is 2 and isentropic efficiency is 70%,find the indicated power required to drive the compressor.	[10M]
		(OR)	
6b)		A single-stage double acting air compressor is required to deliver 16 m^3 of air per minute measured at 1 bar and 18^0C.The delivery pressure is 7 bar and the speed 300 rpm. Take clearance volume as 6% of the swept volume with the compression and compression index of n=1.2. Calculate (i) Swept volume of the cylinder (ii) The delivery temperature (iii) Indicated power	[10M]