

**III B. Tech I Semester Supplementary Examinations, APRIL/MAY -2025**  
**THERMAL ENGINEERING-II**  
(MECHANICAL ENGINEERING)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**

All Questions Carry Equal Marks

\*\*\*\*\*

<b>UNIT-I</b>			
1.	a)	Explain the Rankine cycle with a T-S diagram and calculate the thermal efficiency of a Rankine cycle operating between given boiler and condenser temperatures.	[7M]
	b)	Define adiabatic flame temperature and stoichiometry. A fuel has the following composition: C = 80%, H <sub>2</sub> = 10%, O <sub>2</sub> = 5%, N <sub>2</sub> = 2%, Ash = 3%. Calculate the stoichiometric air-fuel ratio.	[7M]
(OR)			
2.	a)	Classify boilers and explain the working principle of a Babcock and Wilcox boiler with a neat sketch.	[7M]
	b)	Define boiler horsepower and equivalent evaporation. A boiler generates steam at 5 kg/s with an enthalpy of 2800 kJ/kg from water entering at 50°C. Calculate the boiler horsepower and equivalent evaporation.	[7M]
<b>UNIT-II</b>			
3.	a)	Describe the function of a steam nozzle and derive the expression for the velocity of fluid at the nozzle exit.	[7M]
	b)	Explain the phenomenon of supersaturated flow in nozzles and its effects. Define the Wilson line.	[7M]
(OR)			
4.	a)	Classify steam turbines and explain the working principle of an impulse turbine.	[7M]
	b)	Draw the velocity diagram for an impulse turbine and derive the condition for maximum blade efficiency. A single-stage impulse turbine has a nozzle angle of 20°, a blade speed of 400 m/s, and a nozzle exit velocity of 800 m/s. Calculate the blade angles for maximum efficiency.	[7M]
<b>UNIT-III</b>			
5.	a)	Explain the principle of operation of a reaction turbine and define the degree of reaction.	[7M]
	b)	Describe Parson's reaction turbine with a neat sketch and derive the condition for maximum efficiency.	[7M]
(OR)			
6.	a)	Discuss the requirements of a steam condensing plant and classify different types of condensers.	[7M]
	b)	Define vacuum efficiency and condenser efficiency. Explain the sources and effects of air leakage in condensers.	[7M]
<b>UNIT-IV</b>			
7.	a)	Classify compressors and differentiate between positive displacement and non-positive displacement types.	[7M]
	b)	Explain the working principle of a reciprocating compressor and define isothermal efficiency and volumetric efficiency.	[7M]

		(OR)	
8.	a)	Explain multi-stage compression and discuss the advantages. Derive the condition for minimum work in a two-stage compressor.	[7M]
	b)	Describe the working principle of a Roots blower and a vane sealed compressor.	[7M]
		<b>UNIT-V</b>	
9.	a)	Explain the mechanical details and principle of operation of a centrifugal compressor.	[7M]
	b)	Discuss the energy transfer process in centrifugal compressors and define slip factor and power input factor. A centrifugal compressor has an impeller with an outer diameter of 0.5 m and rotates at 15000 rpm. If the slip factor is 0.9, calculate the tangential component of the absolute velocity at the impeller exit.	[7M]
		(OR)	
10.	a)	Describe the mechanical details and principle of operation of an axial flow compressor.	[7M]
	b)	Explain the velocity triangles and energy transfer in an axial flow compressor.	[7M]

\*\*\*\*\*