

# CBCS SCHEME



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BME401

## Fourth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 Applied Thermodynamics

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Use of Steam Tables and Thermodynamic Data hand book is permitted.  
3. M : Marks , L: Bloom's level , C: Course outcomes.*

Module - 1					
<b>Q.1</b>	<b>a.</b>	Define cut off ratio and Air standard efficiency.	<b>M</b>	<b>L</b>	<b>C</b>
	<b>b.</b>	With usual notations obtain Air Standard efficiency of otto cycle.	<b>04</b>	<b>L1</b>	<b>CO1</b>
	<b>c.</b>	The compression ratio of Diesel cycle is 14, and cut-off ratio is 2.2. At the beginning of the cycle, air is at 0.98 bar and 100° C. Find : i) Temperature and pressure at salient points. ii) Air standard efficiency.	<b>06</b> <b>10</b>	<b>L2</b> <b>L3</b>	<b>CO1</b> <b>CO1</b>
<b>OR</b>					
<b>Q.2</b>	<b>a.</b>	Define the following : i) Indicated power ii) Brake power iii) Friction power iv) Mechanical efficiency	<b>04</b>	<b>L1</b>	<b>CO1</b>
	<b>b.</b>	Explain the process of combustion in SI engine.	<b>06</b>	<b>L2</b>	<b>CO1</b>
	<b>c.</b>	The following data were obtained from a Morse test on a 4 – cylinder, 4 – stroke, S.I engine, coupled to a hydraulic dynamometers operating at constant speed of 1500 rpm. Brake load with all the four cylinders firing = 296 N. Brake load with cylinder No. 1 not firing = 201 N. Brake load with cylinder No. 2 not firing = 206 N. Brake load with cylinder No. 3 not firing = 192 N. Brake load with cylinder No. 4 not firing = 200 N. The brake power in 'KW' is calculated using $BP = \frac{WN}{42300}$ Where, W = Brake load in Newton. N = Engine speed in rpm. Calculate : i) Brake power ii) Indicated power iii) Friction power iv) Mechanical efficiency	<b>10</b>	<b>L3</b>	<b>CO1</b>
<b>Module - 2</b>					
<b>Q.3</b>	<b>a.</b>	Derive an expression for the efficiency of a Brayton cycle.	<b>06</b>	<b>L2</b>	<b>CO2</b>
	<b>b.</b>	Explain the difference between open cycle and closed cycle gas turbine.	<b>04</b>	<b>L1</b>	<b>CO2</b>
	<b>c.</b>	Air enters the compressor of an ideal air standard Brayton cycle at 100 kpa, 300 k with a volumetric flow rate of 6 m <sup>3</sup> /s. The compressor work ratio is 10. The turbine inlet temperature is 1500 k. Determine: i) The thermal efficiency ii) Work ratio iii) Power. Take $\gamma = 1.4$ $C_p = 1.005$ KJ/KgK	<b>10</b>	<b>L3</b>	<b>CO2</b>

OR

Q.4	a.	With a neat sketch explain the working of Ram jet.	10	L2	CO2
	b.	Discuss the working principle of Rocket propulsion with neat sketch.	10	L2	CO2

Module - 3

Q.5	a.	List the drawbacks of Carnot vapour power cycle.	04	L1	CO3
	b.	Discuss the effect of i) Boiler pressure ii) Condenser pressure on the performance of a Rankine cycle.	06	L2	CO3
	c.	In a steam power cycle, the steam supply is at 15 bar, and dry saturated. The condenser pressure is 0.4 bar. Calculate the thermal efficiency for i) Carnot vapour power cycle ii) Rankine vapour power cycle Neglect pump work.	10	L3	CO3

OR

Q.6	a.	With help of neat sketch, explain the working of Reheat Rankine cycle.	08	L2	CO3
	b.	A turbine is supplied with steam at a pressure of 20 bar and Temperature $350^{\circ}\text{C}$ , The steam is then expands to a condenser pressure of 0.04 bar. Calculate its thermal efficiency. It is desired to improve the efficiency by regenerative feed heating by bleeding steam at 2 bar and heating in an open feed heater. Calculate the percentage improvement in thermal efficiency. Neglect pump work in the above calculation.	12	L3	CO3

Module - 4

Q.7	a.	List out the desirable properties of refrigerant.	04	L1	CO4
	b.	With help of neat sketch, explain the working principle of vapour compression Refrigeration System.	06	L2	CO4
	c.	A simple vapour compression refrigeration plant produces 5 Tonnes of refrigeration. The enthalpies of the working fluid at inlet to the compressor = 183.19 kJ/kg, at exit of compressor = 209.41 kJ/Kg, at exit of the condenser = 74.59 kJ/kg. Estimate : i) The refrigerant flow rate ii) COP of the plant iii) Power required to drive the compressor iv) The rate of heat rejection in the condenser	10	L3	CO4

OR

Q.8	a.	Define : i) Sensible heating ii) Sensible cooling	04	L1	CO4
	b.	With a neat sketch, explain a summer air conditioning system.	06	L2	CO4
	c.	An air conditioning system is designed under the following conditions. Out door conditions: $30^{\circ}\text{C}$ DBT, 75% RH Required indoor conditions: $22^{\circ}\text{C}$ DBT, 70% RH. Amount of free air circulated $3.33\text{ m}^3/\text{s}$ . Coil dew point temperature (DPT) = $14^{\circ}\text{C}$ . The required conditions is achieved first by cooling and dehumidification and then by heating. Estimate : i) The capacity of the cooling coil in Tonnes of refrigeration ii) The capacity of heating coil in KW iii) The amount of water vapour removed in kg /hr.	10	L3	CO4

## Module – 5

Q.9	a.	Define the following with respect to a reciprocating air compressor. i) Volumetric efficiency ii) Adiabatic efficiency iii) Isothermal efficiency iv) Mechanical efficiency	06	L1	CO5
	b.	Explain the advantages of multistage compression.	04	L2	CO5
	c.	A 2 – stage air compressor with complete inter cooling delivers air to the mains at a pressure of 30 bar suction conditions are 1 bar of 15°C. If both cylinders have same stroke. Find the ration of cylinder diameter for maximum efficiency. The index of compression is 1.3.	10	L3	CO5
OR					
Q.10	a.	With usual notations derive the expression for critical pressure ratio.	10	L2	CO5
	b.	A turbine having a set of 16 nozzles receives steam at 20bar and 400°C. The pressure of steam at the nozzle exit is 12 bar. If the discharge rate is 260 kg/mm and nozzle efficiency is 90%. Calculate the cross – sectional area at the nozzle exit. If the steam has a velocity of 80 m/s at entry to the nozzle. Fine the percentage increase in discharge.	10	L4	CO5

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