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	M	L	C
Q.1	a.	Define cut off ratio and Air standard efficiency.	04	L1	CO1
	b.	With usual notations obtain Air Standard efficiency of otto cycle.	06	L2	CO1
	c.	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.	10	L3	CO1
		OR			
Q.2	a.	Define the following : i) Indicated power ii) Brake power iii) Friction power iv) Mechanical efficiency	04	L1	CO1
	b.	Explain the process of combustion in SI engine.	06	L2	CO1
	c.	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 Newtone. N = Engine speed in rpm. Calculate : i) Brake power ii) Indicated power iii) Friction power iv) Mechanical efficiency	10	L3	CO1
		Module – 2			
Q.3	a.	Derive an expression for the efficiency of a Brayton cycle.	06	L2	CO2
	b.	Explain the difference between open cycle and closed cycle gas turbine.	04	L1	CO2
	c.	Air enters the compressor of an ideal air standard Brayton cycle at 100 kpa, 300 k with a volumetric flow rate of 6 m^3/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	10	L3	CO2

		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° 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 coding	**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° C DBT, 75% RH Required indoor conditions: 22°C DBT, 70% RH. Amount of free air circulated 3.33 m^3 / s. Coil dew point temperature (DPT) = 14°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) Adibatic 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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BME402

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

Machining Science and Metrology

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	**a.**	Explain the different types of chips produced during metal cutting with neat sketches.	**7**	**L1**	**CO1**
	b.	Explain the difference between orthogonal cutting and oblique cutting with atleast two examples for each.	**7**	**L1**	**CO1**
	c.	Derive an expression for shear plane angle in terms of rake angle and chip thickness ratio.	**6**	**L3**	**CO1**
		OR			
Q.2	**a.**	With a neat sketch, explain the various parts of a lathe machine.	**6**	**L2**	**CO1**
	b.	Explain how does a capstan lathe differ from turret lathe.	**6**	**L1**	**CO1**
	c.	Explain any four operations performed on a lathe machine.	**8**	**L2**	**CO1**
		Module – 2			
Q.3	**a.**	Explain with a sketch the constructional features of column and knee type milling machine.	**6**	**L2**	**CO2**
	b.	Explain any four operations performed on milling machine.	**8**	**L2**	**CO2**
	c.	Index 87 divisions by compound indexing method having a index plate with circle of holes – 21, 23, 27, 29, 31, 33	**6**	**L3**	**CO2**
		OR			
Q.4	**a.**	With a neat sketch, explain the construction and operation of bench drilling machine.	**7**	**L2**	**CO2**
	b.	Briefly explain the differences between shaper and planer machine.	**6**	**L1**	**CO2**
	c.	With a neat sketch, explain grinding process and the components of a grinding wheel.	**7**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	Explain the different types of tool wear with relevant sketches.	**7**	**L2**	**CO3**
	b.	A cast iron bar stock was turned at 50 m/min, for which the tool life was 3 hours. For the same material, at 40m/min, the tool life was 5 hours. Find the value of constant 'C' and 'n' in the Taylor's tool life equation.	**6**	**L3**	**CO3**
	c.	What is tool life? Explain the factors which affect the tool life.	**7**	**L2**	**CO3**

		OR			
Q.6	**a.**	Briefly explain the desirable properties of cutting tool materials.	**6**	**L2**	**CO3**
	b.	Explain Taylors tool life equation.	**6**	**L2**	**CO3**
	c.	Explain the salient features of HSS and coated carbides.	**8**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Define Metrology. Explain the objectives of metrology.	**7**	**L2**	**CO4**
	b.	Explain with neat sketches wringing phenomenon of step gauges.	**7**	**L2**	**CO4**
	c.	Four length bars A, B, C and D each having a basic length 125 mm are to be calibrated using a calibrated length bar of 500 mm basic length. The 500 mm bar has an actual length of 499.999/mm. Also, $L_B = L_A + 0.0001$ mm, $L_C = L_A + 0.0005$ mm, $L_D = L_A - 0.0002$ mm and $L_A + L_B + L_C + L_D = L + 0.0003$ mm. Determine L_A, L_B, L_C and L_D.	**6**	**L3**	**CO4**
		OR			
Q.8	**a.**	Explain the following terms: i) Tolerance ii) Interchangeability iii) Selective assembly	**6**	**L2**	**CO4**
	b.	Define fit. Explain the different types of fit with neat sketches.	**7**	**L2**	**CO4**
	c.	Determine the tolerances on the hole and the shaft for a precision running fit designated by 50 $H_7$96. Given : i) 50 mm lies between 30-50 mm ii) $i = 0.45\sqrt[3]{D} + 0.001D$ microns iii) Fundamental deviation for 'H' hole = 0 iv) Fundamental deviation for 'g' shaft = $-2.5D^{0.3/-}$ v) IT7 = 16i vi) IT6 = 10i State the actual maximum and minimum sizes of the hole and shaft, and maximum and minimum clearances.	**7**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	What are gauges? How are they classified?	**6**	**L3**	**CO5**
	b.	Explain with neat sketches, any two types of gauges.	**7**	**L2**	**CO5**
	c.	With a neat sketch, explain reed type mechanical comparator.	**7**	**L2**	**CO5**
		OR			
Q.10	**a.**	With neat sketch, explain working of LVDT.	**7**	**L2**	**CO5**
	b.	With neat sketch, explain the principle of sine bar.	**7**	**L2**	**CO5**
	c.	Select the sizes of angle gauges required to built the following angles, also show the arrangement of gauges: i) 57° 34′ 9″ ii) 102° 8′ 42″	**6**	**L3**	**CO5**

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