

T.Y. S. Tech (M) Sem VI



Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai - 400058



End Semester Examination May-2026

Program: B. Tech Mechanical

Course Code: PC-BTM601

Course Name: Refrigeration and Air-Conditioning.

Duration: 3 Hours

Maximum Points: 100

Semester: VI

Instructions:

- 1) Question number ONE is compulsory and solve any FOUR questions out of remaining SIX
- 2) Use of refrigerant properties table and psychrometric chart is permitted.
- 3) Use of steam table is permitted.
- 4) Assume suitable data, mention it and justify the same.

Q.No.	Questions	Points	CO	BL	Module Number
1(a)	Explain in detail the Ozone Depletion Potential (ODP) and Global Warming Potential (GWP) of refrigerants.	3+2	1	1	2
1(b)	Draw neat schematic diagram and p-h diagram for Liquid Vapour Regenerative Heat Exchanger used in the vapour compression refrigeration cycle.	2+3	1	2	1
1(c)	Explain the following terms in short with respect to the air distribution system. (i) Blow or Throw (ii) Drop (iii) Entrainment Ratio (iv) Spread	4	3	1	6
1(d)	Define effective temperature. Enlist the factors which govern the effective temperature. Draw neat sketch of ET and ET* lines on temperature verses vapour pressure for following two cases (i) Metabolic rate of 58.1 W/m ² and clothing factor of 60% of standard clothing. (ii) Metabolic rate of 174 W/m ² and clothing factor 50% of in (i)	1+2+3	3	1,2	7
2(a)	Draw neat sketch of schematic and T-s diagram of the followings. (i) Bootstrap aircraft refrigeration system. (ii) Regenerative aircraft refrigeration system. Also write equation for the COP of the system considering ram compression.	4+4+2	1	1,2	1



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2(b)	A R-134a vapour compression system operating at a condenser temperature of 40°C and an evaporator temperature of 0°C develops 15 tons of refrigeration. Using only values from the properties table for R134a refrigerant, determine. (a) the discharge temperature and mass flow rate of the refrigerant circulated, (b) the theoretical piston displacement of the compressor and horsepower per ton of refrigeration, (c) the theoretical horsepower of the compressor and horsepower per ton of refrigeration, (d) the heat rejected in the condenser, and (e) the Carnot COP and actual COP of the cycle.	10	2	3,4	1
3(a)	Explain the desirable properties of the ideal refrigerants.	10	2	1,2	2
3(b)	Explain the measurement of wet bulb temperature in detail. Explain how it is indirect measure of humidity of air.	5+5	3	1,2	4
4(a)	Draw neat sketch of a three fluid refrigeration system and explain it in detail.	5+5	3	1	3
4(b)	Explain ASHRAE's thermal sensation scale about human comfort. Also draw neat sketch of comfort chart.	5+5	3	1	6
5	A building has the following calculated cooling loads: Room sensible heat gain = 310 kW Room latent heat gain = 100 kW The space is maintained at DBT of 25°C and relative humidity of 50 %. The outdoor air is at 38°C and 50% R.H. And 10 % by mass of air supplied to the building is outdoor air. If the air supplied to the space is not at temperature lower than 18°C. Find (i) Minimum amount of air supplied to space in m ³ /s. (ii) Volume flow rates of return air and outdoor air (iii) State and volume flow rate of air entering the cooling coil. (iv) Capacity, ADP, BPF and SHF of the cooling coil. Note: Attach the psychrometric chart with sketch.	20	4	3,4	5
6(a)	Explain ASHRAE's thermal sensation scale for human comfort. Also, draw a neat sketch of the comfort chart.	10	3	1	7
6(b)	The DBT and WBT of the air are 35°C and 23°C respectively. Find the followings if total air pressure is 1.00125 bar. Calculate following without using psychrometric chart. (i) Specific humidity (ii) Relative humidity (iii) DPT (iv) density (iv) Enthalpy.	10	3	1	4



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7(a)	Draw neat sketch of practical single effect water lithium bromide system. Explain its working.	5+5	1	1,2	3
7(b)	What is rectangular equivalent of a circular duct. Explain the concept of total pressure, static pressure and velocity pressure with respect to air flow in the duct.	4+6	3	1,2	3,6



Bhara: *21/9/26*
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Program: B.Tech. Mechanical *8cm VI*
 Course Code: PCC-BTM 602
 Course Name: Thermal and Fluid Machines

Duration: 3 Hours
 Maximum Points: 100
 Semester: VI

Notes:

- 1) Solve: Any FIVE Questions.
- 2) Write **SPECIFIC** answers and in legible handwriting.
- 3) Draw neat system diagram / process diagrams/ neat sketches wherever asked or necessary.
- 4) Assume suitable data wherever necessary and state the same.

Q. No.	Question	Points	CO	BL	Module	PL																
1.	a) Explain: Working, Advantages and disadvantages of a two-stage compressor with perfect intercooling. Derive: Expression for minimum compressor work for the same. Draw: Neat system diagram and p-V diagram.	10	2	II, III, V	1	1.4.1																
	b) The following data refers to a performance test of a single acting compressor: <table><tr><td>Bore and stroke (cm)</td><td>14 x 10</td><td>Discharge temp.</td><td>180°C</td></tr><tr><td>Suction pressure</td><td>1 bar</td><td>Compressor Speed</td><td>1200 rpm</td></tr><tr><td>Suction temp.</td><td>20°C</td><td>Shaft power</td><td>6.25 kW</td></tr><tr><td>Discharge pressure</td><td>6 bar</td><td>Mass of air delivered (kg/min)</td><td>1.7</td></tr></table> Evaluate: i) The actual volumetric efficiency ii) Indicated power iii) Isothermal efficiency iv) Mechanical efficiency of the compressor. Draw: p-V Diagram for the working of compressor.	Bore and stroke (cm)	14 x 10	Discharge temp.	180°C	Suction pressure	1 bar	Compressor Speed	1200 rpm	Suction temp.	20°C	Shaft power	6.25 kW	Discharge pressure	6 bar	Mass of air delivered (kg/min)	1.7	10	4	III, VI	1	1.4.1
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2.	a) Explain: Working of an ideal closed cycle gas turbine plant. Draw: Neat system diagram and T-s diagram. Compare: its advantages and disadvantages over open cycle gas turbine plant regarding at least 03 aspects.	07	2, 3	II, III, VI	6	1.4.1
	b) Explain: Classification of I.C. Engines stating at least 05 various criterion. Compare: S.I. and C.I. Engines with respect to at least 04 criterion.	07	1	II, IV	3,4	1.4.1
	c) For a single stage reciprocating air compressor, Explain the following terms: i) Clearance ratio ii) Volumetric efficiency iii) Isentropic efficiency iv) Isothermal efficiency v) Mechanical efficiency, vi) Free air delivery.	06	1	II	1	1.4.1
3.	a) Explain: i) Ignition limits ii) Ignition lag. Describe: Phenomenon of combustion in S.I. Engines with stages involved. Draw: Neat p- θ diagram.	10	2	II, III	3	1.4.1.
	b) In a Morse test of a four cylinder, four stroke petrol engine having a bore of 75 mm and a stroke of 100 mm, following results were obtained with a fixed setting of fuel supply of 6 kg/h: B.P. with all four cylinders working: 15.6 kW B.P. with cylinder no. 1 cut off: 11.1 kW B.P. with cylinder no. 2 cut off: 11.03 kW B.P. with cylinder no. 3 cut off: 10.88 kW B.P. with cylinder no. 4 cut off: 10.66 kW If the calorific value of the fuel is 83600 kJ/kg and clearance volume is 0.0001m ³ , Evaluate: i) Mechanical efficiency ii) Indicated thermal efficiency and iii) Air standard efficiency of the engine.	10	4	VI	3	1.4.1
4.	a) Explain: Knocking in C.I. engines. Compare: Petrol Knock and diesel knock on the basis of at least 03 aspects. Draw: Neat sketches.	08	2, 3	II, III, IV	4	1.4.1



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	b) In a trial on a single cylinder diesel engine with compression ratio of 15, following observations were obtained: <table><tr><td>Fuel Consumption</td><td>10.2 kg/h</td><td>Cooling water flow</td><td>15.5 kg/min</td></tr><tr><td>Calorific value</td><td>43890 kJ/ kg</td><td>Temp. rise of cooling water</td><td>36°C</td></tr><tr><td>Air consumption</td><td>3.8 kg/min</td><td>Exhaust gas temp.</td><td>410°C</td></tr><tr><td>Speed</td><td>1900 rpm</td><td>Room temperature</td><td>20°C</td></tr><tr><td>Torque on brake drum</td><td>186 m.N</td><td>c_p of exhaust gases (kJ/kg.K)</td><td>1.17</td></tr></table> Evaluate: i) Brake power ii) Brake specific fuel consumption iii) Brake thermal efficiency of the engine. Prepare: Heat balance sheet for the engine in kJ/min and percentage.	Fuel Consumption	10.2 kg/h	Cooling water flow	15.5 kg/min	Calorific value	43890 kJ/ kg	Temp. rise of cooling water	36°C	Air consumption	3.8 kg/min	Exhaust gas temp.	410°C	Speed	1900 rpm	Room temperature	20°C	Torque on brake drum	186 m.N	c_p of exhaust gases (kJ/kg.K)	1.17	12	4	V, VI	4	1.4.1
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Torque on brake drum	186 m.N	c_p of exhaust gases (kJ/kg.K)	1.17																							
5.	a) Discuss: Classification of steam generators on the basis of at least 05 criterion of classification. State: At least one example of each type. Differentiate: between fire tube and water tube boilers with respect to at least 05 points. b) Discuss: At least 03 unique features of high pressure boilers. Explain: Working of Benson boiler. Draw: Neat system diagram.	10	1	IV	5	1.4.1																				
6.	a) State: Methods of improving efficiency of a simple gas turbine plant. Explain: Method of reheating for open cycle gas turbine plant. Draw: Neat system diagram and T-s diagram. b) The pressure ratio of an open cycle gas turbine power plant is 5.6. Air is taken at 30°C and 1 bar. The compression is carried out in two stages with perfect intercooling in between the two stages. The maximum temperature of the cycle is limited to 700°C. Assuming the isentropic efficiency of each compressor stage as 85% and that of the turbine as 90%, Evaluate: i) the power developed and ii) efficiency of the power plant, if the air-fuel ratio is 1.2 kg/s. The mass fuel may be	08	2	I, II, III	6	1.4.1																				
		12	4	III, VI	1.6	1.4.1																				



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	neglected. c_p of air = 1.02 kJ /kg.K and $\gamma = 1.41$. Draw: Neat T-s diagram.					
7.	a) Describe: Constructional features and at least 04 main parts of a centrifugal pump. Draw: Neat sketch.	10	1	II, III	2	1.4.1
	b) Describe: Constructional features and at least 04 main parts of a Pelton turbine. Draw: Neat sketch.	10	1	II, III	7	1.4.1



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F.Y. comp sem V *26/5/26*
Program: BTech Mechanical
Course Code: PC-BTM603
Course Name: Manufacturing Planning and Control

Duration: 3hr
Maximum Points: 100
Semester: VI

Note:
Que 1 is compulsory Solve any 4 questions out of remaining
ND Tables are permitted.

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Q.No.	Question	Points	CO	BL	Module																						
	Explain the following terms with reference to JIT [Toyota Production Systems / Manufacturing Systems. Draw the sketches wherever necessary. 1.PokaYoke. 2. Seven Waste 3.TPM 4.SMED 5.Jidoka	20	CO1, CO2	3	M3																						
Q2A	Consider the time series data below and use the least square method to determine the equation of the line of best fit for the data. <table><tr><td>X</td><td>13</td><td>8</td><td>7</td><td>15</td><td>16</td><td>8</td><td>11</td><td>10</td><td>11</td><td>13</td></tr><tr><td>Y</td><td>9</td><td>17</td><td>6</td><td>17</td><td>14</td><td>9</td><td>14</td><td>11</td><td>6</td><td>19</td></tr></table> State the and explain the Factors affecting demand Forecasting	X	13	8	7	15	16	8	11	10	11	13	Y	9	17	6	17	14	9	14	11	6	19	10	CO1, CO2	5	1
X	13	8	7	15	16	8	11	10	11	13																	
Y	9	17	6	17	14	9	14	11	6	19																	
Q2B	A glass factory specializing in crystal is experiencing a substantial backlog, and the firm's management is considering three courses of action: A) Arrange for subcontracting B) Construct new facilities C) Do nothing (no change). The correct choice depends largely upon demand, which may be low, medium, or high. By consensus, management estimates the respective demand probabilities as 0.1, 0.5, and 0.4. The management also estimates the profits when choosing from the three alternatives (A, B, and C) under the differing probable levels of demand. These profits, in thousands of dollars are presented in the table below <table><tr><td></td><td>0.1</td><td>0.5</td><td>0.4</td></tr><tr><td></td><td>Low</td><td>Medium</td><td>High</td></tr><tr><td>A</td><td>10</td><td>50</td><td>90</td></tr><tr><td>B</td><td>-120</td><td>25</td><td>200</td></tr><tr><td>C</td><td>20</td><td>40</td><td>60</td></tr></table> State the factors affecting over capacity and under capacity.		0.1	0.5	0.4		Low	Medium	High	A	10	50	90	B	-120	25	200	C	20	40	60	10	CO2, CO4	5	2,3		
	0.1	0.5	0.4																								
	Low	Medium	High																								
A	10	50	90																								
B	-120	25	200																								
C	20	40	60																								
Q3A	Derive an Expression for Economic Batch Quantity as per Production Model of Inventory Management. Draw the cost curves of Inventory Management. Draw the Model and State the assumptions. State the reasons of keeping the inventory.	10	CO2, CO4	5	3,4																						

**END SEM / RE EXAMINATION - MAY 2026**

Q3B	Numerical on Quantity Discount • A company need 60000 units per year which costs Rs20 per unit. • Ordering cost is estimated to be 200 per order carrying cost are 15% per annum of average inventory. • The supplier is ready to give 2 % discount in price of the original value if the company purchases 10000 units or more but less than 25000 lot size. • A further of 1 % in price of original value is available on the order of 25000 or more units. • Find the economical lot size and min total cost. • State the reasons of keeping the inventory	10	CO2, CO4	5	3																																
Q4A	Use the graphical method and find the minimum total elapsed time, Idle time of each job for the given data. Prepare the Gantt chart to showcase the loading of the machine on common time scale. Show which job will be loaded first on each machine. What are the different scheduling techniques. <table><tr><td rowspan="3">Job 1</td><td>Machines</td><td colspan="5"></td></tr><tr><td>Sequence</td><td>M1</td><td>M2</td><td>M3</td><td>M4</td><td>M5</td></tr><tr><td>Time in hrs</td><td>3</td><td>5</td><td>2</td><td>5</td><td>6</td></tr><tr><td rowspan="2">Job2</td><td>Sequence</td><td>M3</td><td>M1</td><td>M4</td><td>M5</td><td>M2</td></tr><tr><td>Time in hrs</td><td>3</td><td>4</td><td>5</td><td>3</td><td>4</td></tr></table>	Job 1	Machines						Sequence	M1	M2	M3	M4	M5	Time in hrs	3	5	2	5	6	Job2	Sequence	M3	M1	M4	M5	M2	Time in hrs	3	4	5	3	4	10	CO1, CO3	5	4
Job 1	Machines																																				
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Job2	Sequence	M3	M1	M4	M5	M2																															
	Time in hrs	3	4	5	3	4																															
Q4B	Find the optimal sequence to complete the following jobs on three machines. Find the Total elapsed time to complete all jobs. Find the idle time of each machine. State the name of the technique used to find the Optimal Sequence. <table><tr><td rowspan="2">Machines</td><td colspan="5">Jobs</td></tr><tr><td>J1</td><td>J2</td><td>J3</td><td>J4</td><td>J5</td></tr><tr><td>M1</td><td>11</td><td>13</td><td>14</td><td>16</td><td>15</td></tr><tr><td>M2</td><td>4</td><td>11</td><td>3</td><td>8</td><td>6</td></tr><tr><td>M3</td><td>18</td><td>16</td><td>11</td><td>14</td><td>113</td></tr></table>	Machines	Jobs					J1	J2	J3	J4	J5	M1	11	13	14	16	15	M2	4	11	3	8	6	M3	18	16	11	14	113	10	CO2	5	5			
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Q5A	Refer the project data. 1. Draw the project Network 2. Identify all paths 3. Find the project Duration 4. Find Critical path and show it on the network. 5. Find the earliest occurrence of each event 6. Find the latest occurrence of each event 7. Find the earliest start time and latest start time of each activity. 8. Find the earliest finish time and latest finish time if each activity 9. Find the float of each activity. 10. State the significance of float. <table><tr><th>Activity</th><th>Precedence activity</th><th>Duration</th></tr><tr><td>A</td><td>-</td><td>2</td></tr><tr><td>B</td><td>A</td><td>8</td></tr><tr><td>C</td><td>A</td><td>10</td></tr><tr><td>D</td><td>B</td><td>6</td></tr><tr><td>E</td><td>C</td><td>3</td></tr><tr><td>F</td><td>B</td><td>3</td></tr><tr><td>G</td><td>D,E</td><td>5</td></tr><tr><td>H</td><td>C</td><td>7</td></tr><tr><td>I</td><td>F</td><td>2</td></tr><tr><td>J</td><td>H</td><td>8</td></tr></table>	Activity	Precedence activity	Duration	A	-	2	B	A	8	C	A	10	D	B	6	E	C	3	F	B	3	G	D,E	5	H	C	7	I	F	2	J	H	8	10	CO3		3,4, 6
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G	D,E	5																																				
H	C	7																																				
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J	H	8																																				
Q5B	The cost information computed by the cost accountant is as follows : Sales = 1,00,000 units Selling Price = Rs. 10 per unit Variable cost or out of pocket-costs = Rs. 6 per unit Fixed costs or burden = Rs. 60,000 per annum Compute the following : a) Break even points in units and value b) Make a profit of Rs. 40,000 c) Make a profit of Rs. 2 per unit d) Make a profit of 30% on sales Illustrate the ways to lower the Break Even point with suitable examples.	10	1,2	5	1,2																																	
Q6A	A firm assembles and sells two different types of outboards motors, A and B , using four resources. The production details can be as follows. Formulate LPP <table><tr><th>Sr.No.</th><th>Resources</th><th>Capacity per month</th></tr><tr><td></td><td>Motor unit shop resource</td><td>400 Type A Units or 250 type B units or any linear combination of the two</td></tr><tr><td></td><td>Type A gear and Drive Shop Resource</td><td>175 Type A units</td></tr><tr><td></td><td>Type B gear and Drive shop Resource</td><td>225 Type B units</td></tr></table>	Sr.No.	Resources	Capacity per month		Motor unit shop resource	400 Type A Units or 250 type B units or any linear combination of the two		Type A gear and Drive Shop Resource	175 Type A units		Type B gear and Drive shop Resource	225 Type B units	10	CO2	5	6																					
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	Type B gear and Drive shop Resource	225 Type B units																																				

**END SEM / RE EXAMINATION - MAY 2026**

		Final Assembly resource	200 Type A units or 350 Type B units or any linear combination of the two.																																								
Q6B	Suppose a company manufactures two products, <i>A</i> and <i>B</i> , using three inputs, labor, material <i>R</i> , and materials <i>S</i> . To make one unit of product <i>A</i> requires 7 pounds of <i>R</i> , 8.5 pounds of <i>S</i> , and 8 person-hours of labor; to make one unit of product <i>B</i> requires 14 pounds of <i>R</i> , 5.5 pounds of <i>S</i> , and 7 person-hours of labor. The demands for the products are such that the company can sell as much of each product as it can produce and earn a profit of \$4 per unit of <i>A</i> and \$5 per unit of <i>B</i> . However, only 1000 pounds of <i>R</i> , 775 pounds of <i>S</i> , and 1400 person-hours of labor are available to the company each day. a. Formulate the company's problem as a linear program to maximize profit. b. Graph the feasible region for this problem. c. Solve the problem graphically by finding the best extreme point.			10	CO2	5	6																																				
Q7A	Consider the problem of assigning five jobs to five persons. The assignment costs are given as follows. Determine the optimum assignment <table border="1"><tr><td></td><td>J1</td><td>J2</td><td>J3</td><td>J4</td><td>J5</td></tr><tr><td>Person A</td><td>8</td><td>4</td><td>2</td><td>6</td><td>1</td></tr><tr><td>Person B</td><td>0</td><td>9</td><td>5</td><td>5</td><td>4</td></tr><tr><td>Person C</td><td>3</td><td>8</td><td>9</td><td>2</td><td>6</td></tr><tr><td>Person D</td><td>4</td><td>3</td><td>1</td><td>0</td><td>3</td></tr><tr><td>Person E</td><td>9</td><td>5</td><td>8</td><td>9</td><td>5</td></tr></table>				J1	J2	J3	J4	J5	Person A	8	4	2	6	1	Person B	0	9	5	5	4	Person C	3	8	9	2	6	Person D	4	3	1	0	3	Person E	9	5	8	9	5	10	CO1, CO2, CO3	5	6
	J1	J2	J3	J4	J5																																						
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Person B	0	9	5	5	4																																						
Person C	3	8	9	2	6																																						
Person D	4	3	1	0	3																																						
Person E	9	5	8	9	5																																						
Q7B	The management of ABC company is considering the question of marketing a new product. The fixed cost required in the project is Rs.4,000. Three factors are uncertain viz. the selling price, variable cost and the annual sales volume. The product has a life of only one year. The management has the data on three factors as under. <table border="1"><tr><th>Sale Price (Rs.)</th><th>Probability</th><th>Variable Cost (Rs.)</th><th>Probability</th><th>Sales Volume (Units)</th><th>Probability</th></tr><tr><td>3</td><td>0.2</td><td>1</td><td>0.3</td><td>2,000</td><td>0.3</td></tr><tr><td>4</td><td>0.5</td><td>2</td><td>0.6</td><td>3,000</td><td>0.3</td></tr><tr><td>5</td><td>0.3</td><td>3</td><td>0.1</td><td>5,000</td><td>0.4</td></tr></table> Considering the following sequence of thirty random numbers: 81, 32, 60, 04, 46, 31, 67, 25, 24, 10, 40, 02, 39, 68, 08, 59, 66, 90, 12, 64, 79, 31, 86, 68, 82, 89, 25, 11, 98, 16. Using the sequence (first 3 random numbers for the first trial etc.) simulate the average profit for the above project on the basis of 10 trails.			Sale Price (Rs.)	Probability	Variable Cost (Rs.)	Probability	Sales Volume (Units)	Probability	3	0.2	1	0.3	2,000	0.3	4	0.5	2	0.6	3,000	0.3	5	0.3	3	0.1	5,000	0.4	10	CO2	5	7												
Sale Price (Rs.)	Probability	Variable Cost (Rs.)	Probability	Sales Volume (Units)	Probability																																						
3	0.2	1	0.3	2,000	0.3																																						
4	0.5	2	0.6	3,000	0.3																																						
5	0.3	3	0.1	5,000	0.4																																						



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END SEM/RE-EXAM EXAMINATION MAY/JUNE 2026

29/5/26

Program: BTECH (MECH. ENGG.)

Sem VI

Duration: 3 hrs

Course Code: MI-BT022

Maximum Points: 100

Course Name: Artificial Intelligence and Machine Learning

Semester: VI

Q.No.	Questions	Points	CO	BL	Module No.
Q.1 (a)	Explain the working of the Linear Regression algorithm with the help of: • Linear regression equation • Cost/Loss function • Best fit line concept • Gradient descent optimization • Also explain how the model updates its parameters during training to minimize prediction error.	10	1,2	2	3
(b)	Explain the working of the Support Vector Machine (SVM) classification algorithm with the help of: • Hyperplane and margin concept • Support vectors • Linear and non-linear classification • Kernel functions • Also explain how SVM classifies data points and determines the optimal decision boundary during training. Draw suitable figures wherever required.	10	1,2	2	3
Q.2 (a)	Explain the following AI algorithms (Any two) 1] Breadth first search 3] Uniform Cost search 4] Heuristic informed search algorithm - Explain supervised, Unsupervised and reinforcement learning with examples.	05 05	1,2	2	1
(b)	-What is Principal Component Analysis (PCA)? Explain the step-by-step procedure of PCA and discuss its applications in feature reduction and dimensionality reduction. -Explain different Model Evaluation Metrics such as Accuracy, Precision, Recall, F1-Score, MAE, MSE, and RMSE with suitable examples.	10	1,2	2	2
Q.3 (a)	The following dataset shows whether a machine failure occurs based on Temperature and Vibration conditions.	10	1,2	2	2



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Machine	Temperature	Vibration	Failure
M1	High	High	Yes
M2	High	Low	Yes
M3	Low	High	No
M4	Low	Low	No
M5	High	High	Yes
M6	Low	High	No

Using the Naïve Bayes Classification algorithm, predict whether the machine will fail for the following new condition:

Temperature = High, Vibration = Low

Perform the following steps:

- Calculate prior probabilities
- Calculate conditional probabilities
- Apply Bayes' theorem
- Compute posterior probabilities
- Classify the new data sample into the appropriate class.

(b)

Explain the applications of Artificial Intelligence (AI) and Machine Learning (ML) in Electrical Engineering with respect to smart grids and fault detection & diagnosis. Discuss the role of AI in improving reliability, energy management, and system performance.

10

1,2

2

2

Q.4
(a)

Explain the concept of Generative Adversarial Networks (GANs). Discuss the roles of Generator and Discriminator networks and explain the training process of GANs. along with neat figures

10

1,2

2

2

(b)

-Explain the concept of Bias in Artificial Intelligence. Discuss different sources of bias in AI systems and their impact on engineering and society.
-Discuss the importance of Transparency and Accountability in AI Systems. Explain the challenges associated with explainable AI and ethical decision-making.

10

1,2

2

2



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END SEM/RE-EXAM EXAMINATION MAY/JUNE 2026

Q.5 (a)	Explain the working of the K-Nearest Neighbors (KNN) classification algorithm with the help of: •Distance measurement techniques • Selection of nearest neighbors • Majority voting mechanism • Effect of K value on model performance Also explain how KNN classifies a new data sample during prediction. Draw suitable figures wherever required	10	1,2	2	2																																			
(b)	Explain the working of the K-Means Clustering algorithm with the help of: •Selection of K cluster centroids •Distance-based data point assignment •Centroid update mechanism •Iterative clustering process Also explain how the algorithm minimizes intra-cluster distance during training. Draw suitable figures wherever required.	10	1,2	2	2																																			
Q.6	A manufacturing company wants to classify machine components as Defective or Non-Defective using the Random Forest Algorithm. The following dataset is given:	20	1,2	2	2																																			
<table><tr><th>Component</th><th>Temperature</th><th>Vibration</th><th>Pressure</th><th>Condition</th></tr><tr><td>C1</td><td>High</td><td>High</td><td>Low</td><td>Defective</td></tr><tr><td>C2</td><td>High</td><td>Low</td><td>Low</td><td>Defective</td></tr><tr><td>C3</td><td>Low</td><td>High</td><td>High</td><td>Non-Defective</td></tr><tr><td>C4</td><td>Low</td><td>Low</td><td>High</td><td>Non-Defective</td></tr><tr><td>C5</td><td>High</td><td>High</td><td>High</td><td>Defective</td></tr><tr><td>C6</td><td>Low</td><td>High</td><td>Low</td><td>Non-Defective</td></tr></table> A new component has: • Temperature = High • Vibration = High • Pressure = Low Random Forest generates 3 decision trees.		Component	Temperature	Vibration	Pressure	Condition	C1	High	High	Low	Defective	C2	High	Low	Low	Defective	C3	Low	High	High	Non-Defective	C4	Low	Low	High	Non-Defective	C5	High	High	High	Defective	C6	Low	High	Low	Non-Defective				
Component	Temperature	Vibration	Pressure	Condition																																				
C1	High	High	Low	Defective																																				
C2	High	Low	Low	Defective																																				
C3	Low	High	High	Non-Defective																																				
C4	Low	Low	High	Non-Defective																																				
C5	High	High	High	Defective																																				
C6	Low	High	Low	Non-Defective																																				



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END SEM/RE-EXAM EXAMINATION MAY/JUNE 2026

	Tasks 1. Create bootstrap sample datasets for Tree 1, Tree 2, and Tree 3. 2. Randomly select any two features for each tree. 3. Using the sampled datasets and selected features, predict the class of the new component for each tree. 4. Determine the final prediction using majority voting. 5. Explain how Random Forest reduces overfitting compared to a single Decision Tree.				
Q.7 (a)	What is Retrieval-Augmented Generation (RAG) in Generative Artificial Intelligence (Generative AI)? Explain the fundamentals of Generative AI and the working principle of RAG architecture with the help of components such as retrieval system, vector database, embedding model, and Large Language Model (LLM). Also discuss the applications of RAG in engineering and industrial domains.	10			
(b)	Discuss the role of Quantum Computing in Artificial Intelligence (AI) and Machine Learning (ML) as an emerging technology in future engineering applications. Explain its basic concept, working principles (qubits, superposition, and entanglement), and discuss its potential impact on optimization, machine learning models, data processing, cybersecurity, and smart engineering systems	10	4	2	2

***** ** ALL THE BEST *****



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End Semester / RE-Examination, MAY-JUNE 2026

26/26

B.Tech. (Mechanical Engineering), Semester-VI
PE BTM 611: COMPUTATIONAL FLUID DYNAMICS

Max. Marks: 100
Duration: 3 Hours

Instructions:

- Answer any **FIVE** questions
- Answers to all sub questions of a particular question must be grouped together for their evaluation
- Make suitable assumption if needed with proper reasoning
- Figures on right in square bracket shows maximum marks for a particular sub-question
- Figure on the extreme right shows **course outcome number (CO)/ Bloom's Taxonomy (BT)**.

- A.** Explain the following concepts with appropriate reasoning and examples wherever necessary: [10] 1/2

 - (a) Distinction between elliptic and hyperbolic partial differential equations.
 - (b) Concept of over-relaxation and under-relaxation in numerical methods.
 - (c) Role of eigenvalues in the solution and convergence of linear algebraic equations.
 - (d) Significance of mesh size and time step size in numerical computation.

B. A solar panel subjected to uniform incident heat flux q is modelled as a lumped parameter system. [10] 1/6

Considering convective and radiative heat losses to the surroundings:

 - (a) Derive an expression for the equilibrium temperature of the panel.
 - (b) Establish the time-dependent temperature response of the system.

Clearly state all assumptions made in the modelling process.
- A.** Consider a one-dimensional steady convection-diffusion problem. When the convective term is discretized using the central difference scheme (CDS), the numerical solution is subject to stability restrictions (in terms of the Peclet number). [10] 2/5

 - (a) Discuss the limitations associated with the CDS for convection-dominated flows.
 - (b) Explain how these stability restrictions can be overcome.
 - (c) Describe the concept of up-winding and its role in improving numerical stability

B. A plane wall of thickness 60 mm has a uniform internal heat generation of 0.5 MW/m^3 and thermal conductivity $k=25 \text{ W/m}^\circ\text{C}$. The left and right surface temperatures are maintained at 100°C and 40°C , respectively. Using the finite difference method (FDM), determine the steady-state temperature distribution at six equally spaced internal nodes. [10] 3/3, 4

 - (a) Write the governing differential equation and boundary conditions.
 - (b) Show computational domain and develop the discretized equations.
 - (c) Compute the nodal temperatures using an appropriate method.
- A.** What do you understand by the modeling and simulation of a mechanical system? Illustrate your answer with a suitable example. Discuss the need for modeling and simulation, along with their limitations. Why is model validation essential? [10] 2/2

B. Consider the following system of linear algebraic equations: [10] 4/6

$$2x+3y+z=5, \quad 4x+y+2z=6, \quad x+5y+z=7$$
 - (a) Check for diagonal dominance and comment on convergence of the Gauss-Seidel method.
 - (b) Perform five Gauss-Seidel iterations with initial guess $x=y=z=0$ and comment on convergence/divergence.
 - (c) Briefly explain how the Relaxation method can improve convergence.
- A.** Thermo-fluid problems can be investigated using analytical, experimental, and numerical (CFD) approaches. [10] 1/4

(a) Compare their advantages and limitations with respect to accuracy, cost, flexibility, and applicability.

(c) Using a suitable case study (e.g., flow over an airfoil), explain how CFD and experimental methods complement each other in practical engineering analysis.

- B.** A plane wall of thickness 0.12 m with thermal diffusivity $1.5 \times 10^{-6} \text{ m}^2/\text{s}$ is initially at a uniform temperature of 85°C . At $t=0$, one surface is suddenly maintained at 20°C , while the other surface is perfectly insulated. The domain is discretized with $\Delta x=0.03\text{m}$ and $\Delta t=300 \text{ s}$. [10] 2/3, 4

(a) Write the governing equation, along with the initial and boundary conditions.

(b) Develop the finite volume discretized equations for all nodes.

(c) Using an explicit scheme, compute and tabulate the temperature distribution across the wall for four time steps only.

- 5. A.** Compare the following concepts, highlighting their key differences and significance in fluid flow analysis: [10] 1/4

(i) Collocated vs. staggered mesh

(ii) Coupled vs. uncoupled flow problems

(iii) Reynolds stresses vs. viscous stresses

- B.** The figure 1 shows a hollow square 2d-geometry. The internal surface is at a constant temperature and external surface is exposed to air cooling. Based on the given geometry and thermal conditions: [10] 3/3, 4

(a) Define a simplified computational domain suitable for numerical analysis, stating any assumptions made (e.g., symmetry, periodicity).

(b) Specify the appropriate boundary conditions for all surfaces,

(c) Write the governing equations for heat transfer within the solid domain.

(d) Propose an efficient non-uniform mesh strategy, highlighting regions requiring mesh refinement and justification for your choices.

- 6. A.** State the fundamental conservation laws used in thermo-fluid analysis. With the help of a neatly drawn differential control volume, and appropriate assumptions, derive the general differential form of the mass conservation equation. [10] 2/4, 5

- B.** Explain the ADI scheme and its applications. Formulate it for a 2D transient conduction problem. Compare it with explicit and implicit schemes, and discuss its advantages. [10] 3/4

- 7. A.** Explain why numerical solution of flow problems is more complex than energy equation analysis, with illustrations. Derive the pressure correction equation for a 2D incompressible flow using the SIMPLE algorithm. [10] 3/4

$$\frac{\partial^2 p'}{\partial x^2} + \frac{\partial^2 p'}{\partial y^2} = -\frac{\rho}{\Delta t} R$$

- B.** Explain the distinguishing features of turbulent flow. Describe the formulation and significance of RANS equations, and list four commonly used turbulence models with their applications. [10]

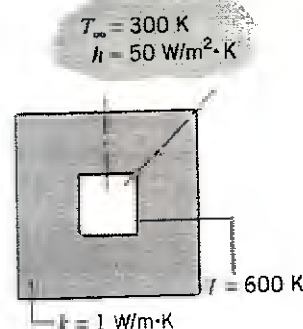


Figure 1.



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END SEM/RE-EXAM EXAMINATION MAY / JUNE 2025

Program: Mechanical

Duration: 3 Hrs

Course Code: PE BTM 612

Maximum Points: 100

Course Name: Composite Material

Semester: VI

Notes: Solve ANY FIVE questions

Assume Suitable Data

Q.No	Questions	Points	CO	BL	Module No.
Q.1 a	Classify composite materials based on reinforcement and matrix. Explain different types of fibers and matrices in detail.	10	1	IV	1
b	Discuss industry applications, advantages and limitations of composite materials.	10	1	V	1
Q.2 a	Explain Polymer Matrix Composites (PMC), Metal Matrix Composites (MMC) and Ceramic Matrix Composites (CMC) with suitable examples.	10	2	VI	2
b	Explain Autoclave molding and Filament winding process with neat sketches.	10	3	VI	5
Q.3 a	Discuss micro and macro approaches used to study structure-property relations in composites	10	3	IV	3
b	Explain anisotropic materials and derive engineering constants for composite lamina.	10	4	V	4
Q.4 a	Explain failure criteria under multiaxial loading in composite materials.	10	4	V	
b	Discuss delamination and interlaminar failures in laminated composites with suitable examples.	10	4	VI	4
Q.5 a	Explain post-processing operations in composites such as machining, bonding and riveting.	10	3	V	6
b	Explain manufacture of foams, honeycombs and adhesives used in composites.	10	2	VI	5
Q.6 a	Discuss preparation of fillers, additives and pigments for Polymer Matrix Composites.	10	2	IV	5
b	A Carbon/Epoxy lamina is subjected to $\sigma_1 = 600$ MPa, $\sigma_2 = 30$ MPa and $\tau_{12} = 35$ MPa. Using Tsai-Hill theory determine the factor of safety of the lamina. Assume suitable material strengths.	10	4	VII	4
Q.7 a	Explain composite product design considerations for thermal, optical, acoustic and electrical requirements.	10	1	V	7
b	Discuss repair techniques of composites, embedded sensors and applications of nanocomposites.	10	4	VI	7



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END SEMESTER EXAMINATION MAY/JUNE 2026

21/22

Program: Mechanical Engineering

Course Code: PE-BTM 613

Course Name: Tool Engineering

Duration: 3 hour

Maximum Points: 100

Semester: VI

INSTRUCTIONS:

1. Attempt any five questions
2. Draw neat schematic diagrams wherever necessary, **highlight** important points of answer.
3. Assume suitable data if necessary and mention it.

Q. No.	Questions	Point	BL	CO	Module
Q1	What is impact of rake angle, clearance angle and wedge angle of cutting tool on machining process?	10	1	1	1
A)	Difference between orthogonal and oblique cutting with figure?				
Q1	Obtain expression for Friction force, Normal friction force as a function of cutting and thrust force & Shear force as a function of resultant force?	10	2	1	1
B)	Draw necessary cutting force circle diagram?				
Q2	Give primary, secondary functions and process effects of cutting fluid in metal cutting operation?	10	1	2	2
A)	Desirable characteristics for efficient lubricant in metal cutting				
B)	Write short note on cutting force measurement by elastic strain and 2-Axis lathe dynamometer.	10	1	2	2
Q3	What is Master line principle for obtaining real geometry of cutting tool?	10	2	1	3
A)	Obtain expression for maximum rake angle as a function of rake angle in ORS system and inclination of master line. Draw necessary sketches?				
B)	Enlist benefits of the conversion of tool angles? Give tool signatures in orthogonal rake, machine rake and normal rake system? Give its nomenclature?	10	1	2	3



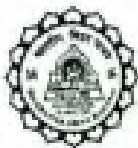
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END SEMESTER EXAMINATION MAY/JUNE 2026

Q4 A)	To maintain product quality how to control process parameters & Give the different strategies by which rolling power requirement can be kept minimum? Discuss in detail & Justify?	10	2	3	4
B)	In tabular form compare hot rolling and cold rolling process? Write a short note on ring rolling process with its advantages and applications?	10	1	3	4
Q5 A)	Give the characteristic features of punched hole and punched slug using neat sketch and for solving problem of punched hole and slug suggest a method, discuss and draw it's setup?	10	1	4	5
B)	Write a short note on the following: 1) Burnishing dies 2) Trimming die 3) Shaving die? Draw detailed sketch of compound die setup?	10	1	3	5
Q6 A)	Give the difference between impression and closed die forging with neat sketch in the tabular form? Discuss the forging force and its relevant parameters? What is flow stress?	10	1	4	6
B)	Discuss in detail all steps for forging of an "Connecting rod" along with sketch? Discuss important die design features for impression die forging process?	10	2	3	6
Q7 A)	Write short note on the following in respect of sheet metal forming operations; a) Rate sensitivity, b) Elongation, c) Planar anisotropy, d) Yield point elongation?	10	1	3	7
B)	How can forming a limit diagram (FLD) can be formed using a set of specimens? Give significance to each region's FLD and draw labeled test setup?	10	1	4	7



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✓
END SEM/RE-EXAM/May/June 2026-2

26/26

Program: T. Y. B Tech (Mechanical Engg.)

Duration: 3 hr

Course Code: PE-BTM614

Maximum Points: 100

Course Name: Mechanical Vibration

Semester: VI ✓

1. Solve any five questions.
2. Answers to each sub-questions are grouped together
3. Use of scientific calculator is allowed
4. Begin answer to each question on new page.
5. Keep some margin on left side of answer paper
6. Candidates should write the answer legibly

Q.No.	Questions	Pts	CO	BL
1	a) Define Logarithmic Decrement and derive its expression for a viscously damped free vibration system.	10	1,2	1,2,3
	b) The ratio of successive amplitudes of a damped SDOF system is 18:1. Calculate the damping ratio of the system. Find amount of damping present in the system if $m=1\text{kg}$, $k=100\text{N/m}$.	10		
2	a) Derive the differential equation of motion for a forced damped translational single dof system using Newton's Second Law; also obtain expression for the steady-state amplitude and phase angle.	10	1,2	2,3
	b) A vehicle of mass 1000 kg and total spring constant of its suspension system is 60 kN/m. The profile of the road may be approximated to a line curve of amplitude 4.0 cm and wavelength of 4.0 meters. Determine: i) the critical speed of the vehicle ii) amplitude of the steady state motion of the mass when the vehicle is driven at critical speed and iii) at speed of 40 kmph, take the damping factor is 0.25	10		
3	a) An undamped system with two identical masses ($m_1 = m_2 = m$) and three identical springs ($k_1 = k_2 = k_3 = k$) connected in a line; obtain the equation of motion, natural frequencies and mode shapes.	10	1,3,4	2,3,4
4	b) Dynamic Vibration Absorber: How does adding a secondary mass help in controlling vibrations?	10		
	Discuss the following numerical methods in detail: a) Dunkerlay's method b) Holzer's method	20		



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5	Write Short note on: a) Frequency response curves b) Force Transmissibility c) Semi-definite System of vibration d) Beats Phenomenon	20	1,3	1,2
6	a) Compare discrete and continuous vibrating system. b) The strings of guitar are made of music wire with diameter 0.05 mm, weight density 76.5 kN/m^3 , $E = 210 \text{ GPa}$. If the length of two of the strings is 100 cm and 105 cm each, determine the fundamental natural frequencies of the strings. The tension in each string is 40 kN.	10 10	2,4	2,3
7	a) Draw flow-diagram of basic vibration measurement scheme. Discuss the function of each block. b) Compare vibrometer and accelerometer	10 10		



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END SEM / RE EXAMINATION ^{July} ~~MAY~~ 2026

13/07/26

Program: BTech Mechanical
3hr

Course Code: PC-BTM603

Points:100 Course Name: Manufacturing Planning and Control

Semester: VI

Note:

Que 1 is compulsory Solve any 4 questions out of remaining
ND Tables are permitted.

Duration:

Maximum

Sem - VI

Q.No.	Question	Points	CO	BL	Module																
Q1	Explain the following terms with reference to JIT [Toyota Production Systems]. Draw the sketches wherever necessary. 1.VSM Kaizen 2.VA / NVA Value Creation 3.Single piece flow 4.5S	20	CO1, CO2	3	M3																
Q2A	Numerical on Sales Forecasting using Regression equation. The annual sales of company is given below. <table><tr><th>Year</th><th>Sales in Rs</th></tr><tr><td>Y1</td><td>45000</td></tr><tr><td>Y2</td><td>51000</td></tr><tr><td>Y3</td><td>67000</td></tr><tr><td>Y4</td><td>69000</td></tr><tr><td>Y5</td><td>72000</td></tr><tr><td>Y6</td><td>73000</td></tr><tr><td>Y7</td><td>74000</td></tr></table> Use Least square find the trend value of for each of the five years. Also estimate the sales annual sales for year 2025. State the objectives of Short term forecasting and Limitations of forecasting	Year	Sales in Rs	Y1	45000	Y2	51000	Y3	67000	Y4	69000	Y5	72000	Y6	73000	Y7	74000	10	CO1, CO2	5	1
Year	Sales in Rs																				
Y1	45000																				
Y2	51000																				
Y3	67000																				
Y4	69000																				
Y5	72000																				
Y6	73000																				
Y7	74000																				
Q2B	Draw the diagram of Aggregate Production Planning showing the inputs and outputs. Refer the following Forecast. <table><tr><th>Quarter</th><th>Forecasted demand (in 000 pounds)</th></tr><tr><td>Q1</td><td>80</td></tr><tr><td>Q2</td><td>50</td></tr><tr><td>Q3</td><td>120</td></tr><tr><td>Q4</td><td>150</td></tr></table> • Hiring Cost = \$100 per worker • Firing Cost = \$500 per worker • Regular Production cost per pound= \$2.00 • Inventory Carrying cost = \$0.5 pound per quarter • Production per employee=1000 pounds per quarter • Beginning workforce =100 workers	Quarter	Forecasted demand (in 000 pounds)	Q1	80	Q2	50	Q3	120	Q4	150	10	CO2, CO4	5	2,3						
Quarter	Forecasted demand (in 000 pounds)																				
Q1	80																				
Q2	50																				
Q3	120																				
Q4	150																				



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~~END SEM~~ / RE EXAMINATION – ^{July} MAY 2026

	Compute the Cost of Level Production Strategy Compute the Cost of Chase Demand Strategy.																																				
Q3A	Draw the cost curves of Inventory Management. Derive an Expression for Economic Order Quantity under Basic Inventory Model. Draw the Model and State the assumptions. State the types of Inventory.	10	CO2, CO4	4	3,4																																
Q3B	Numerical on Quantity Discount A company need 50000 units per year which costs Rs10 per unit. Ordering cost is estimated to be 100 per order carrying cost are 15% per annum of average inventory. The supplier is ready to give 2 % discount in price of the original value if the company purchases 10000 units or more but less than 20000 lot size. A further of 1 % in price of original value is available on the order of 20000 or more units. Find the economical lot size and min total cost. State the reasons of keeping the inventory	10	CO2, CO4	5	3																																
Q4A	Use the graphical method and find the minimum total elapsed time, Idle time of each job for the given data. Prepare the Gantt chart to showcase the loading of the machine on common time scale. Show which job will be loaded first on each machine. What are the different scheduling techniques? <table><tr><td rowspan="3">Job 1</td><td>Machines</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Sequence</td><td>M1</td><td>M2</td><td>M3</td><td>M4</td><td>M5</td></tr><tr><td>Time in hrs</td><td>5</td><td>4</td><td>5</td><td>3</td><td>4</td></tr><tr><td rowspan="3">Job2</td><td>Sequence</td><td>M2</td><td>M4</td><td>M1</td><td>M3</td><td>M5</td></tr><tr><td>Time in hrs</td><td>7</td><td>5</td><td>6</td><td>6</td><td>3</td></tr></table>	Job 1	Machines						Sequence	M1	M2	M3	M4	M5	Time in hrs	5	4	5	3	4	Job2	Sequence	M2	M4	M1	M3	M5	Time in hrs	7	5	6	6	3	10	CO1, CO3	5	4
Job 1	Machines																																				
	Sequence		M1	M2	M3	M4	M5																														
	Time in hrs	5	4	5	3	4																															
Job2	Sequence	M2	M4	M1	M3	M5																															
	Time in hrs	7	5	6	6	3																															
	Q4B	Find the optimal sequence to complete the following jobs on three machines. Find the Total elapsed time to complete all jobs. Find the idle time of each machine. State the name of the technique used to find the Optimal Sequence. <table><tr><td rowspan="2">Machines</td><td colspan="5">Jobs</td></tr><tr><td>J1</td><td>J2</td><td>J3</td><td>J4</td><td>J5</td></tr><tr><td>M1</td><td>11</td><td>8</td><td>12</td><td>14</td><td>13</td></tr><tr><td>M2</td><td>4</td><td>5</td><td>3</td><td>8</td><td>6</td></tr><tr><td>M3</td><td>13</td><td>8</td><td>11</td><td>9</td><td>12</td></tr></table>	Machines	Jobs					J1	J2	J3	J4	J5	M1	11	8	12	14	13	M2	4	5	3	8	6	M3	13	8	11	9	12	10	CO2	5	5		
Machines	Jobs																																				
	J1	J2	J3	J4	J5																																
M1	11	8	12	14	13																																
M2	4	5	3	8	6																																
M3	13	8	11	9	12																																
Q5A	Project has following characteristics. <table><tr><td>Activity</td><td>Most optimistic time</td><td>Most pessimistic time.</td><td>Most likely time.</td></tr><tr><td>1-2</td><td>1</td><td>1</td><td>7</td></tr><tr><td>1-3</td><td>1</td><td>4</td><td>7</td></tr><tr><td>1-4</td><td>2</td><td>2</td><td>8</td></tr><tr><td>2-5</td><td>1</td><td>1</td><td>1</td></tr><tr><td>3-5</td><td>2</td><td>5</td><td>14</td></tr></table>	Activity	Most optimistic time	Most pessimistic time.	Most likely time.	1-2	1	1	7	1-3	1	4	7	1-4	2	2	8	2-5	1	1	1	3-5	2	5	14	10	CO3	5	3,4, 6								
Activity	Most optimistic time	Most pessimistic time.	Most likely time.																																		
1-2	1	1	7																																		
1-3	1	4	7																																		
1-4	2	2	8																																		
2-5	1	1	1																																		
3-5	2	5	14																																		



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END-SEM / RE EXAMINATION – ^{July} MAY 2026

	4-6	2	5	8				
	5-6	3	6	15				
	- Construct the PERT network of Project. - Find Effective time for each activity - Find variance for each activity - Find the critical path. - Find E and L of each event. - Find EST, EFT LST LFT and float of each activity. - Find probability of completing the project in 4 time units less than duration.(4 weeks)							
Q5B	A company producing a single product and sells it at Rs. 10 per unit. Variable cost is Rs. 6 per unit and fixed cost is Rs. 40,000 per annum. Calculate (a) Break even point, (b) Sales volume required to earn a profit of Rs. 60,000 per annum..Draw the Break Even Analysis chart based on following points. Show Fixed Cost line, Show Variable Cost line, Show Total Cost Line Show Sales Revenue Line , Show Break Even Point				10	1,2	5	1,2
Q6A	A company makes two products (say, P and Q) using two machines (say, A and B). Each unit of P that is produced requires 50 minutes processing time on machine A and 30 minutes processing time on machine B. Each unit of Q that is produced requires 24 minutes processing time on machine A and 33 minutes processing time on machine B. Machine A is going to be available for 40 hours and machine B is available for 35 hours. The profit per unit of P is \$25 and the profit per unit of Q is \$30. Company policy is to determine the production quantity of each product in such a way as to maximize the total profit given that the available resources should not be exceeded. Formulate the Linear programming .				10	CO2	5	6
Q6B	Suppose a company manufactures two products, A and B, using three inputs, labor, material R, and materials S. To make one unit of product A requires 6 pounds of R, 7.5 pounds of S, and 9 person-hours of labor; to make one unit of product B requires 12 pounds of R, 4.5 pounds of S, and 6 person-hours of labor. The demands for the products are such that the company can sell as much of each product as it can produce and earn a profit of \$3 per unit of A and \$4 per unit of B. However, only 900 pounds of R, 675 pounds of S, and 1200 person-hours of labor are available to the company each day. a. Formulate the company's problem as a linear program to maximize profit. b. Graph the feasible region for this problem. c. Solve the problem graphically by finding the best extreme point.				10	CO2	5	6



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END SEM / RE EXAMINATION - ~~MAY 2026~~ ^{July 2026}

Q7A	Consider the problem of assigning five jobs to five persons. The assignment costs are given as follows. Determine the optimum assignment. <table><tr><td>Jobs (J_i)</td><td>J1</td><td>J2</td><td>J3</td><td>J4</td><td>J5</td></tr><tr><td>Person A</td><td>9</td><td>5</td><td>4</td><td>8</td><td>9</td></tr><tr><td>Person B</td><td>11</td><td>4</td><td>8</td><td>6</td><td>7</td></tr><tr><td>Person C</td><td>12</td><td>8</td><td>13</td><td>15</td><td>6</td></tr><tr><td>Person D</td><td>12</td><td>7</td><td>8</td><td>5</td><td>11</td></tr><tr><td>Person E</td><td>9</td><td>17</td><td>8</td><td>12</td><td>5</td></tr></table>	Jobs (J _i)	J1	J2	J3	J4	J5	Person A	9	5	4	8	9	Person B	11	4	8	6	7	Person C	12	8	13	15	6	Person D	12	7	8	5	11	Person E	9	17	8	12	5	10	CO1, CO2, CO3	5	6
Jobs (J _i)	J1	J2	J3	J4	J5																																				
Person A	9	5	4	8	9																																				
Person B	11	4	8	6	7																																				
Person C	12	8	13	15	6																																				
Person D	12	7	8	5	11																																				
Person E	9	17	8	12	5																																				
Q7B	A bakery keeps stock of a popular brand of cake. Previous experience shows the demand pattern for the item with associated probabilities, as given below: <table><tr><td>Daily demand (Units)</td><td>0</td><td>10</td><td>20</td><td>30</td><td>40</td><td>50</td></tr><tr><td>Probability</td><td>0.01</td><td>0.20</td><td>0.15</td><td>0.50</td><td>0.12</td><td>0.02</td></tr></table> Use the following sequence of random numbers to simulate the demand for next 10 days. Random numbers: 25, 39, 65, 76, 12, 05, 73, 89, 19, 49. Also estimate the daily average demand for the cakes on the basis of simulated data.	Daily demand (Units)	0	10	20	30	40	50	Probability	0.01	0.20	0.15	0.50	0.12	0.02	10	CO2	5	7																						
Daily demand (Units)	0	10	20	30	40	50																																			
Probability	0.01	0.20	0.15	0.50	0.12	0.02																																			



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July 2026
END SEMESTER /RE-EXAMINATION, TERM-II, A.Y. 2025-26

14/07/26

Program: B.Tech. Mechanical

Course Code: PCC-BTM 602

Course Name: Thermal and Fluid Machines

Third Year
Sem-VI

Duration: 3 Hours

Maximum Points: 100

Semester: VI

Notes:

- 1) Solve: Any FIVE Questions.
- 2) Write SPECIFIC answers and in legible handwriting.
- 3) Draw neat **system** diagram / process diagrams/ neat sketches wherever asked or necessary.
- 4) Assume suitable data wherever necessary and state the same.

Q. No.	Question	Points	CO	BL	Module	PL															
1.	a) Explain: Working, Advantages and disadvantages of a two-stage compressor with perfect intercooling. Derive: Expression for minimum compressor work for the same. Draw: Neat system diagram and p-V diagram.	10	2	II, III, V	1	1.4.1															
	b) The following data refers to a performance test of a single acting compressor: <table border="1"><tr><td>Bore and stroke (cm)</td><td>14 x 10</td><td>Discharge temp.</td><td>180°C</td></tr><tr><td>Suction pressure</td><td>1 bar</td><td>Compressor Speed</td><td>1200 rpm</td></tr><tr><td>Suction temp.</td><td>20°C</td><td>Shaft power</td><td>6.25 kW</td></tr><tr><td>Discharge pressure</td><td>6 bar</td><td>Mass of air delivered (kg/min)</td><td>1.7</td></tr></table> Evaluate: i) The actual volumetric efficiency ii) Indicated power iii) Isothermal efficiency iv) Mechanical efficiency of the compressor. Draw: p-V Diagram for the working of compressor.	Bore and stroke (cm)	14 x 10	Discharge temp.	180°C	Suction pressure	1 bar	Compressor Speed	1200 rpm	Suction temp.	20°C	Shaft power	6.25 kW	Discharge pressure	6 bar	Mass of air delivered (kg/min)	1.7	10	4	III, VI	1
Bore and stroke (cm)	14 x 10	Discharge temp.	180°C																		
Suction pressure	1 bar	Compressor Speed	1200 rpm																		
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END SEMESTER /RE-EXAMINATION, TERM-II, A.Y. 2025-26

2.	a) Explain with reasons: The effect of i) temperature of air at the inlet to compressor and ii) Temperature of products of combustion at inlet to the gas turbine at various pressure ratio on thermal efficiency of a gas turbine plant. Draw: Neat performance curves.	06	2, 3	II, III, VI	6	1.4.1
	b) Explain: i) Thermal efficiency ii) Specific fuel consumption and iii) Mechanical efficiency for an I.C. Engine. Compare: S.I. and C.I. Engines with respect to at least 04 criterion.	07	1	II, IV	3,4	1.4.1
	c) For a single stage reciprocating air compressor, Explain: i) Clearance ratio ii) Volumetric efficiency and Derive: The expression for volumetric efficiency. Draw: Neat p-V diagram.	07	1	II	1	1.4.1
3.	a) Explain: Phenomenon of knocking in S.I. Engines as regards to its reasons, effects, and control. Draw: Neat sketches and p-t diagram.	10	2	II, III	3	1.4.1.
	b) In a Morse test of a four cylinder, four stroke petrol engine having a bore of 75 mm and a stroke of 100 mm, following results were obtained with a fixed setting of fuel supply of 6 kg/h: B.P. with all four cylinders working: 15.6 kW B.P. with cylinder no. 1 cut off: 11.1 kW B.P. with cylinder no. 2 cut off: 11.03 kW B.P. with cylinder no. 3 cut off: 10.88 kW B.P. with cylinder no. 4 cut off: 10.66 kW If the calorific value of the fuel is 83600 kJ/kg and clearance volume is 0.0001m ³ , Evaluate: i) Mechanical efficiency ii) Indicated thermal efficiency and iii) Air standard efficiency of the engine.	10	4	VI	3	1.4.1
4.	a) Explain: Phenomenon of combustion in a C.I. engines with stages involved. Draw: Neat p- θ diagram.	08	2, 3	II, III, IV	4	1.4.1
	b) In a trial on a single cylinder diesel engine with compression ratio of 15, following observations were obtained:	12	4	V, VI	4	1.4.1



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END SEMESTER / RE-EXAMINATION, TERM-II, A.Y. 2025-26

	<table><tr><td>Fuel Consumption</td><td>10.2 kg/h</td><td>Cooling water flow</td><td>15.5 kg/min</td></tr><tr><td>Calorific value</td><td>43890 kJ/ kg</td><td>Temp. rise of cooling water</td><td>36°C</td></tr><tr><td>Air consumption</td><td>3.8 kg/min</td><td>Exhaust gas temp.</td><td>410°C</td></tr><tr><td>Speed</td><td>1900 rpm</td><td>Room temperature</td><td>20°C</td></tr><tr><td>Torque on brake drum</td><td>186 m.N</td><td>c_p of exhaust gases (kJ/kg.K)</td><td>1.17</td></tr></table>	Fuel Consumption	10.2 kg/h	Cooling water flow	15.5 kg/min	Calorific value	43890 kJ/ kg	Temp. rise of cooling water	36°C	Air consumption	3.8 kg/min	Exhaust gas temp.	410°C	Speed	1900 rpm	Room temperature	20°C	Torque on brake drum	186 m.N	c_p of exhaust gases (kJ/kg.K)	1.17					
Fuel Consumption	10.2 kg/h	Cooling water flow	15.5 kg/min																							
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Speed	1900 rpm	Room temperature	20°C																							
Torque on brake drum	186 m.N	c_p of exhaust gases (kJ/kg.K)	1.17																							
	Evaluate: i) Brake power ii) Brake specific fuel consumption iii) Brake thermal efficiency of the engine. Prepare: Heat balance sheet for the engine in kJ/min and percentage.																									
5.	a) Discuss: Classification of steam generators on the basis of at least 05 criterion of classification. State: At least one example of each type. Differentiate: between fire tube and water tube boilers with respect to at least 05 points.	10	1	IV	5	1.4.1																				
	b) Discuss: At least 03 advantages of high pressure boilers. Explain: Working of LaMont boiler. Draw: Neat system diagram.	10	2	II, III	5	1.4.1																				
6.	a) State: Methods of improving efficiency of a simple gas turbine plant. Explain: Method for regeneration for open cycle gas turbine plant. Draw: Neat system diagram and T-s diagram.	08	2	I, II, III	6	1.4.1																				
	b) The pressure ratio of an open cycle gas turbine power plant is 5.6. Air is taken at 30°C and 1 bar. The compression is carried out in two stages with perfect intercooling in between the two stages. The maximum temperature of the cycle is limited to 700°C. Assuming the isentropic efficiency of each compressor stage as 85% and that of the turbine as 90%, Evaluate: i) the power developed and ii) efficiency of the power plant, if the air-fuel ratio is 1.2 kg/s. The mass fuel may be neglected. c_p of air = 1.02 kJ /kg.K and $\gamma = 1.41$. Draw: Neat T-s diagram.	12	4	III, VI	1,6	1.4.1																				



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7.	a) Describe: Constructional features and at least 04 main parts of a centrifugal pump. Draw: Neat sketch.	10	1	II, III	2	1.4.1
	b) Describe: Constructional features and at least 04 main parts of a Pelton turbine. Draw: Neat sketch.	10	1	II, III	7	1.4.1



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Third Year

End Semester Examination May-2026

RE -

July

15/07/26

Program: B. Tech Mechanical

Duration: 3 Hours

Course Code: PC-BTM601

Maximum Points: 100

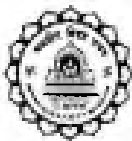
Course Name: Refrigeration and Air-Conditioning.

Semester: VI

Instructions:

- 1) Question number ONE is compulsory and solve any FOUR questions out of remaining SIX
- 2) Use of refrigerant properties table and psychrometric chart is permitted.
- 3) Use of steam table is permitted.
- 4) Assume suitable data, mention it and justify the same.

Q.No.	Questions	Points	CO	BL	Module Number
1(a)	Draw a neat sketch of schematic diagram and T-s diagram of vapour compression refrigeration cycle.	2+2	1	1	1
1(b)	Draw a neat schematic diagram and T-s diagram for regenerative system air refrigeration cycle. Explain the working of it in detail.	2+2+2	1	1	1
1(c)	Explain the mechanism of depletion of ozone layer by writing reaction of ozone depletion. Write about substitutes for CFC refrigerants.	3+3	3	1	2
1(d)	Explain the following terms in short with respect to the air distribution system. (i) Blow or Throw (ii) Drop (iii) Entrainment Ratio (iv) Spread	4	3	1	6
2(a)	Explain the designation system of refrigerants in detail for all the types of refrigerants.	10	3	2	2
2(b)	Solve the followings: (i) A R134a machine operates at -15°C evaporator and 35°C condenser temperature. Assuming a simple-saturation cycle, estimate COP and HP/TR of the cycle. (ii) If a liquid vapour regenerative heat exchanger is installed in the system, with the suction vapour leaving at 20°C , what will be the effect on COP and HP/TR?	4+6	1	3	1
3(a)	Describe the desirable properties of an ideal refrigerants.	10	3	1	2



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~~End Semester Examination May 2026~~

RE -



3(b)	Draw neat sketch of the followings for the actual vapour compression refrigeration cycle: (i) T-s diagram (ii) p-h diagram. Also explain the exact process and heat and pressure gains or losses happening in the system.	3+3+4	1	1,2	1
4(a)	Draw a neat sketch of the comfort chart and explain it in detail.	10	3	2	6
4(b)	Investigate the effect of humidity on the density of moist air by computing the vapour density for an air water vapour mixture at 26°C and relative humidities of 0, 50 and 100 per cent. Also, for each case compare the values of the degree of saturation to the values of relative humidity.	10	2	3,4	4
5(a)	Discuss mechanism of body heat loss and explain mathematical model of heat exchange between man and environment.	10	3	2	6
5(b)	The DBT and WBT of the air are 35°C and 23°C respectively. Find the followings if total air pressure is 1.00125 bar. Calculate following without using psychrometric chart. (i) Specific humidity (ii) Relative humidity (iii) DPT (iv) density (iv) Enthalpy.	10	3	1	4
6	In an industrial application for winter air conditioning an air washer is used with heated water spray followed by a reheater. The room sensible heat factor may be taken as unity. The design conditions are: Outside: 0°C DBT and dry Inside :22°C DBT and 50% RH Room heat loss: 703 kW The following quantities are known from the summer design. Ventilation air: 1600 cmm Supply air: 2800 cmm Spray water quantity: 500 kg/min The air washer saturation efficiency is 90 percent. The make-up water is available at 20°C. Calculate (i) The supply air condition to space (ii) The entering and leaving air conditions at the spray chamber. (iii) The entering and leaving spray water temperatures. (iv) The heat added to the spray water. (v) The reheat, if necessary. Note: Attach the psychrometric chart with sketch.	20	4	3,4	5
7.	Write short notes on the followings: (i) Three fluid refrigeration system in VARS. (ii) Maximum COP of heat operated refrigeration system. (iii) Duct design methods. (iv) Types of supply air outlets.	20	3	1,2	3,6



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RE-EXAM ~~End Semester~~ **2026 Examinations**

SET A

Program: CME

Course Code: MI BT013

Course Name: Financial Management

Duration: 03 hours

Maximum Points: 100

Semester: VI

Note:

- Question 01 is compulsory
- Attempt any four questions out of remaining 06 questions
- Attempt main question and sub question together
- Draw neat charts wherever required
- Q5 B, 6 and & 7 to be attempted on Excel sheet.

17/07/26

Sr No	Questions	Module	BL	Points
Q 1.A	Discuss in detail the scope and importance of financial management in modern organizations. Explain the major functions of financial management.	01	L2	10
Q.1.B	Explain the concept of sustainability in financial management. Discuss how environmental, social, and governance (ESG) considerations affect investment decisions, capital budgeting, and long-term organizational value creation.	07	L4	10
Q.2.A	Critically analyse the difference between profit maximization and wealth maximization as objectives of financial management.	02	L2	10
Q.2.B	Name three types of capital budgeting and explain in detail the function and scope of capital budgeting.	03	L1	10
Q.3. A	A manufacturing company is planning to invest in a new production unit costing ₹50 lakh. The management expects higher profits in the coming years but is uncertain about market demand. Questions 1. Identify the financial management decisions involved in this case. 08 2. Explain how the concept of time value of money can help evaluate this investment. 08 3. What financial strategy should the company adopt to minimize risk? 04	03	L5	20

Q.3.B	What do you understand by risk and return? Explain its components and the way it is measured with suitable example.	04	L4	10																		
Q.4.B	Explain briefly the concept of Time Value of Money and the genesis behind this concept.	02	L2	10																		
Q.5. A	Identify how financial management contributes to long-term sustainability of organizations. Explain how financial strategies influence business expansion decisions.	04	L5	10																		
Q.5 B	Mr. Rajiv is an entrepreneur with a business in Medical Equipment space. He has received a large order from a US company for which he needs to incur a capex of INR 5 CR. He currently plans to fund the capex through a bank loan which is available at 9% pa for a 5-year loan. Please calculate the EMI and share the principal outstanding at the end of 15 th monthly repayment? (5+5)	03	L5	10																		
Q.6.A.	Nihar is a final year graduating student currently interning at a startup. Out of his monthly stipend he invests INR 5000/- every month. He plans to invest this for the next 12 months and expects a return of 12%pa. What would be his corpus at the end of 2 years?	03	L3	10																		
Q.6.B	Mihir is a Fresh graduate recently placed in at an FMCG Company as a Management Trainee. He intends to work for the next 3 years and save 35,000 pm from his salary for his Master's degree. What is the rate of return at which he'd able to accumulate a corpus of INR 15 Lacs? (10 Marks)	04	L6	10																		
Q.7.A	1. Please calculate the Payback period for the below mentioned projects: (10 Marks) Initial Investment in Project A is 11,00,000/- and Project B 12,50,000/-. <table><tr><th>Year</th><th>Project A Cash Flow</th><th>Project B Cash Flow</th></tr><tr><td>1</td><td>1,00,000/-</td><td>2,25,000/-</td></tr><tr><td>2</td><td>2,50,000/-</td><td>1,00,000/-</td></tr><tr><td>3</td><td>1,00,000/-</td><td>2,00,000/-</td></tr><tr><td>4</td><td>4,50,000/-</td><td>3,25,000/-</td></tr><tr><td>5</td><td>5,00,000/-</td><td>4,00,000/-</td></tr></table>	Year	Project A Cash Flow	Project B Cash Flow	1	1,00,000/-	2,25,000/-	2	2,50,000/-	1,00,000/-	3	1,00,000/-	2,00,000/-	4	4,50,000/-	3,25,000/-	5	5,00,000/-	4,00,000/-	04	L6	10
Year	Project A Cash Flow	Project B Cash Flow																				
1	1,00,000/-	2,25,000/-																				
2	2,50,000/-	1,00,000/-																				
3	1,00,000/-	2,00,000/-																				
4	4,50,000/-	3,25,000/-																				
5	5,00,000/-	4,00,000/-																				

	Please calculate the payback period for both the projects.			
Q.7.B	Mrs. Rajni is an entrepreneur with a business in Medical Equipment space. He has received a large order from a US company for which he needs to incur a capex of INR 7 CR. He currently plans to fund the capex through a bank loan which is available at 11% p.a for a 3-year loan. Please calculate the EMI and share the principal outstanding at the end of 9 th monthly repayment? (5 + 5 Marks)	06	L6	10



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~~END SEM~~ **RE-EXAM EXAMINATION** ~~MAY~~ ^{July} ~~JUNE~~ 2026

20/07/26

Program: Mechanical

Third Year B.tech

Duration: 3 Hrs

Course Code: PE BTM 612

Mech. Sem - VI

Maximum Points: 100

Course Name: Composite Material

Semester: VI

Notes: Solve ANY FIVE questions

Assume Suitable Data

Q.No	Questions	Points	CO	BL	Module No.
Q.1 a	Explain composite materials and classify composites based on matrix and structure. Discuss advantages, limitations and applications.	10	1	IV	1
b	Explain reinforcement fibers, whiskers and matrix materials used in PMC with suitable examples.	10	2	IV	2
Q.2 a	Discuss Metal Matrix Composites (MMC) and Ceramic Matrix Composites (CMC) with advantages, disadvantages and applications.	10	2	VI	2
b	Explain different manufacturing processes of composite materials. Discuss Pultrusion and Hand Lay-Up process with neat sketches.	10	3	VI	5
Q.3 a	Explain anisotropy in composite materials and discuss anisotropic elastic constants.	10	3	IV	3
b	Explain transversely isotropic materials and derive five independent elastic constants.	10	4	V	4
Q.4 a	Discuss interlaminar failure mechanisms in laminated composites with suitable examples.	10	4	V	4
b	Explain machining, cutting, polishing and welding of thermoplastic PMC.	10	3	VI	6
Q.5 a	Discuss bonding, riveting and painting operations used in composite post-processing.	10	3	VI	6
b	Explain the manufacturing of reinforcement fibers, fillers and additives used in composite materials.	10	3	V	6
Q.6 a	A Glass/Epoxy lamina is subjected to stresses $\sigma_1 = 500$ MPa, $\sigma_2 = 20$ MPa and $\tau_{12} = 40$ MPa. Using Tsai-Hill failure criterion determine whether the lamina is safe. Assume suitable strength values.	10	4	V	4
b	Explain ASTM standards used for composite materials and discuss material considerations in composite product design	10	4	VII	4
Q.7 a	Discuss repair of composites, embedded sensors and introduction to nanocomposites.	10	4	VI	7
b	Discuss the manufacturing, testing and fabrication of unidirectional carbon epoxy composites	10	4	VI	7



Divyave Vidyapeeth

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20/7/26

RE-
END SEMESTER EXAMINATION MAY/JUNE 2026

Program: Mechanical Engineering

Third Year B.Tech

Duration: 3 hour

Course Code: PE-BTM 613

Sem - VI

Maximum Points: 100

Course Name: Tool Engineering

Semester: VI

INSTRUCTIONS:

1. Attempt any five questions
2. Draw neat schematic diagrams wherever necessary, **highlight** important points of answer.
3. Assume suitable data if necessary and mention it.

Q. No.	Questions	Point	BL	CO	Module
Q1	Difference between Positive (+ve) and negative (-ve) rake angle with figure.	10	1	1	1
A)	Difference between orthogonal and oblique cutting with figure?				
Q1	Draw neat sketch of Merchant circle for cutting force? Obtain expression for Friction force, Normal friction force as a function of cutting and thrust force & Shear force as a function of resultant force?	10	2	1	1
B)					
Q2	Desirable characteristics for efficient lubricant in metal cutting and give primary, secondary functions and process effects of cutting fluid in metal cutting operation.	10	1	2	2
A)					
B)	Write short note on cutting force measurement by elastic strain and 3-Axis milling dynamometer.	10	1	2	2
Q3	Obtain expression for maximum rake angle as a function of rake angle in ORS system and inclination of master line. Draw necessary sketches?	10	2	1	3
A)					
B)	Enlist benefits of the conversion of tool angles? Give tool signatures in orthogonal rake, machine rake and normal rake system? Give its nomenclature?	10	1	2	3



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RE - *July*
~~END SEMESTER EXAMINATION MAY/JUNE~~ 2026

Q4 A)	To maintain product quality how to control process parameters & Give the different strategies by which rolling power requirement can be kept minimum? Discuss in detail & Justify?	10	2	3	4
B)	In tabular form compare hot rolling and cold rolling process? Write a short note on ring rolling process with its advantages and applications?	10	1	3	4
Q5 A)	Give the characteristic features of punched hole and punched slug using neat sketch and for solving problem of punched hole and slug suggest a method, discuss and draw its setup?	10	1	4	5
B)	Write a short note on the following; 1) Burnishing dies 2) Trimming die 3) Shaving die Draw detailed sketch of compound die setup?	10	1	3	5
Q6 A)	Give the difference between impression and closed die forging with neat sketch in the tabular form? Discuss the forging force and its relevant parameters? What is flow stress?	10	1	4	6
B)	Discuss in detail all steps for forging of an "Connecting rod" along with sketch? Discuss important die design features for impression die forging process?	10	2	3	6
Q7 A)	Write short note on the following in respect of sheet metal forming operations; a) Rate sensitivity, b) Elongation, c) Planar anisotropy, d) Yield point elongation?	10	1	3	7
B)	How can forming a limit diagram (FLD) can be formed using a set of specimens? Give significance to each region's FLD and draw labeled test setup?	10	1	4	7



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Previous Semester Examination – JULY 2026 (R18) 2023-24

Third Year B. tech.

14/07/26

Program: BTECH (MECHANICAL ENGG.)

Duration: 3hrs

Course Code: PC-BTM606

Maximum Points: 100

Course Name: CAD/CAM/CIM

Semester: VI

Important Notes:

Sem VI

- Solve any five questions out of seven
- Figures to the right indicates full marks
- Assume suitable data wherever necessary

Q.No.	Questions	Points	CO	BL	PI
Q.1 (a)	A triangle having vertices A(2,3) B(6,3) & C(4,8) is reflected about a line $Y = 3x + 4$. Find the final position of the triangle.	[10]	1	1	3.2.1
(b)	Write a C++ program for DDA algorithm.	[06]	2,4	3	5.2.1
(c)	Explain Cohen Sutherland Algorithm with figure.	[04]	3	3	5.2.1
Q.2 (a)	A triangle is defined by 3 vertices A (0,2,1) B (2,3,0), C (1,2,1). Find the final coordinates after it is rotated by 45 degree around a line joining the points (1,1,1) and (0,0,0)	[10]	2	3	3.2.1
(b)	Construct a Bspline curve for open uniform vectors with $n=3$ and $K=4$ with polygon vertices A(1,1), B(2,3), C(4,3), and D(6,2).	[10]	1	1	3.2.1
Q.3 (a)	What is Adaptive Control (AC)? Explain the sources of variability for AC in machining conditions along with neat sketches? Also explain Adaptive Control Optimization (ACO) & Adaptive Control Constraint (ACC) with neat block diagrams?	[10]	3	3	5.2.1
(b)	Explain CAPP neat block diagrams?	[10]	2,3,4	1	3.2.1
Q.4 (a)	Explain 5 G codes with examples	[05]	4	3	5.2.1



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Previous Semester Examination – JULY 2026 (R18) 2023-24

(b)	• Explain significance of G98 & G99 codes along with neat sketches? • Explain Tool Length Compensation with neat sketch	[05]	1	2	5.2.1
(c)	Explain 5 M codes with example. Write a short note on FMS	[10]	3	3	5.2.1
Q.5 (a)	Explain the method of Feature recognition using Attribute adjacency graph (AAG)	[10]	3	3	5.2.1
(b)	Explain Bresenham's Line Algorithm	[06]	3	3	5.2.1
(c)	Explain the properties of BSpline curves with neat sketches	[04]	3	3	5.2.1
Q.6	Write a C++ program for following 2D transformations using class & object • Translation • Scaling • Rotation • Reflection • Shearing Insert comments wherever necessary.	[20]	2,4	3	5.2.1
Q.7	Write Short Notes on (Any Three) • Graphics Standards • Computer Integrated Manufacturing (CIM) • Augmented Reality • Design for Assembly (DFA) • Structured Query Language (SQL)	[20]	3,4	2	5.2.1 3.2.



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14/5/07/26

PREVIOUS SEMESTER EXAMINATION JULY 2026

Program: B.Tech (Mechanical Engineering) *Third Year* Duration: 3 Hours

Course Code: PC-BTM611 *Sem - VI* Maximum Points: 100

Course Name: Refrigeration and Air-Conditioning (R-18) Semester: VI

Instructions:

- 1) Notes: Question number ONE is compulsory and solve any FOUR questions out of remaining SIX
- 2) Use of refrigerant properties table and psychrometric chart is permitted.
- 3) Use of steam table is permitted.
- 4) Assume suitable data, mention it and justify the same.

Q.No.	Questions	Points	CO	BL	Module No.
Q.1(a)	Draw only neat sketch of schematic diagram and p-h diagram for Vapour Compression Refrigeration (VCR) cycle.	3+2	1	1	1
Q.1(b)	Draw only neat sketch schematic and T-s diagram of Boot-Strap air refrigeration cycle.	3+2	1	1	1
Q.1(c)	Explain in detail the Ozone Depletion Potential (ODP) and Global Warming Potential (GWP) of refrigerants.	4+2	1	1	2
Q.1(d)	Differential between followings: (i) Wet Bulb Temperature and Thermodynamic Wet Bulb Temperature (ii) Temperature and Effective Temperature of air in an air-conditioning.	2+2	1	2	3
Q.2(a)	Draw neat sketch of schematic and T-s diagram of the followings. (i) Regenerative aircraft refrigeration system. (ii) Reduced Ambient System Also write equation for the COP of the system considering ram compression.	4+4+2	1	1,2	1
Q.2(b)	Solve the followings by using refrigerant properties table: (i) A R134a machine operates at -16°C evaporator and 40°C condenser temperature. Assuming a simple-saturation cycle, estimate COP and HP/TR of the cycle.	4+6	1	3	1



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PREVIOUS SEMESTER EXAMINATION JULY 2026

	(ii) If a liquid vapour regenerative heat exchanger is installed in the system, with the suction vapour leaving at 15°C, what will be the effect on COP and HP/TR?				
Q.3(a)	Explain the desirable properties of the ideal refrigerants.	10	2	1,2	2
Q.3(b)	Draw p-h and T-s diagram for actual vapour compression cycle showing heat gains and pressure losses happening in each component and pipes. Write about heat gains, heat losses, pressure gains and pressure losses etc. between various states of the refrigerants.	4+4+2	1	1	1
Q.4(a)	Draw a neat sketch of the comfort chart and explain it in detail.	10	3	2	6
Q.4(b)	The DBT and WBT of the air are 35°C and 23°C respectively. Find the followings if total air pressure is 1.00125 bar. Calculate following without using psychrometric chart. (i) Specific humidity (ii) Relative humidity (iii) DPT (iv) density (iv) Enthalpy.	10	3	1	3
5	A building has the following calculated cooling loads: Room sensible heat gain = 310 kW Room latent heat gain = 100 kW The space is maintained at DBT of 25°C and relative humidity of 50%. The outdoor air is at 38°C and 50% R.H. And 10 % by mass of air supplied to the building is outdoor air. If the air supplied to the space is not at temperature lower than 18°C. Find (i) Minimum amount of air supplied to space in m ³ /s. (ii) Volume flow rates of return air and outdoor air (iii) State and volume flow rate of air entering the cooling coil. (iv) Capacity, ADP, BPF and SHF of the cooling coil.	20	4	3,4	4
6(a)	Draw neat sketch of three fluid refrigeration system and explain its working.	10	3	1,2	7
6(b)	Draw neat sketch of practical single effect water-lithium bromide absorption chiller and explain its working.	10	3	1,2	7
7(a)	Explain various duct design methods in detail.	10	3	1,2	5
7(b)	Discuss mechanism of body heat loss and explain mathematical model of heat exchange between man and environment.	10	3	2	6



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PREVIOUS SEMESTER EXAMINATION, JULY 2026 *Old Course*

Program: Third Year B.Tech. Mechanical Engineering

Duration: 03 Hrs

Course Code: PC-BTM612

Sem - VI

Maximum Points: 100

Course Name: Machine Design

Semester: VI

Notes: 1. Solve any FIVE questions.

2. Each question carries equal marks.

3. Assume suitable data wherever necessary and justify the same.

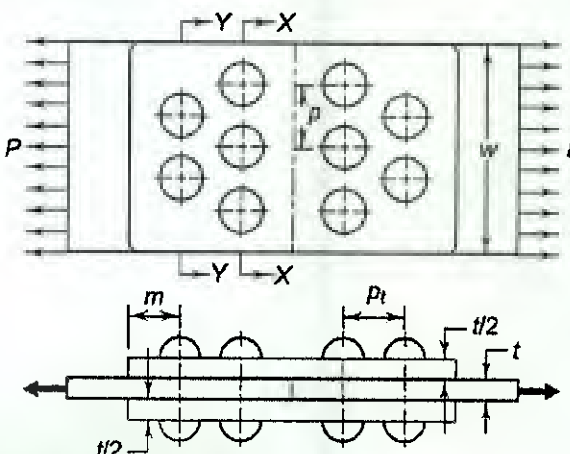
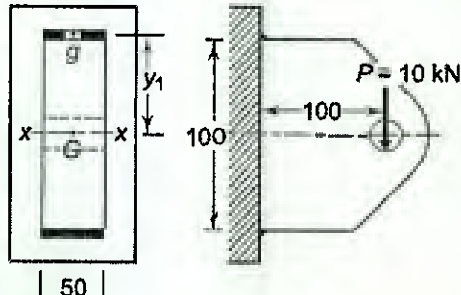
4. Use of **Machine Design Data Book** by V. B. Bhandari is permitted.

16/07/26

Q.No.	Questions	Points	CO	BL	PI
1	a) Describe the machinability and castability properties of engineering materials such as cast iron, mild steel, aluminium alloys, and brass. b) Select appropriate steel grades for sprockets and railway coaches and justify your choice based on their standard designations and applications. c) For a hole-shaft assembly specified as H8/g7 with a nominal diameter of 50 mm, calculate the limits of size for both the hole and the shaft, and classify the resulting fit. d) Define the surface roughness parameters CLA (Centre Line Average) and RMS (Root Mean Square). Explain their significance in surface finish evaluation and mention one engineering application where surface roughness plays a critical role. e) Explain the ergonomic considerations for designing a component, with reference to the design of a car steering wheel.	20	3	2	3.7 .1
2	A cotter joint is to be used for connecting two co-axial rods subjected to a tensile load of 25 kN. Design the cotter joint by determining its principal dimensions, taking the permissible stresses as: tensile stress $\sigma_t = 50 \text{ N/mm}^2$, compressive stress $\sigma_c = 120 \text{ N/mm}^2$, and shear stress $\tau = 40 \text{ N/mm}^2$.	20	1	5	5.4 .1
3	a) Identify a real-life engineering component that undergoes high-cycle fatigue and briefly explain the loading conditions responsible for it. b) Explain the concept of fluctuating stress with a neat stress-time diagram. Cite one practical engineering component (e.g., a rotating shaft or connecting rod) that is subjected to fluctuating stress. c) A solid circular shaft, 15 mm in diameter, is subjected to torsional shear stress, which varies from 0 to 35 N/mm ² and at the same time, is subjected to an axial stress that varies from -15 to +30 N/mm ² . The frequency of variation	05 05	 1	 3	 5.4 .2

	of these stresses is equal to the shaft speed. The shaft is made of steel FeE 400 ($S_{ut} = 540 \text{ N/mm}^2$ and $S_{yt} = 400 \text{ N/mm}^2$) and the corrected endurance limit of the shaft is 200 N/mm^2. Determine the factor of safety.	10			
4	The layout of a shaft carrying two pulleys 1 and 2, and supported on two bearings A and B is shown in Figure. The shaft transmits 7.5 kW power at 360 rpm from the pulley 1 to the pulley 2. The diameters of pulleys 1 and 2 are 250 mm and 500 mm respectively. The masses of pulleys 1 and 2 are 10 kg and 30 kg respectively. The belt tensions act vertically downward and the ratio of belt tensions on the tight side to slack side for each pulley is 2.5:1. The shaft is made of plain carbon steel 40C8 ($S_{yt} = 380 \text{ N/mm}^2$) and the factor of safety is 3. Estimate suitable diameter of shaft. If the permissible angle of twist is 0.5° per metre length, calculate the shaft diameter on the basis of torsional rigidity. Assume $G = 79300 \text{ N/mm}^2$.	20	2	4	5.5 .1
	a) A railway wagon moving at a velocity of 1.5 m/s is brought to rest by a bumper consisting of two helical springs arranged in parallel. The mass of the wagon is 1500 kg. The springs are compressed by 150 mm in bringing the wagon to rest. The spring index can be taken as 6. The springs are made of oil-hardened and tempered steel wire with ultimate tensile strength of 1250 N/mm^2 and modulus of rigidity of $81\,370 \text{ N/mm}^2$. The permissible shear stress for the spring wire can be taken as 50% of the ultimate tensile strength. Design the spring and calculate: (i) wire diameter; (ii) mean coil diameter; (iii) number of active coils; (iv) total number of coils; (v) solid length; (vi) free length; (vii) pitch of the coil; (viii) required spring rate; and (ix) actual spring rate. b) A closed coil helical extension spring needs to be designed, for a spring balance with a capacity of 196.2 N. The spring index is to be taken as 8. Choose a suitable material and take the maximum allowable shear stress as 50 % of the ultimate tensile strength of the material. Give the specifications of the spring and make a simple sketch of the spring.	12			
5		08	2	4	5.4 .2



6	a) Select a belt Munshi Dastur High Speed for power transmission of 11 KW from motor pulley running at 1440 rpm to machine pulley at 480 rpm. Centre distance between the pulleys is 2.4 m. Velocity of the belt can be taken from 14-16 m/s. Service factor as 1.2. Power transmission from high speed belt is 0.0118 KW per mm width per ply at $V = 5$ m/s. Take open belt drive system. b) Explain the procedure for selection of a standard V belt. c) What is polygon effect in chain drive? How this effect is minimized?	12 04 04	2	5	5.4 .1
7	a) Two flat plates subjected to a tensile force P are connected together by means of double-strap butt joint as shown in Figure. The force P is 250 kN and the width of the plate w is 200 mm. The rivets and plates are made of the same steel and the permissible stresses in tension, compression and shear are 70, 100 and 60 N/mm² respectively. Calculate: (i) the diameter of the rivets; (ii) the thickness of the plates; (iii) the dimensions of the seam, viz., p, p_t and m; and (iv) the efficiency of the joint.  b) A bracket is welded to the vertical column by means of two fillet welds as shown in Figure. Determine the size of the welds, if the permissible shear stress in the weld is limited to 70 N/mm². 	10 10	2	4	5.5 .1