Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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

END SEM EXAMINATION JUNE 2024

T.Y.

Program: BTECH MECH **Duration: 3 Hour** 10/6/24

Course Code: PC-BTM605 **Maximum Points:** 100

Course Name: Manufacturing Planning Control **Semester:** VI

- **Instructions:**
- **Solve any 5 questions.**
- **Assume suitable data wherever necessary**

Q.No.	Questions	Points	CO	BL	Module
Q1A	Identify and explain the ways/ approaches to reduce cost per unit product in a manufacturing environment.	10	1,2	5	1
Q1B	A maker of golf shirts is tracking the relationship between sales and advertising dollars. Use linear regression to Forecast the sales might be if the company invested $53,000 in advertising next year.	10	2	5	2
Q2A	Prepare the flowchart of Lean Six sigma approach to improve the quality and reduce wastes as a part of MPC programme.	10	1,2	2,3, 4	1
Q2B	A firm has developed MPS for 5 weeks for the products P and Q. Determine whether the above MPS overloads or underloads the final assembly line of product P and Q. The assembly line has available weekly capacity of 200 hours. Each of product P requires 2 hours and each of product Q requires 3 hours of final assembly capacity. • Compute the actual Final assembly capacity required to produce the MPS for both products. • Compute the weekly load on the assembly line.	10	1,3	5	2

Q1B

	Sales $ (Y) '000 $	Adv.$ (X) 000'
1	130	32
2	151	52
3	150	50
4	158	55
5	???	53
Total	589	189

Q2B

Product	MPS for 5 weeks				
	Quantity to be produced				
	1	2	3	4	5
P	-	60	60	60	-
Q	-	70	-	70	70

END SEM EXAMINATION JUNE 2024

	• Compute Total Load for 5 weeks • Compute total available capacity for 5 weeks • Does the sufficient final assembly capacity exist to produce the MPS? • Whether the capacity and load on assembly per week are balanced ? • What changes to MPS would you recommend?				
Q3A	Explain the Material Requirement Planning steps. State the Problems with MRP..Draw and explain overall view of the inputs to a standard MRP program and reports generated by the Program.	10	1,2	1,2, 3,4	3
Q3B	A materials manager Mr. A adopts the policy to place an order for a minimum quantity of 500 of a components to avail the discount of 10 % . It was found from the company records that for last year 8 orders were placed each of size 200. Ordering cost is Rs.500 per order . Inventory carrying charges are 40 % of unit price. Cost per unit is Rs.400. Is the material manager Mr. A justified in his decision? What is the effect of his decision on company?	10	4	5	3
Q4A	What do you mean by JIT. State the principles of JIT/ Lean as per Toyota Production System. Compare traditional manufacturing with Lean manufacturing Draw and explain Lean Implementation Quickstart approach.	10	1,2	1,2, 3,4	1, 4
Q4B	A machine operator has to perform operations on 6 jobs using three machines A,B,C. The time required to perform these operations in minutes for each job are given in table. Find the optimal sequence of these jobs and total duration for the machining. Also find idle time for each machine	10	2,3	5	5
Q5A	Draw and explain the Graphs showing inventory cost curves and EOQ. Draw the Basic Inventory Model and State the assumptions. Derive expressions for EOQ and Minimum Total Cost of Inventory.	10	1,4	1,2,3	1,3
Q5B	Refer the following project data. Draw the project Network. Find earliest occurrence time E and latest occurrence time L for each event. Find the critical path and the Duration of project. Find	10	2	5	5

JOB	Time for A [in Min]	Time for B [in Min]	Time for C [in Min]
1	3	8	13
2	12	6	14
3	5	4	9
4	2	6	12
5	9	3	8
6	11	1	13

END SEM EXAMINATION JUNE 2024

Earliest start time, Earliest finish time , Latest Start Time and Latest finish time for each activity

Activity	Duration
1-2	6
1-3	9
2-4	7
2-5	5
2-6	5
3-7	6
3-8	4
4-9	2
5-9	4
6-10	6
7-10	5
8-11	10
9-12	3
10-12	5
11-13	2
12-13	8

Q6A 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 annual sales volume. The product has a life of only one year. The management has the data on three factors as given in 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.

Selling Price	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 | 2,3 | 5 | 5

Q6B A firm produces three different products P1, P2 and P3. Each product needs to be processed through two departments, A and B. Department A has three machine A_1 , A_2 and A_3 while B has two Machine B_1, B_2. Product 1 can be manufactured on any type

10 | 2 | 5 | 6

END SEM EXAMINATION JUNE 2024

	of A and B machines. Product 2 can be manufactured on A machine and Only on B_2 of B type machines. Product 3 can be manufactured on machines A_2 of type A and B_2 of type B. Time taken to manufactured one unit of each of product on each type of machine is given below. Formulate the L.P. model to maximize the profit.				

Machine	Product			Time Available per Week (Minute)	Cost/week at full capacity (Rs.)
	P1	P2	P3		
A_1	4	6	-	4500	260
A_2	5	9	10	9500	510
A_3	7	8	-	7500	410
B_1	8	-	-	3500	210
B_2	3	8	7	5100	290
Material					
Cost (Rs.)	0.35	0.45	0.55		
Sale Price (Rs.)	1.60	1.70	2.20		

Q7A	State the definition of Simulation. State the benefits of the simulation. State the limitations of simulation. State the areas of application of simulation. State the software to be used for simulation. State the situations when simulation is not appropriate. Draw the simulation process chart Explain it in detail.	10	1,2	1,2	7
Q7B	*Six jobs are to be assigned to Six machines. The cost of processing of each job on each machine is given in the following table. Prepare the optimal assignment and find the cost of optimal assignment.*	10	2	5	5

Machines → Jobs ↓	*A*	*B*	*C*	*D*	*E*	*F*
J1	*17*	*14*	*19*	*21*	*16*	*19*
J2	*22*	*13*	*14*	*16*	*18*	*20*
J3	*13*	*23*	*18*	*19*	*16*	*17*
J4	*17*	*19*	*21*	*23*	*18*	*22*
J5	*22*	*15*	*19*	*18*	*20*	*16*
J6	*18*	*16*	*21*	*19*	*21*	*19*

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Munshi Nagar, Andheri (W) Mumbai – 400058

End Semester Examination – JUNE 2024 Examinations

T.Y. B. Tech 12/6/24

Program: BTECH (MECHANICAL ENGG.) **Duration:** 3hrs

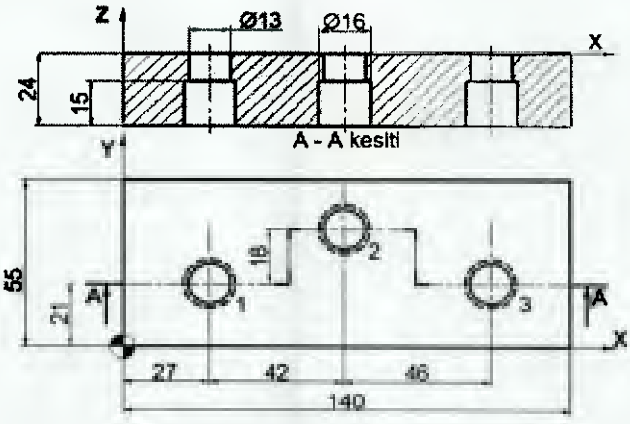
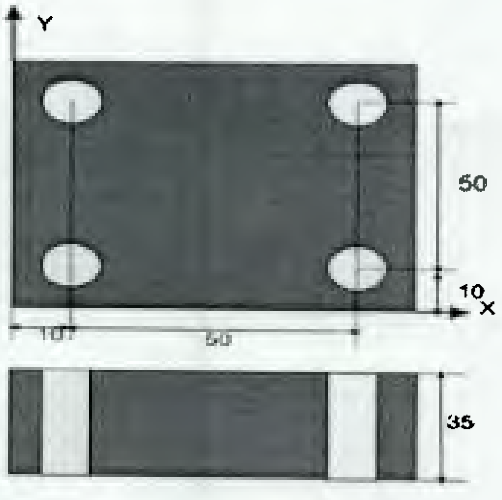
Course Code: PC-BTM606 **Maximum Points:** 100

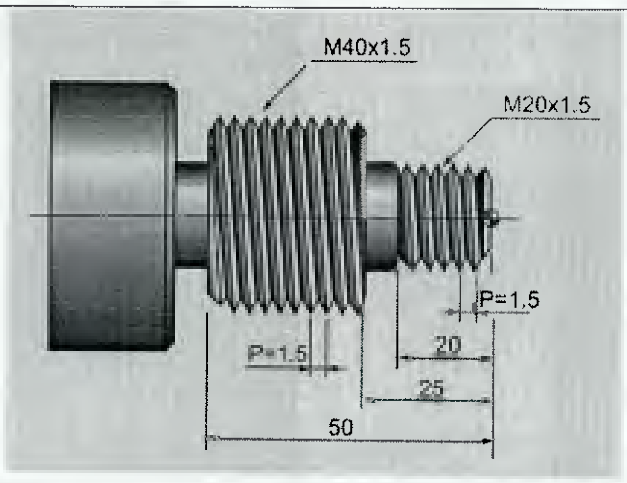
Course Name: CAD/CAM/CIM **Semester:** VI

Important Notes:

- 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 Rectangle ABCD is represented by the vertices A(20,20) B(106.603), C(81.603, 113.301), D(-5, 63.01). The Rectangle is rotated 30 degree about the vertex A. Determine the new Vertex positions A', B', C', D'. The transformed rectangle is then to be mirrored about a line joining the diagonal vertices A' and C'. Determine the new vertices of the rectangle.	[10]	1	1	3.2.1
(b)	Explain concurrent engineering with neat figure?	[04]	2,4	3	5.2.1
(c)	Explain Cohen Sutherland Algorithm with figure.	[06]	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 (2,2,2) and (1,1,1)	[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 Generative CAPP & CAQC with neat sketches?	[10]	2,3,4	1	3.2.1
Q.4 (a)	 **Fig.a** What is difference between G86 & G87 canned cycle? Write down the format of G87 cycle and explain it? Formulate a CNC program for the given fig.a using G87 Canned Cycle	[05]	4	3	5.2.1
(b)	 fig.d • What is G83 cycle used for? Write & explain the G83 cycle format? Formulate a CNC program for the given fig.d using G83 Canned Cycle	[05]	1	2	5.2.1
(c)		[10]	3	3	5.2.1

	 **Fig.C** What are canned cycles? Write down the format of G76 cycle and explain it? Formulate a CNC program for the given (M40 & M20) fig. C using G76 cycle. Mention all the calculations required in this cycle				
Q.5 (a)	Explain the complete procedure for Design for Assembly (DFA) step by step along with neat figures?	[10]	3	3	5.2.1
(b)	Write a C++ program for Bresenhams Circle Algorithm	[04]	3	3	5.2.1
(c)	Explain the following properties of Bezier curve with neat sketches • Partition of unity • Variation Diminishing Property • Invariant under Affine Transformations • C^0 & C^1 Continuity • Convex Hull	[06]	3	3	5.2.1
Q.6	Write a C++ program for line with 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 • Virtual Manufacturing • Structured Query Language (SQL)	[20]	3,4	2	5.2.1, 3.2.1

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End Semester Examination June-2024

T.Y.

14/6/24

Program: B. Tech Mechanical | **Duration: 3 Hours**

Course Code: PC-BTM611 | **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)	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)	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+1+3	3	1,2	6
1(d)	Moist air enters a chamber at 5°C DBT and 2.5°C thermodynamic WBT at a rate of 90 cmm. The barometric pressure is 1.01325 bar while passing through the chamber, the air absorbs sensible heat at the rate of 40.7 kW and picks up 40 kg/h of saturated steam at 110°C. Determine the dry and wet bulb temperatures of the leaving air.	2+1+2	4	2,3	4
2(a)	Draw neat sketch of schematic and T-s diagram for boot strap air refrigeration system. Also write the equation for COP by adding work of ram compression.	3+3+2	1	1	1
2(b)	A. R-22 condensing unit is specified to give 40 TR capacity for air-conditioning under standard operating conditions of 40°C condensing and 5°C evaporating temperatures. Estimate (i) refrigeration capacity in kW (ii) refrigeration effect in kJ/kg (iii) mass flow rate of refrigerant (iv) piston displacement in m^3/s (v) work input to compressor in kW (vi) heat rejected in the condenser	6+6	2	2,3	1

	in kW. If same system is modified for food freezing application with the evaporator temperature of -35°C, estimate (i) mass flow rate of refrigerant in kg/s (ii) refrigeration effect kJ/kg (iii) refrigeration capacity in kW (iv) refrigeration capacity in tons of refrigeration. (v) work input to compressor in kW (vi) heat rejected in the condenser in kW. (Use of p-h chart for R-22 is permitted).				
3(a)	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
3(b)	Explain in detail about various thermodynamic, safe working, physical and other desirable properties of refrigerants used in different refrigeration and air-conditioning plants.	10	3	1	2
4(a)	Explain the complete designation system of all the types of refrigerants.	10	3	1	2
4(b)	The DBT and WBT of the sample of air 35°C and 23°C respectively and the barometer reads 1.00125 bar. Calculate following without using psychrometric chart. (i) Specific humidity (ii) Relative humidity (iii) DPT (iv) Density (iv) Enthalpy of atmospheric air.	10	4	2,3	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. (Attach the psychrometric chart with sketch).	20	4	3,4	4
6(a)	Draw neat sketch of three fluid refrigeration system and explain its working.	5+5	1	1	7
6(b)	Explain ASHRAE's thermal sensation scale about human comfort. Also draw neat sketch of comfort chart.	5+5	3	1	6
7(a)	Explain mechanism of body heat loss and mathematical model of heat exchange between man and the environment.	5+5	3	1,2	6
7(b)	Explain various methods of duct design for air distribution in centralize air conditioning plant.	1+3+3+3	3	1	5

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SARDAR PATEL COLLEGE OF ENGINEERING, MUMBAI

DEPARTMENT OF MECHANICAL ENGINEERING

END-SEMESTER EXAMINATION, JUNE 2024

PROGRAM: Third Year B.Tech. (C/M/E), Semester-VI
COURSE: OE-BTM611- Computational Methods

19/6/24

Total Points: 100
Duration: 3 HOURS

Note:

- Answer any 5 question out of 7 questions. Each question carries 20 points,
- Answer should be very specific and to the point,
- Make suitable assumptions if needed,
- Answer of all sub-questions must be grouped together in answer book.
- Data in the last column represents course outcome and Blooms Taxonomy of respective question.

Q1. What is the difference between interpolation and regression? Name any three numerical techniques. **20** CO/BL: 1,3/1,3,4

Construct Newton's divided difference polynomial of second order using following data. Also comment on nature of possible polynomial based on difference table.

x	1	0.2	0.4	0.6	0.8	1	1.2
f(x)	0	0.0016	0.0256	0.1296	0.4096	1	2.0736

Q2. With some real life examples, differentiate between IVP and BVP. Name single step and multi-step method (2 methods for each). **20** 2,3/1,4

Solve the first order ordinary differential equation $\frac{dy}{dt} = y - 3t^2$ subject to initial condition $y(0) = 1$. Use RK4 with a step size of $h = 0.1$ and obtain the solution till $t = 0.5$ in tabular for with details of steps of calculation.
Discuss the error by comparing the numerical solution with the exact solution given by $y_{exact} = 3t^2 + 6t + 6 - 5e^t$

Q3. What are the different numerical methods to solve differential equations? Use an appropriate method to develop approximate solution for the following problem. **20** 2/3,4

$$\frac{d^2y}{dx^2} - 2y = 8x(9-x), \qquad y(0) = 0 \text{ and } y(9) = 0$$

Take a step size as 3 and show the data in tabular form with calculation steps.

Q4. What is least square regression analysis? Explain. **20** 1,2/1,3
Following table shows the thermal expansion coefficient with the temperature.

Temp °C	30	60	100	150	200	300	400
α(mm)/°C	2	3	4	5	6	7	8

Regress the data to a **second order polynomial**.

Q5. Solve the following system of equations correct to two decimal places. **20** 1,2,3/3,4

$$2.412x_1 + 9.879x_2 + 1.564x_3 = 4.89$$
$$1.876x_1 + 2.985x_2 + 11.62x_3 = -0.972$$
$$12.214x_1 + 2.367x_2 + 3.672x_3 = 7.814$$

Use following methods to formulate and compare the result,

a. Gauss–Jacobi method

b. Gauss–Seidel method

Show result in tabular form for **minimum six iterations.**

Q6. How Taylor series helps to find numerical derivatives. State different schemes with sufficient representation of first order and second order derivative term. Also mention their order of accuracy. **20** 1,2,3 /1,2,3

The velocity of particle which starts from the rest is given below

T (sec)	0	2	4	6	8	10	12	14	16	18	20
V (m/s)	0	16	29	40	46	51	32	18	8	3	0

Q7. State limitations of Newton Raphson method. **20** 1,2/3,4

Solve for one of the roots of the following equation by the Newton Raphson method and compare the result with secant method.

$$x^3 - 6x^2 + 8x + 0.8 = 0$$

Analyse the rate of convergence.

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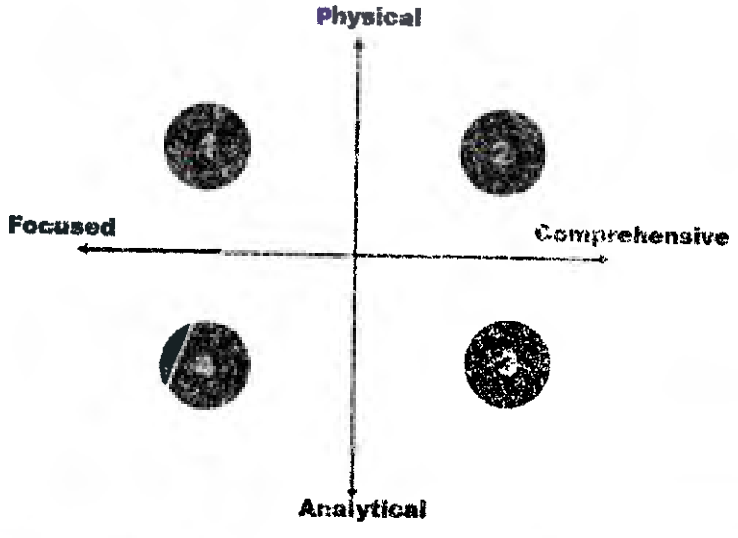
Endsemester Examination June 2024

Programme: **Third Year B.Tech. in Mechanical/Civil/Electrical Engineering**
Course Name & Code: **Open Elective - Entrepreneurship Development and Start Up (OE-BTM613)**

Semester: **VI**
19/6/24
Session: **Afternoon**
Time: **3 Hrs.**

Note:
1. Question 1 is Compulsory.
2. Attempt **any 4** out of the **remaining 6** questions.

Q. No.	Question	Points	CO/ MO	B.T. Level
1	Attempt **any four:**			
a.	What are the functions of Entrepreneur as per Austrian Political Economist Joseph Schumpeter?	05	01/01	01
b.	Create atleast two Matrix Template for idea generation with Brain Storming or Brain Writing techniques.	05	02/02	06
c.	Distinguish between Primary and Secondary sources of Market research.	05	02/03	02
d.	Give the Classification of Intellectual Property.	05	04/05	04
e.	What are the Contents of the Techno-Economic Feasibility Report?	05	04/06	01
f.	Give the Classification of MSME?	05	04/07	04
2 a.	List the Barriers to Entrepreneurship?	05	01/01	01
2 b.	The Office tiffin design is to be revamped. Current design is given below. Generate atleast 5 ideas with SCAMPER.	05	02/02	06
2 c.	Evaluate the ideas using Evaluation Matrix Technique and Rate top 3 ideas from above generated ideas.	10	02/02	05
3 a.	Explain Observational Market Research Method. State its advantages and disadvantages.	10	02/03	02
3 b.	You wish to redesign the Office Chair and make it a smart tech chair. Generate atleast 10 ideas and create Sketch Prototype of it.	10	03/04	06
	**********End of Page 1**********			

4 a.	What is Prototyping and Why is it Needed?	10	03/04	01
4 b.	What is WIPO? Write in short about the Patent System in India.	05 05	04/05	02
5 a.	Given below is the list of prototyping models of an Electric Car. Place them in their respective quadrant as per its classification of prototyping. 3D CAD model of Car, Battery Heat Dissipation Test Model, Beta Prototype for field testing, Color rendering in graphics, Hydraulic test.  	05	03/04	05
5 b.	List atleast 3 types of Leadership Styles.	05	01/01	01
5 c.	What are Different Technical Considerations for a Techno – Economic Feasibility Report?	10	04/06	01
6 a.	What is PCT? What are its Advantages?	05	04/05	02
6 b.	Give the flow chart for a PCT Application process.	05	04/05	01
6 c.	Describe the role of commercial banks in providing institutional finances to the SSIs?	10	04/07	02
7 a.	Describe the Clarence Danhof Classification of Entrepreneurs.	10	01/01	04
7 b.	What is National Small Industries Corporation Ltd. and its Functions?	10	04/07	02

**********End**********

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Munshi Nagar, Andheri (W) Mumbai – 400058

END SEMESTER EXAMINATION JUNE 2024 21/6/24

Program: Third Year B.Tech. Mechanical Engineering — **Duration:** 03 Hrs

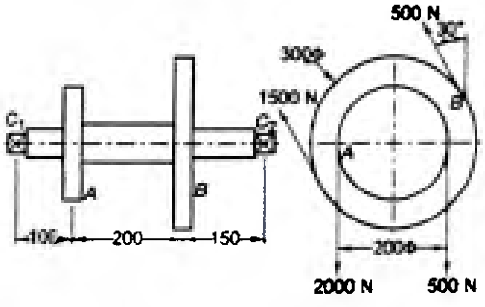
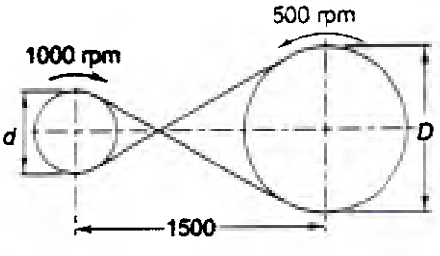
Course Code: PC–BTM612 — **Maximum Points:** 100

Course Name: Machine Design — **Semester:** VI

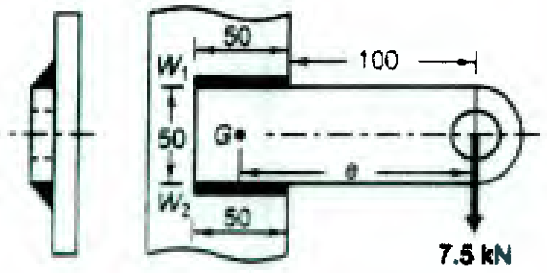
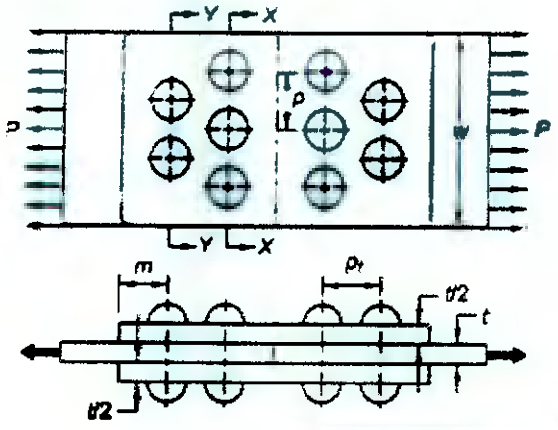
Notes: 1. Solve any **FIVE** questions.
2. Each question carries equal marks.
3. Assume suitable data wherever necessary and justify the same.
4. Use of **Machine Design Data Book** by **V. B. Bhandari** is permitted.

Q.No.	Questions	Points	CO	BL	Module No.
1	a) Explain briefly the selection of materials in the process of machine design. b) List the ergonomic considerations to be taken into account while designing a component c) Sketch the arrangement representing Clearance, Transition and Interference fit in Hole Basis System d) Give Examples of sustainable casting practices and their benefits.	20	3	1,2	1
2	Design Knuckle joint connect the steering linkage to the wheels in vehicles The axial force P acting on the rods is 39 KN. The rods and the pin are made of plain carbon steel 40C8. Assume suitable data, if necessary and justify the same. Draw neat sketch representing major dimensions.	20	1	3,4	2
3	a) Differentiate between failure due to static load and fatigue failure. b) What is repeated stress? Draw a stress–time curve for repeated stress. c) Explain with neat sketch Gerber curve. d) Discuss endurance limit.	20	1	2	3
4	a) A transmission shaft, supporting two pulleys A and B and mounted between two bearings C_1 and C_2 is shown in Fig. Power is transmitted from the pulley A to B. The shaft is made of plain carbon steel 45C8 (Sut = 600 and Syt = 380 N/mm^2). The pulleys are keyed to the shaft. Determine the shaft diameter using the ASME code if, k_b = 1.5 and k_t = 1.0. Also, determine the shaft diameter on the basis of torsional rigidity, if the permissible angle of twist between the two pulleys is 0.5° and the modulus of rigidity is 79 300 N/mm^2.	15	2	3	4

END SEMESTER EXAMINATION JUNE 2024

					
	b) Differentiate between rigid and Flexible coupling.	05			
5	a) A semi-elliptic spring used for automobile suspension, consists of two extra full-length leaves and eight graduated-length leaves, including the master leaf. The centre-to- centre distance between the two eyes is 1 m. The leaves are made of steel 55Si2Mo90 (Syt = 1500 N/mm^2 and E = 207 000 N/mm^2) and the factor of safety is 2. The maximum spring load is 30 KN. The leaves are pre-stressed so as to equalize stresses in all leaves under maximum load. Determine the dimensions of the cross-section of the leaves and the deflection at the end of the spring. b) What is pulsating shear stress? Why are springs subjected to pulsating shear stress?	16 04	2	1,2	5
6	a) The layout of a crossed leather belt drive is shown in Figure. The belt, 6 mm thick, transmits 7.5 kW and operates at a velocity of 13 m/s approximately The coefficient of friction is 0.3 and the permissible tensile stress for the belt material is 1.75 N/mm^2. The density of leather is 0.95 g/cc. Calculate (i) the diameters of pulleys; (ii) the length and width of the belt and (iii) belt tensions on the tight and loose sides.  b) Derive the expression for pitch length of the belt for Crossed belt drive.	15 05	2	3,4	6

END SEMESTER EXAMINATION JUNE 2024

	a) A welded connection, as shown in Fig. is subjected to an eccentric force of 7.5 KN. Determine the size of welds if the permissible shear stress for the weld is 100 N/mm^2. Assume static conditions. 					
	b) 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/mm^2 respectively. Calculate (i) the diameter of the rivets, (ii) the thickness of the plates, (iii) the dimensions of the seam, viz. p, p_r and m and (iv) the efficiency of the joint. 	10			
7		10	2	3,4	7	

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END SEMSTER EXAMINATION JUNE-2024

T.Y 26/6/24

Program: B.Tech. Mechanical | **Duration: 3 Hour**

Course Code: PCC-BTM 614 | **Maximum Points: 100**

Course Name: Internal Combustion Engines | **Semester: VI**

Notes:

1) **Solve: Any FIVE Questions.**
2) Answers must be **SPECIFIC** and in **legible** handwriting.
3) **Draw neat, labelled system and process diagrams** wherever asked or necessary.
4) **Illustrate your answers with suitable examples** wherever asked or necessary.
5) **Assume suitable data wherever necessary and state the same.**

Q. No.	Question	Points	CO	BL	Module
1.	**a) Explain:** Classification of I.C. Engines. **State:** criterion for classification. **Compare:** i) Four-stroke and two-stroke engines and ii) SI and CI engines. **State:** Criterion used for comparison.	**10**	1	I, II, IV	1
	b) Explain: i) Indicated thermal efficiency ii) brake specific fuel consumption. A six-cylinder, four-stroke petrol engine has a compression ratio of 7, bore of 90 mm and stroke of 100 mm. The relative efficiency based on indicated power is 55 %, the indicated specific fuel consumption of 300 gm/kW.h, indicated mean effective pressure of 8.5 bar and engine speed on 2500 rpm. Evaluate: i) indicated power ii) calorific value of fuel ii) fuel consumption in kg/h.	**10**	1	II, V	1
2.	**a) Explain:** i) Ignition lag and ii) ignition delay. **Differentiate:** Between knocking in SI and CI engine with reasons and remedial measures to avoid the same.	**08**	2	II, IV	2,3
	c) A six-cylinder, four-stroke diesel engine operating on the air standard Diesel cycle has 100 mm bore and 120 mm stroke for each cylinder. The engine speed is 1800 rpm. At the beginning of the compression stroke, the pressure and temperature of the air is 1.03 bar and 35° C. If the clearance volume is 1/8th (one by eight) of the stroke volume, and air is	**12**	2	I, V	1,3

	heated to 1500° C in the process of combustion, **Evaluate:** i) Pressure and temperature at each nodal point of the cycle, ii) compression ratio of the engine, iii) thermal efficiency of the cycle and iv) power output of the engine. Take values of cp and cv for air as 1.004 and 0.717 kJ/kg.K respectively. **Draw:** p-V and T-s diagrams of the cycle.				
3.	**a) State:** Types of diesel injection systems. **Describe:** Working, advantages and limitations of any One of them. **Draw:** Neat schematic diagram of the system.	**8**	2	I, II	3
	b) Explain: Procedure and significance of Morse test. A four-stroke, single acting, four-cylinder petrol engine has each cylinder of 7.5 cm bore and 9 cm stroke. The engine is coupled to a brake drum having torque arm radius of 38 cm. At 3300 rpm, with all cylinders operating, the net brake load is 324 N. When each cylinder is separately cut-off, the average net brake load obtained at the same speed is 245 N. **Evaluate:** i) Indicated power and ii) Indicated mean effective pressure of the engine.	**12**	3	II, V	4
4.	**a) Explain:** Principle involved in measurement of engine brake power. **State:** Various types of dynamometers and Describe: Features and working of any One of them. Draw: Neat schematic diagram of the system.	**08**	2	I, II	4
	b) During the trial of a single cylinder, four-stroke diesel engine, the following test results are obtained. Assume 1 kg of fuel used.	**12**	3	V	4

Parameter	Value	Parmeter	Value
Cylinder diameter	20 cm	Cooling water flow rate	4.5 kg/min
Piston stroke	40 cm	Air used per kg of fuel	30 kg
Imep	6 bar	Rise in cooling water temp.	45° C
Torque	407 m.N	Temp. of exhaust gases	420° C
Speed	250 rpm	Ambient temperature	20° C
Fuel consumption	4 kg/h	Mean specific heat of exhaust gases	1 kJ/kg. K
Calorific value of fuel	43 MJ/kg	Specific heat of water	4.18 kJ/kg. K

END SEMSTER EXAMINATION JUNE-2024

	Evaluate: i) Indicated power, ii) Brake power and Construct: Heat balance Sheet of the engine.				
5.	**a) Describe:** i) Properties of S.I. Engine fuels and ii) Properties of C.I. Engine fuels. **Draw:** Typical distillation curves for gasoline and diesel.	**10**	3	I, II	5
	b) Explain: i) SAE rating of lubricating oils (single and multigrade) and ii) Anti-knock rating (Octane and Cetane Number) of conventional fules for I.C. Engines.	**10**	3	I, II	5,6
6.	**a) State:** Various types of engine lubrication system. **Explain:** Features, working and advantages of **Any ONE** of the wet sump lubrication systems. **Draw:** Neat schematic diagram of the system.	**10**	2	I, II	6
	b) Explain: Necessity of engine cooling. **State:** Various liquid (water) cooling systems for I.C. Engines. **Compare:** Advantages and limitations of air and water-cooling systems. **Draw:** Neat sketches for each system.	**10**	2	I, II, IV	6
7.	**a) State:** Various alternative liquid fuels for I.C. Engines. **Discuss:** Use, properties, advantages and limitations of i) Alcohol and ii) Biodiesel.	**10**	4	I, II	7
	b) State: Various alternative gaseous fuels for I.C. Engines. **Discuss:** Use, properties, advantages and limitations of i) LPG and ii) Hydrogen	**10**	4	I, II	7

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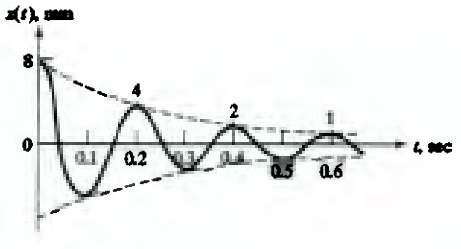
End-Sem Examinations June 2024 28/6/24

Program: T. Y. B Tech (Mechanical Engg.) **Duration:** 3 hr

Course Code: PE-BTM518 **Maximum Points:** 100

Course Name: Mechanical Vibration **Semester:** VI

1. Q. no. 1 is compulsory, solve any four out of remaining.
2. Answers to each sub-questions must be grouped together
3. Use of scientific calculator is allowed
4. Begin answer to each question on new page.
5. Candidates should write the answers legibly

Q.No.	Questions	Pts	Co	BL
1	Answer the following: a) How does a continuous system differ from a discrete system in vibration analysis? Discuss. b) Discuss Dunkerley's Method to evaluate natural frequency. c) Discuss the frequency response curves. d) Discuss the Beats phenomenon when a SDoF is subjected to external forcing frequency.	5x4	1,3, 4	3,4
2	a) Starting with governing equation, discuss the complete solution of single dof free damped vibrating system. b) The free-vibration responses of an electric motor of weight 200 N mounted on the foundation is shown in Fig. Identify the following: (i) the undamped and damped natural frequencies of the electric motor, and (ii) the spring constant and damping constant of the foundation. 	10 10	1,2, 3	2,3
3	a) A machine of mass one ton is acted upon by an external force of 2000 N at a frequency of 720 rpm. To reduce the effect of vibration, isolator of rubber having a static deflection of 2mm under the machine load and an estimated damping ζ =0.15 are used. Determine : a) the force transmitted to the foundation b) the amplitude of vibration of machine c) phase lag.	10		

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3	b) A vehicle of mass 900 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 5.0 cm and wavelength of 3.5 meters. Determine: a) the critical speed of the vehicle b) amplitude of the steady state motion of the mass when the vehicle is driven at critical speed and at speed of 57 kmph, take the damping factor is 0.45 .	10	1,2	2,3
4	a) For the system shown in figure M_1= 1 kg, M_2= 2kg, K_1 =2.5 kN/m , K_2 =3.5 kN/m, K =500 N/m and an initial velocity of 20 m/s is imparted to mass M_1; Calculate the resulting motion of two masses. 	20	2,3	3,4
5	a) A spring-mass system with m = 0.5 kg and k = 10,000 N/m, with negligible damping, is used as a vibration pickup. When mounted on a structure vibrating with amplitude of 4 mm, the total displacement of the mass of the pickup is observed to be 12 mm. Find the frequency of the vibrating structure. b) Draw flow-diagram of basic vibration measurement scheme. Discuss the function of each block. c) Write short note on Accelerometer.	8 6 6	1,2 3	3,4
6	Write Short note on: a) Vibration Isolation b) Force Transmissibility c) Semi-definite System of vibration d) Logarithmic Decrement in free vibration system.	20	1,2 3	2,3
7	a) The strings of guitar are made of music wire with diameter 0.05 mm, weight density 76.5 kN/m^3, E= 207 GPa. If the length of two of the strings is 60 cm and 65 cm each, determine the fundamental natural frequencies of the strings. The tension in each string is 50 kN. b) Discuss Orthogonality of the mode shapes c) In practice, the measurement of vibration has become necessary, Why? (discuss any five point).	8 6 6	2,3	3,4

Free Undamped SDOF:

- Equation of motion

$$x(t) = A_1 \cos \omega_n t + A_2 \sin \omega_n t$$

$$x(t) = x_0 \cos \omega_n t + \frac{\dot{x_0}}{\omega_n} \sin \omega_n t$$

- Amplitude:

$$A = \sqrt{(A_1^2 + A_2^2)} = \sqrt{x_0^2 + \left(\frac{\dot{x_0}^2}{\omega_n}\right)}$$

- Phase Angle

$$\phi = \tan^{-1}\left(\frac{\dot{x_0}}{x_0 \omega_n}\right)$$

Response of Free SDOF Underdamped Vibration

$$C_1' = x_0, \quad C_2' = \frac{\dot{x}_0 + \zeta \omega_n x_0}{\sqrt{1 - \zeta^2}\omega_n}$$

$$X = X_0 = \sqrt{(C_1')^2 + (C_2')^2} = \frac{\sqrt{x_0^2 \omega_n^2 + \dot{x}_0^2 + 2x_0 \dot{x}_0 \zeta \omega_n}}{\sqrt{1 - \zeta^2}\omega_n}$$

$$\phi_0 = \tan^{-1}\left(\frac{C_1'}{C_2'}\right) = \tan^{-1}\left(\frac{x_0 \omega_n \sqrt{1 - \zeta^2}}{\dot{x}_0 + \zeta \omega_n x_0}\right)$$

2DOF:

- **Equation of motion:**

$$[m]\ddot{\vec{x}}(t) + [c]\dot{\vec{x}}(t) + [k]\vec{x}(t) = \vec{f}(t)$$

- **Frequency or Characteristic Equation:**

$$\det\begin{bmatrix} \{-m_1\omega^2 + (k_1 + k_2)\} & -k_2 \\ -k_2 & \{-m_2\omega^2 + (k_2 + k_3)\} \end{bmatrix} = 0$$

- **MODE SHAPE:**

$$r_1 = \frac{X_2^{(1)}}{X_1^{(1)}} = \frac{-m_1\omega_1^2 + (k_1 + k_2)}{k_2} = \frac{k_2}{-m_2\omega_1^2 + (k_2 + k_3)}$$

$$r_2 = \frac{X_2^{(2)}}{X_1^{(2)}} = \frac{-m_1\omega_2^2 + (k_1 + k_2)}{k_2} = \frac{k_2}{-m_2\omega_2^2 + (k_2 + k_3)}$$

$$\vec{x}^{(1)}(t) = \begin{Bmatrix} X_1^{(1)}(t) \\ X_2^{(1)}(t) \end{Bmatrix} = \begin{Bmatrix} X_1^{(1)} \cos(\omega_1 t + \phi_1) \\ r_1 X_1^{(1)} \cos(\omega_1 t + \phi_1) \end{Bmatrix} = \text{first mode}$$

$$\vec{x}^{(2)}(t) = \begin{Bmatrix} X_1^{(2)}(t) \\ X_2^{(2)}(t) \end{Bmatrix} = \begin{Bmatrix} X_1^{(2)} \cos(\omega_2 t + \phi_2) \\ r_2 X_1^{(2)} \cos(\omega_2 t + \phi_2) \end{Bmatrix} = \text{second mode}$$

Sr. No.	Name	Z	Φ
1	Vibration Pickups/ Accelerometer	$\frac{r^2\gamma}{[(1-r^2)^2 + (2\zeta r)^2]^{1/2}}$	$\tan^{-1}\left(\frac{2\zeta r}{1-r^2}\right)$

Continuous vibration nth mode of vibration	$w_n(x,t) = W_n(x)T_n(t) = \sin\frac{n\pi x}{l}\left[C_n \cos\frac{nc\pi t}{l} + D_n \sin\frac{nc\pi t}{l}\right]$
$C_n = \frac{2}{l}\int_0^l u_0(x) \sin\frac{(2n+1)\pi x}{2l}\,dx$	$D_n = \frac{4}{(2n+1)\pi c}\int_0^l \dot{u}_0(x) \sin\frac{(2n+1)\pi x}{2l}\,dx$

A. Forced Vibrations						
Sr. No.	System Type	Xp/δst	Φ	r for Mmax	Force Transmitted to Base	Mmax
1	Forced Undamped System	$1/(1-r^2)$	-	1	-	∞
2	Forced Damped System	$\frac{1}{\sqrt{(1-r^2)^2+(2\zeta r)^2}}$	$\tan^{-1}\left(\frac{2\zeta r}{1-r^2}\right)$	$\sqrt{1-2\zeta^2}$	-	$\frac{1}{2\zeta\sqrt{1-\zeta^2}}$
3	Damped System under Harmonic Base Motion	$\left[\frac{1+(2\zeta r)^2}{(1-r^2)^2+(2\zeta r)^2}\right]^{1/2}$	$\tan^{-1}\left[\frac{2\zeta r^3}{1+(4\zeta^2-1)r^2}\right]$	$r_m=\frac{1}{2\zeta}\left[\sqrt{1-8\zeta^2}-1\right]^{1/2}$	$\frac{F_T}{kY}=r^2\left[\frac{1+(2\zeta r)^2}{(1-r^2)^2+(2\zeta r)^2}\right]^{1/2}$	
4	Damped System under Rotating Unbalance	$\frac{MX}{me}=\frac{r^2}{\left[(1-r^2)^2+(2\zeta r)^2\right]^{1/2}}$	$\tan^{-1}\left(\frac{2\zeta r}{1-r^2}\right)$	$\frac{1}{\sqrt{1-2\zeta^2}}$	$\lvert F\rvert=m\omega^2\left[\frac{1+4\zeta^2r^2}{(1-r^2)^2+4\zeta^2r^2}\right]^{1/2}$	$\frac{1}{2\zeta\sqrt{1-\zeta^2}}$

1.	2 DOF system under external forces	$[Z(i\omega)]\overline{X}=F_0$
2.	Mechanical Impedance	$Z_{rs}(i\omega)=-\omega^2m_{rs}+i\omega c_{rs}+k_{rs}, \quad r,s=1,2$
3.	Impedance Matrix	$[Z(i\omega)]=\begin{bmatrix}Z_{11}(i\omega) & Z_{12}(i\omega)\\ Z_{12}(i\omega) & Z_{22}(i\omega)\end{bmatrix}$
4.	Solution	$X_1(i\omega)=\frac{Z_{22}(i\omega)F_{10}-Z_{12}(i\omega)F_{20}}{Z_{11}(i\omega)Z_{22}(i\omega)-Z_{12}^2(i\omega)}$ $X_2(i\omega)=\frac{-Z_{12}(i\omega)F_{10}+Z_{11}(i\omega)F_{20}}{Z_{11}(i\omega)Z_{22}(i\omega)-Z_{12}^2(i\omega)}$
5.	Dynamic Vibration Absorber: (two resonant frequencies at which amplitude equals infinity)	$\left.\begin{matrix}\left(\frac{\Omega_1}{\omega_2}\right)^2\\ \left(\frac{\Omega_2}{\omega_2}\right)^2\end{matrix}\right\}=\frac{\left\{\left[1+\left(1+\frac{m_2}{m_1}\right)\left(\frac{\omega_2}{\omega_1}\right)^2\right]\right.}{2\left(\frac{\omega_2}{\omega_1}\right)^2}$

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28/6/24

T.Y. B.Tech

End Sem Examination June 2024

Program: Mechanical Engineering **Duration: 3 Hrs**

Course Code: PE BTM 532 **Maximum Points: 100**

Course Name: Composite Material Technology **Semester: VI**

Notes:

1. Solve any **FIVE** questions
2. Assume suitable data whenever necessary

Q.No.	Questions	Points	CO	BL	Module No.
1 a	Explain the biodegradable and compostable matrix. Also discuss bone and wood as a composite	10	I	3	I
1b	Design and develop unidirectional pultruted rod carbon/epoxy rod for rotor shaft of helicopter, subjected to combined ~~tading~~ loading.	10	I	4	III
2a	Give the classification of composite material. Draw and explain Ashby chart and why composite material is preferred over conventional material.	10	IV	5	II
2 b	What are the different types of fibers and different types of matrix.	10	III	3	II
3 a	Discuss the ceramic matrix composite manufacturing process with application of CMC.	10	IV	4	III
3 b	Explain the manufacturing process of glass fiber	10	IV	5	III
4a	Discuss the engineering constants for orthotropic material	10	IV	3	IV
4b	Develop the elastic constants for anisotropic material	10	IV	4	IV
5a	Obtain the engineering constants for specially orthotropic angle lamina.	10	IV	3	VII
5b	Obtain the engineering constants for generally orthotropic angle lamina	10	IV	4	VII

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6a	Discuss the manufacturing of MMC in detail	10	IV	5	IV
6b	Discuss the composite post processing operation such as machining, cutting, polishing and welding.	10	III	5	IV
7a	Explain the failure analysis of composite laminates	10	II	5	VI
7b	Explain the composite manufacturing processes in detail with neat and suitable diagrams	10	III	5	VI

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END SEMESTER EXAMINATION JUNE 2024

Program: Mechanical Engineering

Course Code: PE BTM537

Course Name: **Tool Engineering**

Duration: 3 Hours

Maximum Points: 100

Semester: 6

Note:

1) Solve any five main questions out of seven main questions

2) Write solution point wise and draw necessary sketch whenever required

Q.No.	Questions	Points	CO	BL	Module No.
Q1A	Write short note on strain gauge type Milling dynamometer using its neat sketch? List down desirable requirements of any cutting force dynamometer?	10	2	1,2	3
Q1B	Determine value of orthogonal rake angle (γ_o) and Inclination angle of a turning tool, whose geometry is specified as per ASA system as, [8° , 15° , 9° , 12° , 12° , 35° , 0.1 (inch)] ? Draw tool geometry in ASA system and ORS system.	10	1	4	2
Q2A	Prove that specific cutting pressure in an ideal orthogonal cutting is $2\tau^*\cot\varphi$, if $2\varphi+\beta-\gamma=\Pi/2$ condition satisfied as per Earnt and Merchant condition?	10	3	2	1
Q2B	Using Master-line principal method, obtain expression for orthogonal rake angle and inclination rake angle as a function of back rake, side rake angles in single point cutting tool geometry.	10	2	3	2
Q3A	Explain cutting fluid selection criteria in detail based on process performance and effect on workpiece/machine tool system?	10	4	1	3
Q3B	Explain continuous chip formation mechanism? Give advantages and disadvantages of built up edge formation on rake face of cutting tool?	10	4	2	1
Q4A	Give working principle and mechanism of hot rolling and cold rolling process with neat sketch of set-up?	10	2	1	4

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END SEMESTER EXAMINATION JUNE 2024

Q4B	Explain following sheet metal shearing operation along with one combined sketch? a)Notching, b) Trimming, c) Nibbling operations	10	3	3	2
Q5A	Explain *Tandem* rolling mill, *Cluster* rolling Mills with the help of neat schematic sketch along with their specific application?	10	1	4	4
Q5B	Write significance of three types of Shear can be provided on punch tool along with their necessary schematic sketch?	10	3	3	5
Q6A	With the help of neat schematic sketch explain in brief *spring back, spring back factor, spring back estimation.* Draw and explain in brief graph of "spring back factor versus fraction of radius of bend to the thickness of blank"?	10	4	2	7
Q6B	Justify difference between uniform and pancaking deformation during flat die forging process? Write short note on coining with neat sketch?	10	1	1,3	2
Q7A	Write short note on following terms i) Dent resistance, ii) Planar anisotropy in a sheet-metal specimen?	10	2	2	7
Q7B	Explain Forgeability of Metals? Draw neat sketch of closed die forging set-up? Explain its three features?	10	3	3	4

Notes:

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END SEMSTER EXAMINATION JUNE-2024

28/6/24

Program: B.Tech. Mechanical Sem VI

Course Code: PEC-BTM583

Course Name: Industrial Management & Enterpreneurship

Duration: 3 Hour

Maximum Points: 100

Semester: VI

Notes:

1) Solve: Any FIVE Questions.
2) Answers must be SPECIFIC and in legible handwriting.
3) Illustrate your answers with suitable examples wherever asked and/or necessary.
4) Use Graph paper for drawing the Break-even chart.

Q. No.	Question	Points	CO	BL	Module
1.	a) **Explain:** significance of multiple products, expanded market and diversification for the growth of an industrial organization. **Illustrate:** with **two** examples of industry in details.	10	1	II, IV	1
	b) **Explain:** i) Functions of management and ii) skills required by a manager to serve these functions. **Draw:** Neat sketch required.	10	1	I, II	1
2.	a) **Define:** Motivation. **Explain:** i) Types of motivation, ii) Various techniques of motivation. **Illustrate:** with one example of motivation techniques/ practices in an industrial organization in details.	10	1	I, II, IV	2
	b) **Describe:** Functions of i) Recruitment and selection ii) Training and development. **Illustrate:** each function with **one** suitable example in industrial scenarion.	10	1	II, IV, VI	2
3.	a) **Distinguish:** Between cost control and cost reduction. **Describe:** i) Cost control techniques and ii) cost reduction program.	8	2	II, IV	3
	b) **Explain:** 5 M's of an Industrial organization. **State:** The most important resource in your opinion and **Justify:** your answer.	6	2	I, II, VI	1,4
	c) **Compare:** Advantages and disadvantages of centralized and decentralized organization. **Illustrate:** one suitable example of one industrial organization for each.	6	2	IV	2

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END SEMSTER EXAMINATION JUNE-2024

4.	**a) Explain:** i) Types of capital, ii) Sources and uses of working capital with suitable examples for each.	**8**	2	II	4
	b) Alfa Industries Ltd. has the following data for its operations. Selling price per unit = Rs. 10/-, Variable cost per unit = Rs. 6/-, Fixed cost = Rs. 80,000 /-. Assume entire units produced are sold. **Construct:** Break-even chart. Evaluate: i) Break-even quantity ii) Break-even sales revenue iii) Angle of incidence and iv) Margin of safety of sales revenue for 30,000 units sold.	**12**	2	V	3,4
5.	**a) Differentiate:** between Entrepreneur and Manager. **Explain:** Qualities of an entrepreneur. **Illustrate:** with the example of any one successful entrepreneur.	**10**	3	II, IV	5
	b) Explain: Need for promotion of Entrepreneurship in India. **Justify:** Economic development of India is directly related to entrepreneurship development in India.	**10**	3	II, VI	5,6
6.	**a) Define:** ERP. **Explain** in detail: i) Process of implementation of ERP system in an organization and ii) Requirements for the same.	**10**	4	I, II	7
	b) Discuss: Concept of E-ERP (ERP-II) and **Illustrate:** with two practical examples. **Differentiate:** between ERP (ERP-I) and E-ERP (ERP-II).	**10**	4	II, IV	7
7.	**Explain: ANY THREE** of the following:				
	a) Scientific Managaement by F.W Taylor and Henry Fayol	**20**	1	II	1
	b) Maslow's hierarchy of needs theory of motivation		1		2
	c) Depreciation: Causes and methods of evaluation		2		3
	d) Financial statements of an organisation		2		4
	e) Authority, responsibilty and delegation of authority		1		2

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W.) Mumbai 100058

End Semester Examinations - June 2024

28/6/24

Program: T.Y.B. Tech. (Mech. Engg.) Sem VI **Duration: 03 Hrs**

Course Code: PE-BTM539 **Maximum Points: 100**

Course Name: Professional Elective-II, Additive Manufacturing **Semester: VI**

Notes:
1. **Question number 1 and 2 are compulsory**
2. **Solve any three questions from question number 3 to 7.**
3. **If necessary assume suitable data with justification**
4. **Draw neat labeled sketches wherever required.**

Q. No.	Questions	Points	CO	BL	M. N.
1	A startup proposed to develop the machine with additive approach to prepare toast sandwich. The raw material viz tomato, beetroot, and cucumber from the farm along with the slice breads from the bakery will be inputs to the machine. Students shall develop the conceptual design plan depicting the (i) slicing, (2) feeding and (3) locating mechanisms for the input materials for the development of the proposed machine. Design shall be (a) modular, (b) scalable and (c) versatile to have scope for customization and finally the customer delight. Design shall be in the form of labeled drawings and sketches.	20	1 to 4	6	1 to 7
2	A five year child likes watching "Mau and Zingtu" the two cartoon characters resembling Cat and Dog. Following picture of Mau and Zingtu as topping for birthday cake is designed by a family on the occasion of child's birthday. (Note: Designed toppings of cartoon are on thick extruded base of the cake).	20	1 to 4	6	1 to 7

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You having an engineering background supplemented with the knowledge of Additive Manufacturing/3D Printing have accepted this customized order and decided to prepare a **general purpose computer aided extrusion integrated with baking unit type 3D cake making machine**. The recipe for making the cake base and toppings is as below:

Followings are the ingredients for the base and toppings of the cake

1. 50 gm white sugar
2. 200 gm unsalted butter
3. 2 large eggs
4. 150 gm vanilla extract
5. 200 gm all-purpose flour
6. 100 gm baking powder
7. 250 ml milk
8. 200 gm Icing Sugar

With above ingredients following steps are to be followed for base of the cake

1. Preheat the oven to 350 degrees F (175 degrees C). Grease and flour a 9-inch square cake pan.
2. Cream sugar and butter together in a mixing bowl.
3. Add eggs, one at a time, beating briefly after each addition.

	4. Mix in vanilla. 5. Combine flour and baking powder at separate station. 6. Add to the wet ingredients and mix well. 7. Add milk and stir until smooth. 8. Pour batter into the prepared cake pan. 9. Bake in the preheated oven until the top springs back when lightly touched, 30 to 40 minutes. 10. Remove from the oven and cool completely. Following is the procedure to prepare icing in the form of cartoon characters Mau and Zingtu: 1. Beat the butter with an electric hand mixer until light and fluffy. 2. Sift in the icing sugar, then work it into the butter, starting slowly at first, then beating more vigorously once all the sugar is combined. 3. Add the milk and the vanilla, then beat until creamy and smooth. 4. Colour the buttercream by adding flavourings such as cocoa/ melted chocolate/lemon/orange zest as required in toppings of the cake. On the basis of above information Provide A. Conceptual drawings of your machine workstations for preparing 1. Base of the cake. 2. Base baking unit 3. Customized Toppings on the cake. B. Mechanism for (i) mixing, (ii) Egg cracking (iii) beating (iv) stirring the ingredients, transfer and ingredient deposition mechanisms C. Computer Aided Processes Involved D. Flow Chart depicting Process Plan for executing the customized order in Machine				
3	Prototype consists of pentagonal pyramid is to be develop using following RP processes (i) Scanning Type Stereolithography (ii) Bulk lithography	20	1, 2,3,4	6	1 to 7

	(iii) Laminated Object Manufacturing (iv) Selective Inhibition Sintering Pentagonal pyramid is to be developed using compatible material for above mentioned processes. State (i) Compatible materials with above processes. (ii) Part orientation in developing part with above processes. (iii) Explain process plan with neat schematic diagram of above processes iv) Support process plan with at least five critical sliced sections of part geometry (Note: Answer shall clearly show slicing place, sliced geometry, hatched section etc.).				
4 (A)	Explain .stl and amf file format and its importance.	10	1	3	2
4 (B)	State process of unconstraint depth photopolymerization with the first principles (using nonlinear Shrodinger equation, diffusion and non-linearity due to change of refractive index)	10	3	3	3,4
5 (A)	Explain shape deposition modeling process. Take suitable part geometry to explain processes involved in shape deposition manufacturing.	10	2	5	5
5 (B)	With neat sketches explain projection microstereolithography (MSL)? Discuss advantages and issues with projection surface MSL.	10	1	1	3,4
6 (A)	With neat sketch explain design of flexural mechanism for XY scanning system	10	3	2	3
6 (B)	With neat sketches explain the constraint surface type of microstereolithography.	10	1	3	4
7(A)	Describe extrusion based RP systems. Discuss Fused deposition modeling (FDM) process with a neat labeled diagram. Discuss various sub-systems of FDM. In one of the FDM system issues in linear scan speeds is observed due to error in software program. On investigation it is observed that X scan speed is optimum, however the Y scan (in the direction of pitch) is twice the optimum speed. Explain consequences in part fabrication. Further in case if Y scan speed would have been optimum and X scan speed being twice the optimum X scan speed, comment in which case part quality would be worst.	10	3	6	5
7(B)	Explain mathematical form of cured depth in ceramic or metal microstereolithograhy along with Mie theory. Explain influence of followings material properties on curing radius and cured depth i) Particle mean size	10	1	4	6

	ii) Particle size distribution iii) Refractive index of powder iv) Refractive index of UV curable solution v) Absorption coefficient of powder (Note: Draw rough graphs with curing radius and cured depth taken on y-axis on common graph depicting influence of materials properties. Material properties shall be on x-axis. Justify each of the characteristics).				