



Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING

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



END SEM/RE-EXAM EXAMINATION MAY / JUNE 2025

Program: M.Tech (Machine Design) *Sem II*

Course Code: OE-MTMD204

Course Name: Waste to Energy

Duration: 3 Hours

Maximum Points: 100

Semester: II

Notes:

1. Attempt any 5 questions out of the given 7.
 2. Each question carries 20 marks (2 sub-questions of 10 marks each).
 3. If you choose to attempt Q.1(a), you must also attempt Q.1(b) — sub-questions must be answered in pairs.
- 14/5/25*

Q.No.	Questions	Points	CO	BL	Module No.
Q1(a)	Define the concept of energy from waste and elaborate on the types of waste suitable for energy recovery.	10	1	1	1
Q1(b)	Compare incinerators and gasifiers in terms of operational principles and application areas.	10	1	4	1
Q2(a)	Explain the process of pyrolysis and differentiate between its slow and fast types.	10	2	2	1
Q2(b)	Discuss the primary uses and benefits of pyrolytic gases and oils.	10	2	2	2
Q3(a)	Describe the construction and working of a fluidized bed gasifier.	10	2	3	3
Q3(b)	Differentiate between thermal and electrical power generation in biomass gasification systems.	10	2	4	3
Q4(a)	Illustrate the operation of a fixed-bed combustor and explain its significance.	10	3	3	4
Q4(b)	Analyze the working of fluidized bed combustors and compare it with inclined grate combustors.	10	3	4	4



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Q5(a)	Calculate the volume of cow dung-based biogas plant required for cooking needs of a family of 5 adults and lighting needs with two 100 CP lamps for 3 hours daily. Also, calculate the required number of cows to feed the plant. Assume standard values where required.	10	4	3	5
Q5(b)	Explain the layout and functioning of a typical biogas plant.	10	4	2	5
Q6(a)	Discuss biochemical biomass conversion and its real-world applications.	10	4	3	6
Q6(b)	Evaluate biomass gasification as a clean energy alternative.	10	4	5	6
Q7(a)	Summarize different types of biogas plants and explain the principle of biodiesel production.	10	4	2	7
Q7(b)	Analyze the benefits of the Biomass Energy Programme in India.	10	4	4	7



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Program: M.Tech (Machine Design) *Sam II*

Duration: 3 Hours

Course Code: PC MTMD201

Maximum Points: 100

Course Name: System Modeling and Synthesis of Mechanisms

Semester: II

Notes:

1. Attempt any 5 questions out of the given 7.
 2. Each question carries 20 marks (2 sub-questions of 10 marks each).
 3. If you choose to attempt Q.1(a), you must also attempt Q.1(b) — sub-questions must be answered in pairs.
- 20/5/25*

Q.No.	Questions	Points	CO	BL	Module No.
Q1(a)	Define a system in mechanical modeling and provide two relevant examples.	10	1	1	1
Q1(b)	Distinguish between input and output variables with real-world examples	10	1	2	1
Q2(a)	Explain the effect of damping in mechanical systems and give its mathematical formulation.	10	4	2	2
Q2(b)	Derive the differential equation for a mass-spring-damper system acted upon by an external force.	10	4	2	2
Q3(a)	What is a kinematic chain? Give a practical example and explain its significance.	10	2	1	3
Q3(b)	Define and compare lower pairs and higher pairs in mechanisms with suitable examples.	10	2	2	3
Q4(a)	Explain the Grashof condition and how it determines the type of motion in a four-bar linkage.	10	2	2	4
Q4(b)	Compare the roles of double points and symmetry in determining the coupler curve.	10	2	2	4



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END SEM/RE-EXAM EXAMINATION MAY / JUNE 2025

Q5(a)	What is an inflection circle? Explain its use in the analysis of planar kinematics.	10	2	2	5
Q5(b)	What is the Euler-Savary equation? Explain its significance in planar mechanism analysis.	10	2	2	5
Q6(a)	A crank-follower four-bar system has a crank rotating at 5 rad/s. Calculate the angular velocity of the follower.	10	3	3	6
Q6(b)	Illustrate the effect of varying link lengths on angular velocity and acceleration in a crank-follower mechanism.	10	3	3	6
Q7(a)	Given three precision points, explain the process of synthesizing a four-bar mechanism using Freudenstein's eqn.	10	2	3	7
Q7(b)	Assume link dimensions and demonstrate how accuracy conditions affect the synthesized linkage.	10	2	3	7



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End Sem EXAMINATION May 2025_VI

Program: MTech M/c Design *sem 5*

Duration: 3 hr

Course Code: PC-MTMD 202

Maximum Points: 100

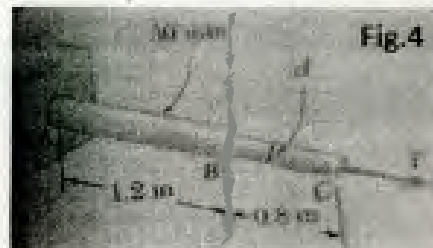
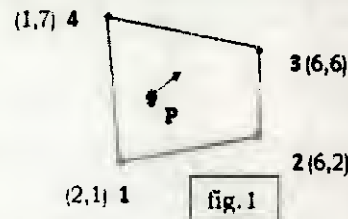
Course Name: Advanced FEM

Semester: II

Notes:

1. Questions no. 1 is compulsory, solve any four out of remaining
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. Write the answers legibly

Q.No.	Questions	Pts	CO	BL
1	a) Discuss the characteristics of the stiffness matrix. b) List the steps involved in finite element analysis. c) What are the types of boundary conditions in FE analysis? d) Derive the stiffness matrix for arbitrary oriented bar element.	5 5 5 5	2	1,2
2	a) Find the Jacobian Matrix for the element shown in fig. 1 b) A taper steel bar of circular c/s varying from 80 mm ² to 50 mm ² having length of 1.2 meter, is subjected to point load 'P' at smaller end. Obtain the stiffness matrix by discretizing bar in to 4 number of elements. (Take E = 210 GPa).	10 10	2	2
3	The element shown in Fig.1, P (3, 4) is the point on which the load of 10kN in the directions of 45 degrees with horizontal is applied. Determine its nodal equivalent forces	20		
4	For the stepped bar shown in fig.4, obtain the nodal displacement and stress in each element using FEA. Take d=20 mm and P=100kN. E= 205 GPa	20		



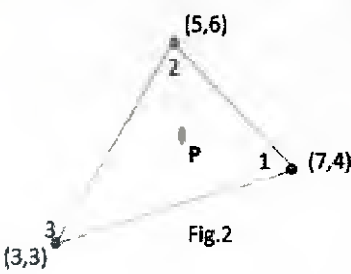
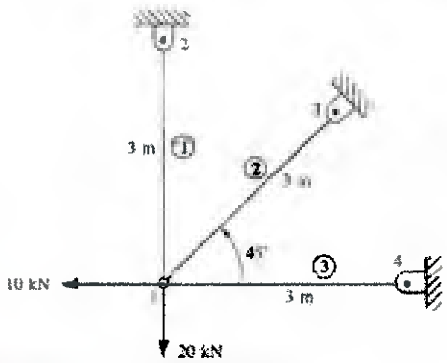


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End Sem EXAMINATION May 2025_V1

5	a) Obtain the shape functions for triangular element (fig.2) b) For the three-noded triangular element shown in fig.2, calculate temperature at point P(6,4). Given the nodal temperatures $T_1 = 70^\circ \text{C}$, $T_2 = 120^\circ \text{C}$, $T_3 = 95^\circ \text{C}$. c) For the three-noded triangular element shown in fig.2, calculate displacement at point P(5,4). Given $u_1=1$, $u_2=2$, $u_3=3$; $v_1=2$, $v_2=3$, $v_3=5$.	 Fig.2	20		
6	For the figure given: a) Write the stiffness matrix for each element. b) Obtain the assembled stiffness matrix. c) Find the vertical and horizontal deformation of node 1. Take $E = 210 \text{ GPa}$, $A = 4 \times 10^{-4} \text{ m}^2$		20		
7	a) What are the advantages and disadvantages of FEM? b) Discuss the gauss quadrature numerical integration . c) Explain Galerkin weighted residual technique.		7 7 6		

**END SEMESTER/RE-EXAMINATION MAY/JUNE 2025 SET 1**Program: M. Tech. *F.Y. M.Tech Sem II*

Duration: 3 Hrs

Course Code: PE-MTMD08

with mic design Maximum Points: 100

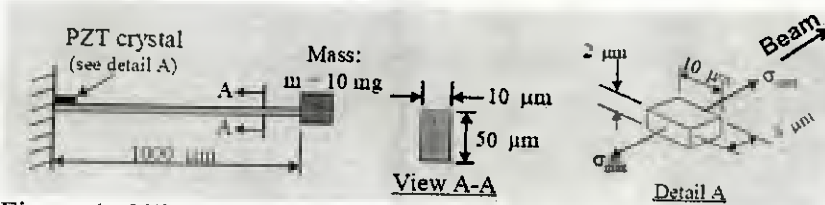
Course Name: Micro Electro Mechanical Systems

Semester: II

Notes:

1. Question Number 1 is compulsory
2. Solve any four questions from Q. 2 to Q. 7
2. If necessary assume suitable data with justification
3. Draw neat labeled sketches wherever required.

26/5/25

Q.No.	Questions	Points	CO	BL	Modu No.
1 (a)	A thin piezoelectric crystal film, PZT is used to transduce the signal in a micro accelerometer involving a cantilever beam made of silicon. The accelerometer is design for maximum acceleration/deceleration of 10 g. The PZT transducer is located at the support of the cantilever beam where the maximum strain exists (near the support) during the bending of the beam as illustrated below in Figure 1. Determine the electrical voltage output from the PZT film at a maximum acceleration/deceleration of 10 g. Take E for silicon beam as 1.9×10^{11} Pa. Piezoelectric coefficient $d = 480 \times 10^{-12}$ m/V  Figure 1: Silicon cantilever beam for micro-accelerator	10	2 to 4	6	4,5
1 (b)	Differentiate between Micro electromechanical Systems (MEMS) and Micro-electronics	10	1	4	1
2 (a)	With neat labelled sketches explain the working of (i) Linear Micro motor (ii) MEMS Biosensor	10	1,2	3	2,3
2 (b)	Explain Reactive Ion Etching (RIE) and Chemical Etching with neat sketches.	10	4	4	4,5
3	Only draw labelled sketches depicting working principle of (i) Scanning Electron Microscope (ii) Electrophoresis systems (iii) Micro pressure sensor (iv) Atomic Force Microscope	20	1 to 4	5	1 to 7



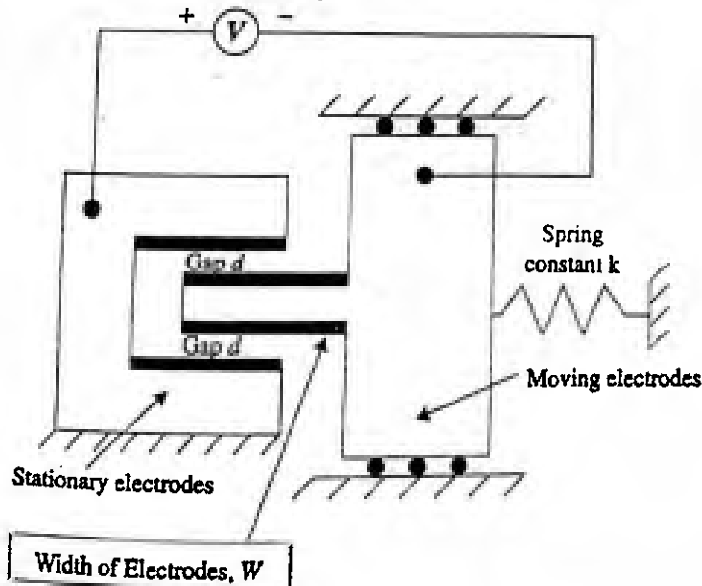
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END SEMESTER/RE-EXAMINATION MAY/JUNE 2025 SET 1

For the comb-driven actuator shown in Figure 2, determine the voltage supply required to pull the moving electrode 10 microns from the unstretched position of the spring. The spring constant k is 0.05 N/m. The comb drive is operated in air. The gap d between the electrodes and the width W of the electrodes are 2 microns and 5 microns respectively. The $\epsilon_r=1.0$ for air as dielectric material and $\epsilon_0=8.85 \text{ Pf/m}$



4(a)	Figure 2 Comb drive actuator	10	3,4	5	4
4 (b)	Explain microstereolithography with neat sketch.	10	1,2	4	4,5
5 (a)	Explain bulk lithography with neat sketch.	10	1,2	4	5,6
5 (b)	Explain Micro accelerometer with neat sketch	10	2, 3	4	3
6	Only draw labelled sketches depicting working principle of (i) Optical Sensor (ii) Chemical Sensor (iii) Micro Valve (iv) Micro Pump	20	1 to 4	5	1 to 7
7 (a)	Explain all 10 steps of lithography with neat labeled sketches	10	3,4	4	5
7 (b)	Explain LIGA with neat labeled sketches	10	2,4	4	6

02/02



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END SEM/RE-EXAM EXAMINATION MAY / JUNE 2025

Program: M.Tech (Machine Design) *Sumit*

Duration: 3 Hours

Course Code: PE-MTMD09

Maximum Points: 100

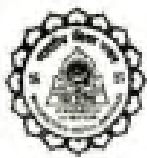
Course Name: Entrepreneurship Development and Management

Semester: II

Notes:

1. Attempt any 5 questions out of the given 7.
2. Each question carries 20 marks (2 sub-questions of 10 marks each).
3. If you choose to attempt Q.1(a), you must also attempt Q.1(b) — sub-questions must be answered in pairs.

Q.No.	Questions	Points	CO	BL	Module No.
Q1(a)	How do ownership structures such as sole proprietorship, partnership, and private limited companies differ within the Indian business landscape?	10	2	2	1
Q1(b)	Critically evaluate how initiatives like Startup India and Atmanirbhar Bharat have reshaped entrepreneurial opportunities in India.	10	2	5	1
Q2(a)	What do you understand by a business plan, and why is it important for entrepreneurs in India?	10	1	1	2
Q2(b)	Assess the effectiveness of various startup financing options available in India, such as venture capital, bank loans, crowdfunding, and government schemes like Mudra Yojana, SIDBI, and the Startup India Fund.	10	3	5	1
Q3(a)	What is entrepreneurship, and what are the essential steps an entrepreneur needs to follow when launching a new business in India?	10	1	1	3
Q3(b)	Evaluate the advantages and disadvantages of starting a new business versus acquiring an existing business in India, considering factors such as costs, risks, and growth potential.	10	4	5	3
Q4(a)	What is women's entrepreneurship, and why is it important for the economic development of India?	10	2	1	4
Q4(b)	Analyze the significance of women's entrepreneurship in India's economic growth, focusing on the challenges and opportunities that women entrepreneurs face.	10	3	4	4



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Q5(a)	Describe the role of the Ministry of MSME in promoting entrepreneurship in India. Provide examples of its initiatives.	10	3	2	5
Q5(b)	Critically evaluate the role of public-private partnerships (PPPs) in the development of entrepreneurship in India.	10	4	5	5
Q6(a)	What are the major challenges faced by micro and small enterprises in India? Explain how these challenges impact their growth and sustainability.	10	4	2	6
Q6(b)	Analyze the role of risk management in ensuring the success and longevity of micro and small enterprises in India.	10	4	4	6
Q7(a)	What are the key factors to consider when deciding whether to harvest or close a small business? Discuss the decision-making process.	10	4	3	7
Q7(a)	Describe the key stages in the life cycle of a small business. How do these stages impact business development?	10	4	2	7