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SJC INSTITUTE OF TECHNOLOGY

(An Autonomous Institute under VTU, Belagavi)

1st SEMESTER M.Tech DEGREE SEMESTER END EXAMINATIONS APRIL 2025

Course:	**WASTE TO ENERGY**			
Course Code:	**MME101**	**Program:**	**M.Tech in Machine Design**	
Max Marks:	**100**		**Duration:**	**03 Hours**

Note:

1. Answer ONE question from each MODULE and Question 1 & 2 is compulsory.
2. Any missing Data can be suitably assumed.

Q. No.		Module - 1	Marks	CO	RBTL
Q1	a	Explain the concept of energy from waste. What are its advantages and limitations?	6	1	L1
	b	What is Municipal Solid Waste (MSW)? Discuss the challenges associated with converting MSW into energy.	6	1	L2
	c	Describe the types of biomass waste and explain how they are utilized in energy generation using various conversion technologies.	8	1	L3
		Module – 2			
Q2	a	Describe slow pyrolysis. What are its operating conditions and typical products?	6	2	L1
	b	Describe the process of manufacturing pyrolytic oils. What are the factors affecting the yield and quality of these oils?	6	2	L2
	c	Discuss the influence of feedstock characteristics on the yield and quality of charcoal, pyrolytic oil, and gas in a pyrolysis process	8	2	L3
		Module – 3			
Q3	a	Define biomass gasification. What are the main advantages of using gasification for energy conversion?	6	3	L1
	b	Explain the working principle of a downdraft gasifier. What type of feedstock is suitable for this gasifier?	6	3	L3
	c	Compare fixed bed and fluidized bed gasifiers in terms of design, efficiency, and application.	8	3	L4
		OR			
Q4	a	Discuss the process of integrating a gasifier with a diesel engine for dual-fuel operation.	6	3	L1
	b	What are the equilibrium and kinetic considerations in biomass gasifier operation? Briefly explain each	6	3	L3
	c	Explain the gasifier burner arrangement for thermal heating. Include a simple schematic if possible.	8	3	L4

Module – 4					
Q5	**a**	What is biomass combustion? How is it used for energy generation?	**6**	**4**	**L1**
	b	Explain the operating procedure of a fluidized bed biomass combustor.	**6**	**4**	**L2**
	c	Describe the construction and working of an inclined grate biomass combustor. What are its applications?	**8**	**4**	**L3**
OR					
Q6	**a**	What is a fixed bed combustor? Mention its types and working principle.	**6**	**4**	**L1**
	b	What are the key factors affecting the performance of biomass combustion systems	**6**	**4**	**L2**
	c	Compare fixed bed and fluidized bed biomass combustors in terms of design, efficiency, and fuel flexibility	**8**	**4**	**L3**
Module – 5					
Q7	**a**	What is biogas? Mention its major components and their typical percentages.	**6**	**5**	**L1**
	b	Explain biochemical conversion of biomass. List the main processes involved.	**6**	**5**	**L2**
	c	Describe the working principle of a floating drum biogas plant.	**8**	**5**	**L3**
OR					
Q8	**a**	State the calorific value of biogas. How does it compare with other fuels?	**6**	**5**	**L1**
	b	Discuss the role of urban waste as a potential energy source and illustrate how modern technologies enable the transformation of waste into usable energy, citing relevant examples.	**6**	**5**	**L2**
	c	Describe the process of alcohol production from biomass. What are its uses?	**8**	**5**	**L3**

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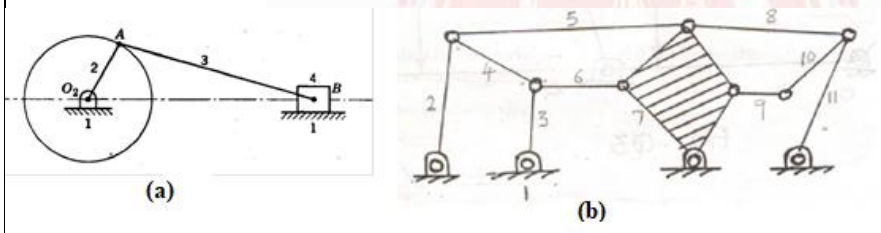
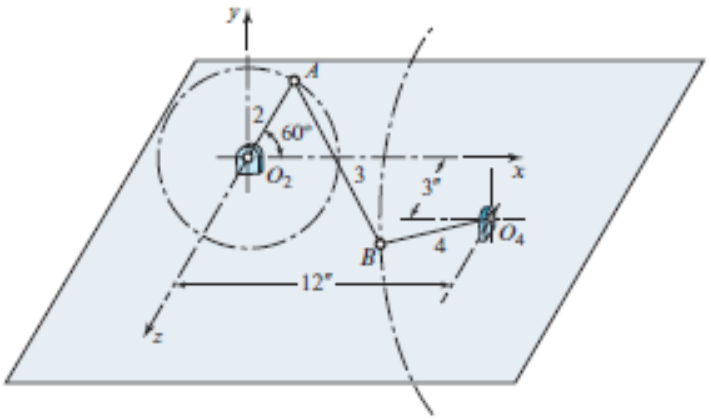
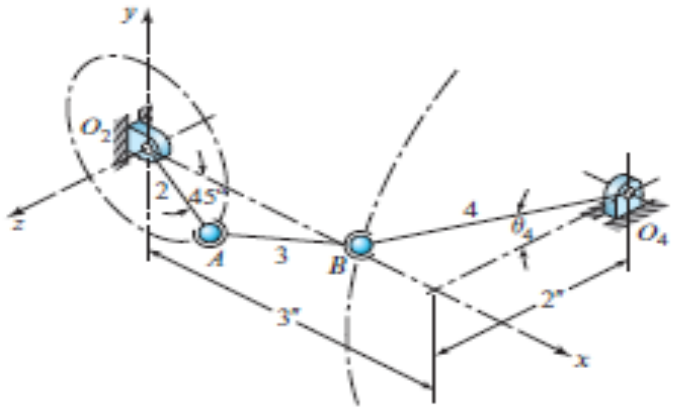
1st SEMESTER M.Tech DEGREE SEMESTER END EXAMINATIONS APRIL 2025

Course:	**COMPUTER SIMULATION OF MACHINES**			
Course Code:	**MME102**	**Program:**	**M.Tech in Machine Design**	
Max Marks:	**100**		**Duration:**	**03 Hours**

Note:

1. Answer ONE question from each MODULE and Question 1 & 2 is compulsory.
2. Any missing Data can be suitably assumed.

		Module - 1	Marks	CO	RBTL
Q1	a	Define Simulation and Why simulations are required for Mechanisms.	4	1	L1
	b	Describe the vector loop method for 4-bar mechanism.	8	1	L2
	c	Determine the DOF for the following Mechanisms shown in Fig 1c.  Fig 1c.	8	1	L3
		Module – 2			
Q2	a	Define Synthesis and list different types of synthesis of Linkages.	4	1	L1
	b	Explain the Freudenstein's equation for four bar mechanisms.	8	1	L2
	c	Synthesize a function generator to follow the equation $y = 1/x$ over the range $1 \leq x \leq 2$ using three precision postures.	8	1	L3
		Module – 3			
Q3	a	Explain with a neat sketch three prescribed position synthesis of crank and rocker mechanism.	10	2	L2
	b	Determine the length of the links of a four bar linkage to generate $y = \log10(x)$ in the interval $10 \leq x \leq 60$. The length of the smallest link is 50 mm. Use three accuracy points with Chebychev's spacing. Draw the mechanism.	10	2	L3

		OR			
Q4	**a**	Explain with a neat sketch two prescribed position synthesis of four bar mechanism.	**10**	**2**	**L2**
	b	Synthesize a linkage to generate the function $y = x^{0.8}$ for $1 \leq x \leq 3$ using an input crank range of 120˚ and an output range of 90˚ by three point position reduction.	**10**	**2**	**L3**
		Module – 4			
Q5		The angular velocity of link-2 of the four bar RGGR linkage of Fig. 5 is ω_2 = 50k rad/s. Find the angular velocity and angular acceleration of links 3 and 4 and the velocity and acceleration of point B for the position shown in Fig. 5.  Fig 5	**20**	**3**	**L3**
		OR			
Q6		A four link RGGR crank-rocker mechanism is shown in Fig. 6. The knowns are the position and plane of rotation of the input link, the plane of rotation of the output link, and the dimensions of all four links. Find the positions of all moving links when the input crank is set to θ2 = -50˚ as shown in Fig.6.  **Fig. 6**	**20**	**3**	**L3**

Module – 5					
Q7	**a**	In detail explain the Robot generalized coordinates and joint configuration.	**10**	**4**	**L2**
	b	Write the Vector equation and Dynamic equation for the planar robot system.	**10**	**4**	**L3**
OR					
Q8	**a**	Briefly explain Robot coordinate control.	**10**	**4**	**L2**
	b	Write the simultaneous constrain matrix and Dynamic simulation of two link planar robot system.	**10**	**4**	**L3**

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1st SEMESTER M.Tech DEGREE SEMESTER END EXAMINATIONS APRIL 2025

Course:	**MECHATRONICS FOR INDUSTRIAL APPLICATIONS**			
Course Code:	**MME103**	**Program:**	**M.Tech in Machine Design**	
Max Marks:	**100**		**Duration:**	**03 Hours**

Note:

1. Answer ONE question from each MODULE and Question 1 & 2 is compulsory.
2. Any missing Data can be suitably assumed.

			Marks	CO	RBTL
		Module - 1			
Q1	**a**	How Mechatronic concepts are applied in Engineering process automation? Explain	**06**	**1**	**L1**
	b	Discuss on elements of Mechatronics with the help of a block diagram	**06**	**1**	**L2**
	c	Evaluate the performance of embedded controllers in real-time Mechatronics applications.	**08**	**1**	**L3**
		Module – 2			
Q2	**a**	Discuss on the working Mechanism of rotational Mechanical system used in Mechatronics.	**06**	**2**	**L2**
	b	Explain the steps involved in the Development of Part Programming with Block Diagram.	**06**	**2**	**L3**
	c	Compare physical modeling vs mathematical modeling in mechatronics.	**08**	**2**	**L3**
		Module – 3			
Q3	**a**	How does an antilock braking system improve vehicle safety?	**10**	**3**	**L2**
	b	How does adaptive cruise control differ from traditional cruise control?	**10**	**3**	**L3**
		OR			
Q4	**a**	Describe the role of Mechatronics in the Engine control system of a Hybrid vehicle.	**10**	**3**	**L2**
	b	How do digital fly-by-wire systems improve aircraft control and safety.	**10**	**3**	**L3**

Module – 4					
Q5	**a**	Discuss the role of Mechatronics in Additive Manufacturing Process.	**10**	**4**	**L2**
	b	How does the Integration of IoT Enhance the functionality of a smart factory.	**10**	**4**	**L3**
OR					
Q6	**a**	Discuss the role Mechatronics in Automation.	**10**	**4**	**L1**
	b	What are th21/04/2025 8:30 am e challenges associated with implementing SLAM in real-time applications?	**10**	**4**	**L3**
Module – 5					
Q7	**a**	What is the significance of Haptic feedback in Medical Training Simulators.	**10**	**5**	**L2**
	b	How do Sensory-assisted Exoskeletons Enhance Mobility for individuals with disabilities?	**10**	**5**	**L4**
OR					
Q8	**a**	How does IoT contribute to the functionality of home automation systems	**10**	**5**	**L2**
	b	How are Haptic Technologies used in virtual reality applications	**10**	**5**	**L4**

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1st SEMESTER M.Tech DEGREE SEMESTER END EXAMINATIONS APRIL 2025

Course:	**MATERIAL SELECTION IN MACHINE DESIGN**			
Course Code:	**MME104B**	**Program:**	**M.Tech in Machine Design**	
Max Marks:	**100**		**Duration:**	**03 Hours**

Note:

1. Answer ONE question from each MODULE and Question 1 & 2 is compulsory.
2. Any missing Data can be suitably assumed.

Q. No.		Module - 1	Marks	CO	RBTL
Q1	a	Write the block diagram of design process.	4	1	L1
	b	Enumerate the role of Function, Material, Shape and Process in the design Process.	10	1	L2
	c	With the help of flow diagram, discuss the evolution of engineering materials.	6	1	L3
		Module – 2			
Q2	a	Define any four Engineering Material Properties.	4	2	L1
	b	Explain the parameters in the selection of Engineering Materials for springs and heat exchangers.	10	2	L2
	c	Analyze the strength density chart concept in machine design.	6	2	L3
		Module – 3			
Q3	a	Illustrate about computer-aided process selection in Mechanical design.	10	2	L3
	b	Explain the following (a) Conflicting objectives (b) Penalty-functions	10	2	L2
		OR			
Q4	a	Write a note on Selection of multiple constraints.	6	2	L1
	b	What is Process Selection, Explain the Factors Influencing Process Selection.	6	2	L2
	c	Describe joining process and finishing process in mechanical design.	8	2	L3
		Module – 4			
Q5	a	Discuss Briefly on (a) Composites: Hybrids of type-1 and (b) Sandwich structures: Hybrids of type-2.	10	3	L4
	b	Explain the extreme combinations of thermal and electrical conduction in design of hybrid materials.	10	3	L2

		OR			
Q6	**a**	Evaluate the filling holes in material property space used in designing of hybrid materials.	**10**	**3**	**L4**
	b	Provide and analyze a case study that illustrates the effectiveness of natural resources.	**10**	**3**	**L5**
		Module – 5			
Q7	**a**	With the help of flow chart, explain in detail about material life cycle.	**10**	**4**	**L2**
	b	Explain in details about materials and processes to create product personality in Industrial Design.	**10**	**4**	**L2**
		OR			
Q8	**a**	State the requirements of pyramid in Materials and Industrial Design and explain in detail.	**10**	**4**	**L3**
	b	Discuss in detail about (a) Eco attributes of materials (b) Material and energy-consuming systems	**10**	**4**	**L4**

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1st SEMESTER M.Tech DEGREE SEMESTER END EXAMINATIONS APRIL 2025

Course:	**ADDITIVE MANUFACTURING TECHNIQUES**			
Course Code:	**MME105A**	**Program:**	**M.Tech in Machine Design**	
Max Marks:	**100**		**Duration:**	**03 Hours**

Note:

1. Answer ONE question from each MODULE and Question 1 & 2 is compulsory.
2. Any missing Data can be suitably assumed.

Q. No.		Module - 1	Marks	CO	RBTL
Q1	a	What is the Need for Additive Manufacturing? Explain its significance in Industry 4.0	6	1	L1
	b	Extricate the applications of additive manufacturing in various sectors	6	1	L2
	c	Write a brief note on the technological development of Additive manufacturing and Explain the classification of AM processes	8	2	L3
		Module – 2			
Q2	a	Expound with a neat sketch the working principle of Selective Laser Sintering process	6	1	L1
	b	Expound the post processing of additive manufacturing parts.	6	1	L2
	c	Enumerate the guidelines for process selection in additive manufacturing process.	8	2	L3
		Module – 3			
Q3	a	List out the Vat Photo Polymerization process Benefits and Drawbacks.	10	2	L2
	b	Enumerate the Photo Polymerization Process Modelling in additive manufacturing process.	10	2	L3
		OR			
Q4	a	Enumerate the Vector Scan micro-Vat Photo Polymerization process.	10	2	L2
	b	Interpret with relevant sketches, the Fused Deposition Modeling process in detail. And list its merits and demerits.	10	2	L3

Module – 4					
Q5	**a**	Elucidate the working mechanism of Material jetting process modelling with a neat sketch and List its merits and demerits.	**10**	**3**	**L2**
	b	How does AM-based part consolidation influence the cost, performance, and supply chain logistics of aerospace components?	**10**	**3**	**L3**
OR					
Q6	**a**	Extend the different patterns prepared in the AM process for investment casting	**10**	**3**	**L2**
	b	Interpret with relevant sketches, the Fused Deposition Modeling process in detail.	**10**	**3**	**L3**
Module – 5					
Q7	**a**	Expound the following processes with a neat sketches i) Design for Manufacturing and Assembly ii) AM unique Capabilities	**10**	**4**	**L3**
	b	Concise notes on following: i) Part building errors (ii) STL file Manipulation	**10**	**4**	**L4**
OR					
Q8	**a**	Identify the materials handling issues in Additive manufacturing process and justify it.	**10**	**4**	**L3**
	b	Write short notes on Use of AM to Support Medical Application Surgical and Diagnostic aids	**10**	**4**	**L4**