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SJC INSTITUTE OF TECHNOLOGY

(An Autonomous Institute under VTU, Belagavi)

FIRST SEMESTER M.Tech DEGREE SEMESTER END EXAMINATIONS

MARCH 2026

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**	What do you mean by solid waste? Classify the different types of solid waste.	**4**	**1**	**L1**
	b	Discuss the various method of solid waste management.	**8**	**1**	**L2**
	c	Discuss Agro based waste and forest residue in briefly	**8**	**1**	**L3**
		MODULE – 2			
Q2	**a**	Write a short note on charcoal.	**4**	**2**	**L1**
	b	Explain the slow and fast pyrolysis.	**8**	**2**	**L2**
	c	Discuss the various applications and yield of pyrolytic coil in detail.	**8**	**2**	**L3**
		MODULE – 3			
Q3	**a**	Classify the different types of gasifiers.	**4**	**3**	**L1**
	b	In electric power plant, how gasifier output is utilized.	**8**	**3**	**L2**
	c	Explain the construction and operation of updraft gasifier.	**8**	**3**	**L3**
		OR			
Q4	**a**	Discover the design, construction and operation of fluidizer bed gasifier.	**10**	**3**	**L3**
	b	Draw gasifier engine arrangement for production of electric power and explain its methodology.	**10**	**3**	**L3**
		MODULE – 4			
Q5	**a**	What do you understand by biomass combustion? Classify based on their application and discuss on any one in detail.	**10**	**4**	**L2**
	b	Explain the construction and operation of fixed bed combustor.	**10**	**4**	**L3**
		OR			

Q6	**a**	Explain the construction and operation of grate combustor.	**10**	**4**	**L3**
	b	Explain the construction and operation of fluidized bed combustor.	**10**	**4**	**L3**
MODULE – 5					
Q7	**a**	Write a short note on: (i) Biomass energy Programme (ii) Urban waste to energy conversion	**10**	**5**	**L2**
	b	Explain alcohol production from biomass	**10**	**5**	**L2**
OR					
Q8	**a**	Describe the various steps involved in biodiesel production.	**10**	**5**	**L2**
	b	Write a short note on: (i) Biomass gasification (ii) Pyrolysis and liquefaction	**10**	**5**	**L2**

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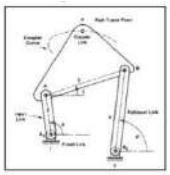
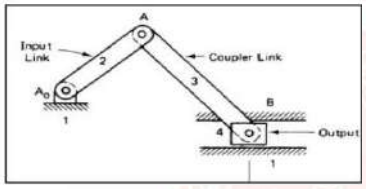
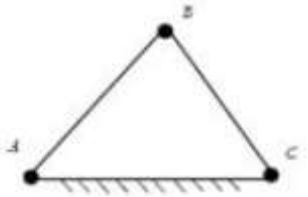
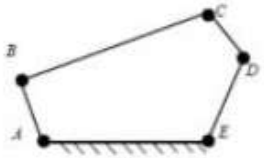
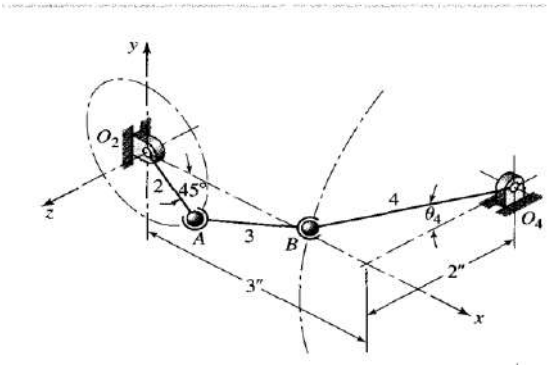
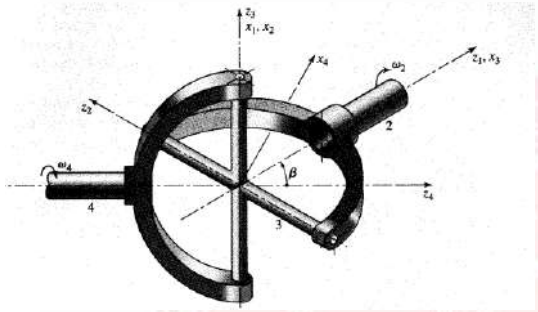
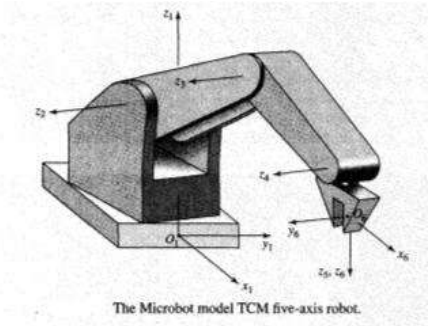
FIRST SEMESTER M.Tech DEGREE SEMESTER END EXAMINATIONS

MARCH 2026

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.

Q. No.		**MODULE - 1**	**Marks**	**CO**	**RBTL**
Q1	**a**	Describe the vector loop method for 4-bar mechanism.	**10**	**1**	**L2**
	b	Determine the DOF of the mechanisms as shown in Fig. Q1(b).     Fig. Q1(b)	**10**	**1**	**L3**
		MODULE – 2			
Q2	**a**	Derive the Freudenstein's equation for four bar mechanism.	**10**	**1**	**L2**
	b	Explain two-position synthesis of slider-crank Mechanisms	**10**	**1**	**L3**
		MODULE – 3			
Q3	**a**	Synthesize the crank rocker mechanisms with optimum Transmission angle	**10**	**2**	**L4**
	b	Explain with a neat sketch two position synthesis of crank and rocker mechanisms.	**10**	**2**	**L2**
		OR			
Q4	**a**	Write a note on overlay method.	**10**	**2**	**L2**
	b	Synthesize a linkage to generate the function $y = x^{0.8}$ for $1 \leq x \leq 3$ using an chebychev spacing three precision positions reduction method.	**10**	**2**	**L3**
		MODULE – 4			
Q5	**a**	A four link ***RGGR*** crank-rocker mechanism is shown in Fig. Q5. 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 s set to θ2 = -45˚.  Fig Q5	**20**	**3**	**L4**
		OR			
Q6	**a**	Analyze the Hooke universal joint of Fig.Q6 to find equations for the positions of all other joint variables when we are given a value for input shaft angle ø1.  Fig. Q6	**20**	**3**	**L4**
		MODULE – 5			
Q7	**a**	Write a note on topological arrangements of robotic arms.	**10**	**4**	**L2**
	b	For the Microbot model TCM 5-axis robot shown in Fig 7b, find the transformation matrix T16 relating the position of the tool coordinate system to the ground co ordinate system when the joint actuators are set to the values ø1=30°,ø2=60°,ø3=-30°,ø4=ø5=0°. Also find the absolute position of the tool point which has coordinates x6=y6=0,z6=2.5  Fig 7b	**10**	**4**	**L2**
		OR			
Q8	**a**	Write a MATLAB code to generate a rotation matrix based on a given set of Euler angles, such as ZYZ, ZXZ, ZYX, and XYZ.	**10**	**4**	**L2**
	b	Explain vector equation and dynamic equation in terms of two link planner robot.	**10**	**4**	**L2**

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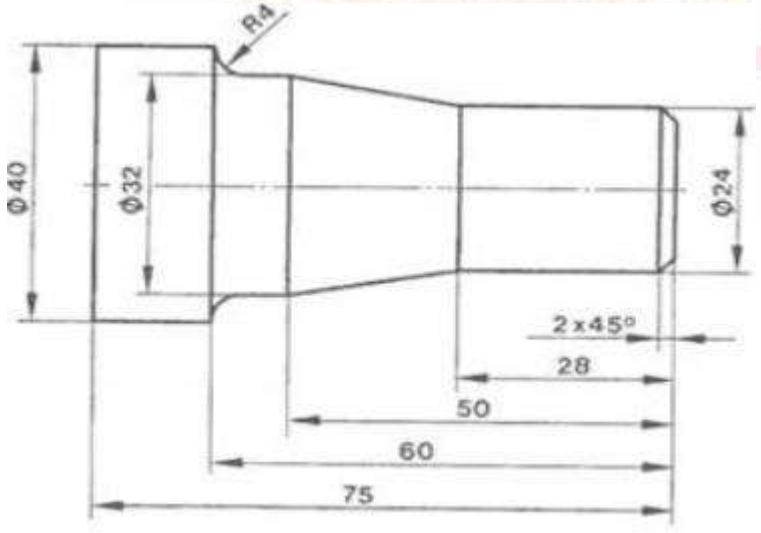
FIRST SEMESTER M.Tech DEGREE SEMESTER END EXAMINATIONS

MARCH 2026

Course:	**MECHATRONICS FOR INDUSTRIAL APPLICATION**			
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.

Q. No.		**MODULE - 1**	**Marks**	**CO**	**RBTL**
Q1	**a**	Explain the principle of various sensors used for measuring displacement.	**6**	**1**	**L1**
	b	Define Flexible Manufacturing System(FMS)? Discuss on any 2 types of Flexible Manufacturing System(FMS).	**6**	**1**	**L2**
	c	Evaluate the performance of embedded controllers in real-time Mechatronics applications.	**8**	**1**	**L3**
		MODULE – 2			
Q2	**a**	Elucidate the types of mechanical systems in Mechatronics?	**6**	**2**	**L1**
	b	Write a manual part program for shown part in Figure 1 by multiple turning cycle. All dimension is in mm.  Fig 2(b)	**8**	**2**	**L3**
	c	Compare physical modeling vs mathematical modeling in Mechatronics.	**6**	**2**	**L3**
		MODULE – 3			
Q3	**a**	Describe the role of mechatronics in the engine control system of a hybrid vehicle.	**10**	**3**	**L2**

	b	How does adaptive cruise control differ from traditional cruise control?	**10**	**3**	**L3**
		OR			
Q4	**a**	What technologies are commonly used in tyre pressure monitoring systems?	**10**	**3**	**L2**
	b	How does an antilock braking system improve vehicle safety?	**10**	**3**	**L3**
		MODULE – 4			
Q5	**a**	How do AGVs navigate within a manufacturing environment?	**10**	**4**	**L2**
	b	What are the challenges associated with implementing? SLAM in real time applications?	**10**	**4**	**L3**
		OR			
Q6	**a**	Explain the concept of SLAM and its importance in robotics.	**10**	**4**	**L2**
	b	How does the integration of IoT enhance the functionality of a smart factory?	**10**	**4**	**L3**
		MODULE – 5			
Q7	**a**	Describe the applications of exoskeletons in rehabilitation.	**10**	**5**	**L2**
	b	How do surgical robots improve precision in medical procedures?	**10**	**5**	**L4**
		OR			
Q8	**a**	What are the security considerations for IOT based home automation?	**10**	**5**	**L2**
	b	How are haptic technologies used in virtual reality applications?	**10**	**5**	**L3**

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FIRST SEMESTER M.Tech DEGREE SEMESTER END EXAMINATIONS

MARCH 2026

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**	Define design. What are the major types of design, and how do they differ?	**12**	**1**	**L2**
	b	If tasked with redesigning a vacuum cleaner, what material modifications would you suggest improving efficiency and durability? Analyze the above statement	**8**	**1**	**L3**
		MODULE – 2			
Q2	**a**	List the main families of engineering materials. Describe any two material families along with their properties, applications and example	**06**	**2**	**L2**
	b	Illustrate the selection strategy, determine a suitable material for a high-temperature heat exchanger.	**14**	**2**	**L3**
		MODULE – 3			
Q3	**a**	List the three primary categories of manufacturing processes, and how do they differ in terms of function and application	**10**	**2**	**L2**
	b	Analyze the impact of multiple constraints on the selection of manufacturing processes in industries like aerospace and automotive.	**10**	**2**	**L3**
		OR			
Q4	**a**	Describe the key features of a computer-aided process selection system?	**10**	**2**	**L2**
	b	Analyze the effectiveness of penalty functions in ensuring compliance with quality standards while minimizing costs in a mass production system.	**10**	**2**	**L3**
		MODULE – 4			
Q5	**a**	Describe the filling holes in material property space used in designing hybrid materials.	**10**	**3**	**L2**

	b	Analyze the trade-offs between using metal matrix composites versus polymer matrix composites in high-performance applications.	**10**	**3**	**L3**
		OR			
Q6	**a**	List the key differences between Type 1, Type 2, Type 3, and Type 4 hybrid structures?	**10**	**3**	**L2**
	b	Analyze the relationship between density and strength in natural materials and its implications for designing lightweight hybrid structures.	**10**	**3**	**L3**
		MODULE – 5			
Q7	**a**	What are the different stages of a material's life cycle?	**10**	**4**	**L2**
	b	Consider a chair made of wood and one made of plastic. Compare their industrial design attributes using the requirements pyramid	**10**	**4**	**L4**
		OR			
Q8	**a**	Clarify the requirements of pyramids in industrial design.	**10**	**4**	**L2**
	b	Differentiate between eco-friendly and non-eco-friendly materials using real-world product examples.	**10**	**4**	**L4**

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FIRST SEMESTER M.Tech DEGREE SEMESTER END EXAMINATIONS

MARCH 2026

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 main difference between AM and CNC machining?	**6**	**1**	**L1**
	b	How does CAD technology support additive manufacturing?	**6**	**1**	**L2**
	c	Discuss a limitation of metal AM and how it can be addressed.	**8**	**2**	**L3**
		MODULE – 2			
Q2	**a**	What are the key steps in the AM process chain?	**6**	**1**	**L1**
	b	Compare vector scanning and DLP in terms of speed and resolution.	**6**	**1**	**L2**
	c	Discuss how variations in resin properties impact final part strength.	**8**	**2**	**L3**
		MODULE – 3			
Q3	**a**	Explain the role of liquefaction and solidification in FDM.	**10**	**2**	**L2**
	b	Compare the material properties of FDM-printed ABS vs. Material Jetted photopolymers.	**10**	**2**	**L3**
		OR			
Q4	**a**	How does UV curing work in Material Jetting?	**10**	**2**	**L2**
	b	Discuss the challenges of multi-material printing in Material Jetting.	**10**	**2**	**L3**

MODULE – 4					
Q5	**a**	Compare traditional DFM constraints with DFAM freedoms. Give an example where AM enables a design impossible with machining.	**10**	**3**	**L2**
	b	Critically evaluate the trade-offs in using AM for part Consolidation (consider cost, performance and supply chain).	**10**	**3**	**L3**
OR					
Q6	**a**	Identify two advantages of using AM for rapid tooling over conventional tooling methods.	**10**	**3**	**L2**
	b	Discuss the limitations of AM in rapid tooling for high-volume production. How might hybrid manufacturing address these?	**10**	**3**	**L3**
MODULE – 5					
Q7	**a**	How does AM improve the accuracy of surgical planning compared to traditional methods?	**10**	**4**	**L3**
	b	Should insurance companies cover 3D-printed implants? Argue for/against, considering cost and accessibility.	**10**	**4**	**L4**
OR					
Q8	**a**	Compare AM's role in medical vs. aerospace applications. How do technical requirements differ?	**10**	**4**	**L3**
	b	Predict how AI integration could address current AM limitations in [medical/automotive] fields. Justify your predictions.	**10**	**4**	**L4**