Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

DEPARTMENT OF MECHATRONICS

VII SEMESTER B.TECH. (MECHATRONICS)

END SEMESTER EXAMINATION, NOVEMBER 2022

SUBJECT: SOFT ROBOTICS [MTE 4062]

(Date: NOVEMBER 28, 2022**)**

Time: 180 Minutes **MAX. MARKS: 50**

Instructions to Candidates:

- **Answer all the questions**.

Q. No		M	CO	PO	LO	BL
1A.	Analyze thermal actuators used in soft robots. With neat sketches explain the fabrication process of the bimorph thermal actuator.	**5**	**1**	**1,2**	**1**	**3**
1B.	Illustrate with neat diagrams the Multi-material Additive Manufacturing techniques for constructing a functional Soft robot with the help of a relevant example.	**3**	**1**	**1**	**1**	**3**
1C.	Interpret the 3D Printing Techniques with relevant details.	**2**	**1**	**1**	**1**	**4**
2A.	Distinguish the various functional materials, fabrication strategies along with their applications used in stretchable electronics.	**5**	**1**	**1,2**	**1**	**3**
2B.	Explain the relevance of Soft Materials used in Soft Robot Manipulations. List any 2 soft materials used for fabricating soft robots along with their properties.	**3**	**1**	**2,3**	**1,4**	**3**
2C.	Explain the working principle and mention the types of material used for fabricating textile strain sensors	**2**	**2**	**3,4,5**	**2,3**	**3**
3A.	Explain with neat diagrams the working principle, the material used for fabrication for HASEL Artificial Muscles	**5**	**2**	**1,2**	**1**	**3**
3B.	Describe a polymer-based Sensors. Analyze how does shape memory polymers work? Distinguish the properties of shape memory polymers?	**3**	**3**	**1**	**1**	**4**

3C.	Illustrate any of the Dielectric elastomer applications with the help of its working principle.	**2**	**1**	**3,4,5**	**2,3**	**3**
4A.	Based on the stimulation type classify and compare the different classes of soft robotic actuators.	**5**	**2**	**1,2**	**1**	**3**
4B.	Sketch neat diagrams of a bending actuator. Interpret the materials used for constructing and elaborate on the working principle of PneuNets (pneumatic networks)	**3**	**1**	**1,2**	**1**	**3**
4C.	Distinguish the materials used for the fabrication of pneumatic networks.	**2**	**3**	**2,3**	**1,4**	**3**
5A.	By applying kirigami-inspired sensors illustrate how soft robots can create awareness of the motion and position of their bodies efficiently.	**5**	**3**	**1,2**	**1**	**3**
5B.	Illustrate the fabrication of a microfluidic chip by soft-lithography methods using poly-dimethylsiloxane (PDMS).	**3**	**4**	**2,3**	**1,4**	**3**
5C.	Analyze 3D Continuum Mechanics related to Finite Element Methods employed for modelling soft robots.	**2**	**4**	**3,4,5**	**2,3**	**3**