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MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL (A constituent unit of MAHE, Manipal)

DEPARTMENT OF MECHATRONICS VII SEMESTER B.TECH. MECHATRONICS END SEMESTER EXAMINATIONS, DECEMBER 2023 SUBJECT: ENGINEERING MATERIALS [MTE 4071] (Date: 07/12/2023)

Time: 3 Hours

MAX. MARKS: 50

Instructions for the Candidates:

✤ Data did not provide any, may be suitably assumed.

Q. No		М	СО	РО	LO	BL
1A.	For the application given in Fig. 1A, explain the mechanism of how the colour of the glass goes from transparent to dark.	04	4	4	4	3
18.	Mr. X had a spinal injury, and a bone was broken in the spinal cord. A shape memory alloy (SMA) implant was kept for rehabilitation purposes, as shown in Fig. 1B. In what way does an SMA aid in rehabilitation in this scenario?	03	4	4	4	3
1C.	Explain the piezoelectric effect in lighting of an electric cigarette lighter.	03	4	4	4	2
2A.	For the polymerization reaction shown in Fig. 2A, describe the ways of terminating the reaction with a chemical reaction. $ \begin{array}{c} H & H & H & H \\ R - C - C + C = C \\ H & H & H \\ \end{array} $ $ \begin{array}{c} H & H & H & H \\ R - C - C - C - C - C \\ H & H & H \\ \end{array} $ $ \begin{array}{c} H & H & H \\ R - C - C - C - C \\ H & H & H \\ \end{array} $ $ \begin{array}{c} Fig. 2A \end{array} $	04	4	4	4	2

[✤] Answer ALL questions.

2 B .	Annealing improves the properties of copper, aluminum, and tin making them suitable for	03	5	4	4	3
	electrical applications. Discuss.					
2C.	Explain the importance of fusible alloys in safety systems against explosion and fire.	03	5	4	4	2
3A.	Compare the characteristics of low and high-resistive materials with examples for both.	05	5	4	4	2
3B.	Mention any three applications of brass and bronze in the context of electrical applications.	03	5	4	4	2
3C.	In what way does a dielectric material act as an insulation cover around a copper wire for domestic purposes?	02	5	4	4	3
4A.	 A coil of wire 0.25 m long and having 400 turns carries a current of 15 A. Determine: (a) magnitude of the magnetic field strength H. (b) flux density B if the coil is in a vacuum. (c) flux density inside a bar of chromium that is positioned within the coil. The susceptibility for chromium is 3.13 × 10⁻⁴ (d) magnitude of the magnetization M. Magnetic Permeability of Vacuum = 1.257 × 10⁻⁶ H/m. 	04	5	2	1	3
4B.	Discuss the applications of hot and cold rolled, hard and soft drawn metals in electrical applications.	03	5	4	4	2
4C.	Explain the filament winding process in the fabrication of fiber-reinforced (FRC) composites.	03	4	4	4	2
5A.	Soft magnets are used in transformer cores while hard magnets are used in power drills, and motors. With the help of the hysteresis curve, state the reason.	05	5	4	4	2
5B.	The magnetic flux density within a bar of some material is 0.630 tesla at an H field of 5×10^5 A/m. Determine the following for this material: (a) the magnetic permeability, and (b) the magnetic susceptibility. (c) What type(s) of magnetism is(are) being displayed by this material? Why? (Magnetic permeability of vacuum is 1.257×10^{-6} H/m)	03	5	2	1	3
5C.	Amongst tungsten and carbon, tungsten is the most preferred filament material. Justify.	02	5	4	4	2