Total No. of Questions: 25

Enrollment No : _____

MEDICAPS UNIVERSITY

Faculty of Engineering

End Semester Examination May 2025

RA3EL22 Advanced Materials for Robotics

Programme	:	B.Tech.	**Branch/Specialisation**	:	RA
Duration	:	3 hours	**Maximum Marks**	:	60

Note: *All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary. Notations and symbols have their usual meaning.*

Section 1 (Answer all question(s))

		Marks	CO	BL
Q1.	On heating, one solid phase results in another solid phase and a liquid phase during _____ reaction. ○ Eutectoid ◉ Peritectic ○ Eutectic ○ Peritectoid	1	1	1
Q2.	_____ can be programmed to return to a specific shape when heated, offering a unique actuation mechanism. ○ Soft robotics materials ◉ SMA's ○ CFR composites ○ Photo responsive materials	1	1	1
Q3.	A class of metallic alloys composed of five or more elements in near-equal atomic concentrations are known as _____. ◉ High entropy alloys ○ Soft robotics materials ○ SMA's ○ None of the above	1	2	1
Q4.	_____ are artificial materials or composites whose properties are engineered at a microscopic level, going beyond the capabilities of naturally occurring materials ○ SMA's ○ Soft robotics materials ◉ Metamaterials ○ FRPs	1	2	1
Q5.	Which material combine the ability to respond to stimuli with the ability to decompose naturally, reducing environmental impact? ○ Bio-composites ○ Protein-based materials ○ Smart hydrogels ◉ All of the above	1	2	1
Q6.	_____ is woven into textile materials and is extremely strong and lightweight, with resistance toward corrosion and heat ○ SMA ○ Soft robotics alloy ◉ Kevlar ○ High entropy alloy	1	2	1
Q7.	_____ is a material used in photo-sensing & optoelectronics application. ◉ CdS ○ Graphite ○ Aluminium ○ Iron	1	3	1
Q8.	_____ materials conduct electricity on their surface but act as insulators in their bulk. ◉ Quantum ○ Organic ○ Ceramic ○ Super conductor	1	3	1

Q9. _____ used to produce images from a sample by illuminating it with an electron beam in a high vacuum — 1 | 3 | 1

- ○ Surface patterning
- ○ X-ray diffraction
- ○ AFM
- ◉ TEM

Q10. _____ is a technique that uses an array of ultrasonic transducers to create and steer beams for detailed, non-destructive inspections. — 1 | 3 | 1

- ◉ PAUT
- ○ Radiography test
- ○ Penetrant test
- ○ Magnetic test

Section 2 (Answer any 2 question(s))

Marks | CO | BL

Q11. Explain various type of specific advanced materials to robotics with applications. — 5 | 1 | 1

Rubric	Marks
Any 5 detailed breakdowns , Applications-5	5

Q12. How advanced materials are impacting robotics? — 5 | 1 | 1

Rubric	Marks
Each material with impact-5	5

Q13. Explain phase rule to analyzing phase diagrams. — 5 | 1 | 1

Rubric	Marks
Explain-3, diagram-2	5

Section 3 (Answer any 2 question(s))

Marks | CO | BL

Q14. Classify various structural material used in robots. — 5 | 2 | 2

Rubric	Marks
Each material with application-5	5

Q15. How does shape-memory alloy remember its shape? — 5 | 2 | 1

Rubric	Marks
Explanation of SMA,Mechanism of SMA	5

Q16. Explain composition, properties along with applications of high entropy alloys. — 5 | 2 | 1

Rubric	Marks
Composition and Properties of HEAs-3, Applications of HEAs-2	5

Section 4 (Answer any 2 question(s))

Marks | CO | BL

Q17. Classify metallic composites in soft robotics and explain its applications. — 5 | 2 | 2

Rubric	Marks
Classification 3 Marks, Uses 2 marks	5

Q18. Describe the phenomenology of phase transformation in shape memory alloys. — 5 | 2 | 2

Rubric	Marks
Describe the phenomenology-4. Name of SMAs-1	5

Q19. Describe the types of matrices in composites. **5 2 1**

Rubric	Marks
One mark each for type and description	5

Section 5 (Answer any 2 question(s))

Marks CO BL

Q20. Explain various properties, types and uses of superconducting materials. **5 2 1**

Rubric	Marks
properties(2 Marks), types(2 Marks), Uses(1 mark)	5

Q21. Describe the properties of quantum-materials. **5 2 2**

Rubric	Marks
five properties	5

Q22. Explain various materials used in thin film sand sensor. How they decomposed? **5 2 2**

Rubric	Marks
Any 4 materials-4 marks, Decomposition-1 marks	5

Section 6 (Answer any 2 question(s))

Marks CO BL

Q23. Describe field array NDT techniques with diagram. **5 3 2**

Rubric	Marks
Technique 3 marks, diagram 2 marks	5

Q24. Explain XRD technique to determine structural parameters. **5 3 2**

Rubric	Marks
XRD Principle-3, technique with diagram-2	5

Q25. Describe Transmission Electron Microscopy (TEM) technique with a diagram. **5 3 2**

Rubric	Marks
Technique 3 marks, Diagram 2 marks	5

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