Total No. of Questions: 22

Enrollment No : _____

MEDICAPS UNIVERSITY

Faculty of Engineering

End Semester Examination May 2025

EC3ES09 Engineering Materials

Programme	:	B.Tech.	**Branch/Specialisation**	:	EC
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.	Piezoelectricity is the reverse effect of- ○ Electroluminescence ◉ Electrostriction ○ Peltier effect ○ Hall effect	1	2	2
Q2.	Which of the following is a property of Miller indices? ○ They uniquely identify a plane ○ They are always positive ◉ They are not fractions ○ None of the mentioned	1	1	1
Q3.	All magnetic materials lose their magnetic properties when- ○ Cooled to low temperature ◉ Heated to high temperature (Curie temperature) ○ Kept in an aluminium box ○ Kept in vacuum	1	2	2
Q4.	Which of the following effects can be used to produce ultrasonic waves? ◉ Magnetostriction effect ○ Doppler Effect ○ Magnetic effect ○ Sound effect	1	2	2
Q5.	Which of the following is/are conductor(s)? ○ Ceramics ○ Plastics ◉ Mercury ○ Rubber	1	1	1
Q6.	Materials having resistance equal to zero is _____. ○ Semi-conductor ○ Conductor ◉ Superconductors ○ Insulators	1	2	1
Q7.	N-type of extrinsic semiconductor is formed by adding which type of impurity- ○ trivalent ○ hexavalent ○ bivalent ◉ pentavalent	1	2	2
Q8.	Semiconductors can conduct current when- ○ Kept at a room temperature ○ Temperature is reduced ◉ Temperature is increased ○ Below zero degree temperature	1	2	2
Q9.	If the wavelength of electromagnetic radiation is doubled, what will happen to the energy of photon? ○ Doubled ◉ Halved ○ Remains the same ○ Becomes zero	1	3	3
Q10.	Which of the following is not a characteristic of LASERS? ○ Monochromatic ○ Coherent ◉ Divergent ○ Intense	1	2	2

Section 2 (Answer all question(s))

Marks CO BL

Q11. What is meant by Bravais lattice? 2 2 2

Rubric	Marks
Correct definition	2

Q12. Explain the relationship between ferroelectricity and piezoelectricity. 3 2 2

Rubric	Marks
Explain the relationship between ferroelectricity and piezoelectricity.	3

Q13. (a) What are insulating materials? Explain their properties with example. 5 3 3

Rubric	Marks
Definition of Insulating materials	2
Explanation of properties.	3

(OR)

(b) What is a crystal structure? Explain the same for metallic elements.

Rubric	Marks
Definition of crystal structure.	2
Explanation of the crystal structures.	3

Section 3 (Answer all question(s))

Marks CO BL

Q14. What is magnetic dipole movement? How is the magnetic dipole moment of a current loop related to the current and area of the loop? 4 3 3

Rubric	Marks
Definition of magnetic dipole movement?	2
Relation with current and area of the loop	2

Q15. (a) Give the classification of magnetic materials and explain the term spin magnetic moment. 6 4 4

Rubric	Marks
Classification	3
Explanation of the term spin magnetic moment.	3

(OR)

(b) Discuss the magnetostriction and BH hysteresis loop.

Rubric	Marks
Explanation of magnetostriction.	3
Explanation of BH hysteresis loop	3

Section 4 (Answer all question(s))

Marks CO BL

Q16. Distinguish between electronic and ionic conduction. 3 2 2

Rubric	Marks
Three differences.	3

Q17. (a) Explain the concept of energy band for metal with the help of suitable diagram. **7 3 4**

Rubric	Marks
Explanation.	5
Diagram.	2

(OR)

(b) What is Meissner effect? Explain the different types of superconductors.

Rubric	Marks
Meissner effect	2
Explanation of types of superconductors.	5

Section 5 (Answer all question(s))

Marks CO BL

Q18. Differentiate between direct and indirect band gap semiconductors. **4 3 3**

Rubric	Marks
One mark for each difference.	4

Q19. (a) What are semiconducting materials? How do they differ from metals and insulators in terms of electrical conductivity? **6 4 4**

Rubric	Marks
Definition of semiconducting materials.	2
Difference	4

(OR)

(b) An n-type Si semiconductor containing 10^{16} phosphorus (donor) atoms cm^{-3} has been doped with 10^{17} boron (acceptor) atoms cm^{-3}. Calculate the electron and hole concentrations in this semiconductor.

Rubric	Marks
The electron concentration is 2.5×10^{3} cm^{-3} and the hole concentration is 0.9×10^{17} cm^{-3}.	6

Section 6 (Answer any 2 question(s))

Marks CO BL

Q20. What are the functions of the core and cladding in an optical fiber? Why should their refractive indices be different? **5 2 2**

Rubric	Marks
Functions	4
Reason of refractive indices be different	1

Q21. What are the materials requiring for manufacturing the optical fibre? Explain them. **5 2 2**

Rubric	Marks
Materials requiring for manufacturing the optical fibre	2
Explanation	3

Q22. What is dispersion? Explain different types of dispersion. **5 2 2**

Rubric	Marks
Definition of dispersion	2
Different types	3

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