

END TERM EXAMINATION

THIRD SEMESTER [B.TECH] DECEMBER 2024

Paper Code: EEC-209

Subject: Electrical Materials

Time: 3 Hours

Maximum Marks: 60

Note: Attempt five questions in all including Q. No.1 which is compulsory. Select one question from each unit.

Q1 Attempt all questions:-

- (a) Define Resistivity, also discuss factors affecting resistivity. (4)
- (b) What is the forbidden energy gap in a semiconductor, and how does it affect the electrical conductivity of the material? (4)
- (c) What are natural insulating materials? Give their applications in electrical systems. (4)
- (d) Why net magnetic flux across a closed surface is always zero? (4)
- (e) Which materials are used as electrical fuse? Give the various applications of electrical fuse. (4)

UNIT-I

- Q2 (a) Define superconductivity and describe its fundamental properties. Discuss in detail the phenomenon of the Meissner effect and its implications. Also, outline some key applications of superconductors in modern technology. (5)
- (b) Determine the critical current that can flow through a long thin superconducting conductor of diameter 1 mm. The value of critical magnetic field for the conductor material is 80000 A/m. (5)

- Q3 (a) Write the electrical, mechanical, and thermal properties and applications of high resistivity materials such as manganin, constantan, nichrome, mercury, tungsten, and carbon. (5)
- (b) Determine the temperature coefficient of resistance of material used in a resistor, if the resistance at 250 C is 50 ohm and at 700 C is 57.2 ohm? (5)

UNIT-II

- Q4 (a) State and explain the properties and applications of synthetic insulating materials. (5)
- (b) Describe briefly about gaseous and liquid insulating materials. (5)
- Q5 (a) Classify insulating materials on the basis of temperature. (5)
- (b) Explain why ceramics have low coefficient of thermal expansion. What measures may be taken to reduce the likelihood of thermal shock of a ceramic piece? (5)

UNIT-III

- Q6 (a) State with examples, the difference between hard and soft magnetic materials in terms of hysteresis behaviour. (5)
- (b) Define the terms (i) Curie Temperature, (ii) Remanence of a magnetic material. (5)

- Q7 (a) The area of hysteresis curve obtained with a certain specimen of iron was 9.3 cm^2 . The coordinates were such that $1 \text{ cm} = 1000 \text{ AT/m}$ $1 \text{ cm} = 0.2 \text{ T}$. Calculate the hysteresis loss per cubic metre per cycle. Also compute the hysteresis loss per cubic metre at a frequency of 50 Hz . (5)
- (b) Explain the differences between diamagnetism, paramagnetism and ferromagnetism. (5)

UNIT-IV

- Q8 (a) What is electrical soldering? What are various types of solder? Also discuss the advantages of soldering. (5)
- (b) What are the core materials used for making inductors? (5)
- Q9 (a) Differentiate between film or cermet resistor and a semiconductor resistor. (5)
- (b) What are thermocouples and where is its application in electrical systems? Mention the materials used in making them. (5)

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