Electrical Engineering Materials

1 Mark Questions with Answers (Unit-wise)

Diploma in Electrical Engineering (NSQF Level 4), HSBTE. Previous year papers: Feb 2022, July 2022, Feb 2023, July 2023, Dec 2024, May 2025, May 2026.

Answers to MCQs are written as the correct option's text, because the order of options changes from paper to paper. Where wording differed between years, the versions are merged with "/".

Unit I: Introduction to Materials

Q1. In case of conductors, valence band and conduction band have: (a) More gap (b) Less gap (c) Overlapped (d) Moderate gap *(Unit I, Exam Feb 2022, July 2022, July 2023)*
Ans: Overlapped (the valence and conduction bands overlap, so there is no forbidden gap).

Q2. In case of insulators, valence band and conduction band have: (a) Less gap (b) Moderate gap (c) Large gap (d) Overlapped *(Unit I, Exam May 2026, July 2023)*
Ans: Large (more) gap, about 5 eV or more.

Q3. Conduction band in insulating materials is: (a) filled (b) empty (c) partly filled (d) none of above *(Unit I, Exam Feb 2023)*
Ans: Empty.

Q4. Forbidden energy band in semiconductors is: (a) Low (b) Large (c) Medium (d) None of above *(Unit I, Exam Dec 2024)*
Ans: Low (small): about 0.7 eV for germanium and 1.1 eV for silicon.

Q5. Semiconductors have ___ conduction band and ___ valence band: (a) slightly filled; moderately filled (b) almost filled; moderately filled (c) almost empty; almost filled (d) almost filled; almost empty *(Unit I, Exam May 2025)*
Ans: Almost empty conduction band and almost filled valence band.

Q6. The materials which allow the flow of current through them are called: (a) Semi-conductors (b) Super conductors (c) Conductors (d) Non conductors *(Unit I, Exam Dec 2024)*
Ans: Conductors.

Q7. The property of material by which they can be drawn into wires is known as: (a) Ductility (b) Creep/Elasticity (c) Malleability (d) Plasticity *(Unit I, Exam Dec 2024, Feb 2023, July 2022)*
Ans: Ductility.

Q8. Forbidden energy gap between conduction band and valence band is 1 eV in case of conductors. (True/False) *(Unit I, Exam Dec 2024)*
Ans: False. In conductors the gap is zero because the bands overlap; about 1 eV is the gap of semiconductors.

Q9. Nucleus of an element has ___ charge on it. *(Unit I, Exam Feb 2022, July 2023)*
Ans: Positive charge.

Q10. What is valence band? *(Unit I, Exam Feb 2022)*
Ans: The energy band formed by the energy levels of the valence (outermost shell) electrons. It is the highest energy band that is filled with electrons at 0 K.

Q11. What is energy band? *(Unit I, Exam July 2023)*
Ans: A group of very closely spaced energy levels, formed when many atoms come together in a solid, that electrons are allowed to occupy.

Q12. What is conduction band? *(Unit I, Exam July 2023)*
Ans: The energy band above the valence band, where electrons are free to move and carry current. Electrons must gain energy to reach it.

Q13. Define Insulator. / What is Insulator? *(Unit I, Exam July 2023)*
Ans: A material with very high resistivity and a large forbidden gap (more than about 5 eV) that does not allow current to flow, e.g. glass, mica, rubber.

Unit II: Conducting and Semi-Conducting Materials

Q14. The temperature coefficient of resistance is negative for: (a) Mercury/Tungsten (b) Steel (c) Carbon/Silicon (d) Copper *(Unit II, Exam May 2026, Dec 2024, July 2022)*
Ans: Carbon (semiconductors such as silicon also have a negative coefficient).

Q15. The material having zero temperature coefficient of resistance is: (a) Manganin (b) Steel (c) Carbon (d) Aluminium *(Unit II, Exam Feb 2022, May 2025)*
Ans: Manganin.

Q16. Most commonly used conducting material is: (a) Gold (b) Copper (c) Silver (d) Iron *(Unit II, Exam May 2026, July 2022, July 2023)*
Ans: Copper.

Q17. Poorest conductor of electricity is: (a) Carbon (b) Steel (c) Aluminium (d) Silver *(Unit II, Exam July 2023)*
Ans: Carbon.

Q18. Conductivity of a good conductor should be ___: (a) Very low (b) Low (c) Medium (d) High *(Unit II, Exam July 2023)*
Ans: High.

Q19. Most commonly used overhead transmission line conductor is: (a) Copper (b) Steel (c) Galvanized iron (d) ACSR *(Unit II, Exam Dec 2024, Feb 2023, July 2022)*
Ans: ACSR (Aluminium Conductor Steel Reinforced).

Q20. Which of the following is used for making coil of standard resistances? (a) Copper (b) Nichrome (c) Platinum (d) Manganin *(Unit II, Exam May 2025)*
Ans: Manganin.

Q21. Which is most used semi-conducting material? (a) Gold (b) Copper (c) Silver (d) Silicon *(Unit II, Exam Dec 2024, Feb 2023)*
Ans: Silicon.

Q22. The conduction of electricity in semiconductors takes place due to movement of: (a) positive ions only (b) negative ions only (c) positive and negative ions (d) electrons and holes *(Unit II, Exam May 2025)*
Ans: Electrons and holes.

Q23. For germanium the forbidden energy gap is: (a) 0.15 eV (b) 0.25 eV (c) 0.5 eV (d) 0.7 eV *(Unit II, Exam May 2025)*
Ans: 0.7 eV.

Q24. The minority carrier concentration is largely a function of: (a) forward biasing voltage (b) reverse biasing voltage (c) temperature (d) amount of doping *(Unit II, Exam May 2025)*
Ans: Temperature.

Q25. The conductivity of an extrinsic semiconductor with temperature: (a) decreases (b) increases (c) remains constant (d) None *(Unit II, Exam May 2025)*
Ans: Increases.

Q26. In a P-type semiconductor, the minority carriers are ___. *(Unit II, Exam Feb 2023)*
Ans: Electrons (free electrons).

Q27. Silicon and Germanium are examples of ___ materials. *(Unit II, Exam Feb 2022)*
Ans: Semiconductor materials.

Q28. Define Doping. / What is doping? *(Unit II, Exam May 2026, Dec 2024, Feb 2022, July 2022, May 2025)*
Ans: The process of adding a small, controlled amount of impurity (trivalent or pentavalent) to a pure semiconductor to increase its conductivity.

Q29. Define Semiconductor. / What is semiconductor? *(Unit II, Exam Feb 2022, July 2023)*
Ans: A material whose conductivity lies between that of conductors and insulators, with a small forbidden gap of about 1 eV, e.g. silicon and germanium. Its conductivity rises with temperature and doping.

Q30. What is Extrinsic Semiconductor? *(Unit II, Exam May 2025)*
Ans: A semiconductor that has been doped with impurity atoms. It is either N-type (pentavalent impurity) or P-type (trivalent impurity).

Q31. Brass is an alloy of ___ and ___. *(Unit II, Exam May 2026, July 2022, July 2023)*
Ans: Copper and zinc.

Q32. Bronze is an alloy of ___. *(Unit II, Exam May 2025)*
Ans: Copper and tin.

Q33. Nichrome is an alloy of ___ and chromium. *(Unit II, Exam Dec 2024, Feb 2023)*
Ans: Nickel (and chromium).

Q34. Give the full form of ACSR. / What is ACSR? *(Unit II, Exam May 2026, Dec 2024, Feb 2022, Feb 2023, July 2023, May 2025)*
Ans: Aluminium Conductor Steel Reinforced.

Q35. Name any two low resistivity copper alloys. *(Unit II, Exam May 2025)*
Ans: Brass and bronze (cadmium copper and beryllium copper are also used).

Q36. Name any two conducting materials. *(Unit II, Exam May 2025)*
Ans: Copper and aluminium (silver and gold are also conducting materials).

Q37. Define Conductivity. *(Unit II, Exam May 2025)*
Ans: The ability of a material to conduct electric current. It is the reciprocal of resistivity and its unit is siemens per metre (S/m).

Q38. Define Resistance. *(Unit II, Exam July 2023)*
Ans: The opposition offered by a material to the flow of electric current. $R = V/I = \rho l/A$, and its unit is the ohm (Ω).

Q39. Give the S.I. unit of specific resistance. *(Unit II, Exam Feb 2022)*
Ans: Ohm-metre (Ω·m).

Q40. The relative permeability of superconducting material is: (a) normal (b) zero (c) one (d) infinitely large *(Unit II, Exam Dec 2024, May 2025)*
Ans: Zero (a superconductor is a perfect diamagnet, the Meissner effect).

Q41. Superconductors have ___ resistance. *(Unit II, Exam July 2022, July 2023)*
Ans: Zero resistance.

Q42. What is Superconductivity? *(Unit II, Exam May 2025)*
Ans: The phenomenon in which certain materials lose all electrical resistance when cooled below a critical temperature (Tc), e.g. mercury at about 4.2 K.

Q43. Superconductivity can be destroyed by: (a) adding impurities (b) reducing temperature (c) application of magnetic field (d) any of the above *(Unit II, Exam May 2025)*
Ans: Application of a magnetic field (a strong field above the critical field destroys it). Reducing the temperature produces superconductivity; it does not destroy it.

Q44. Electrical contact resistance is better between: (a) Carbon and Carbon (b) Metal and Metal (c) Carbon and Metal (d) Carbon and Insulator *(Unit II, Exam July 2023)*
Ans: Metal and Metal.

Q45. A good electric contact material should have all of the following properties except: (a) high resistivity (b) high resistance to corrosion (c) good thermal conductivity (d) high melting point *(Unit II, Exam May 2025)*
Ans: High resistivity (it should have low resistivity).

Q46. What is Bundle Conductor? *(Unit II, Exam May 2025)*
Ans: Two or more sub-conductors per phase, held apart by spacers, used in extra high voltage lines to reduce corona loss and line reactance.

Unit III: Insulating Materials

Q47. Class H insulation has a working temperature of ___ °C: (a) 90 (b) 120 (c) 130 (d) 180 *(Unit III, Exam Dec 2024)*
Ans: 180 °C.

Q48. Class E insulation has a working temperature of ___ °C: (a) 90 (b) 120 (c) 130 (d) 180 *(Unit III, Exam Feb 2023, May 2025)*
Ans: 120 °C.

Q49. Class Y insulation has a working temperature of ___ °C: (a) 90 (b) 135 (c) 180 (d) >180 *(Unit III, Exam July 2022)*
Ans: 90 °C.

Q50. The common household glass is: (a) Boro silicate glass (b) High leaded glass (c) Soda lime glass (d) High silica glass *(Unit III, Exam Dec 2024, Feb 2023)*
Ans: Soda lime glass.

Q51. ___ is the main constituent of glass: (a) Fe_2O_3 (b) SiO_2 (c) Al_2O_3 (d) B_2O_3 *(Unit III, Exam May 2025)*
Ans: SiO_2 (silica).

Q52. Basic ceramic material is: (a) Lime stone (b) Clay (c) Cellulose (d) Sand *(Unit III, Exam Feb 2022, July 2023)*
Ans: Clay.

Q53. Plastic is: (a) good conductor of electricity (b) bad conductor of electricity (c) good conductor of heat (d) none *(Unit III, Exam Dec 2024)*
Ans: A bad conductor of electricity.

Q54. ___ insulators are commonly used for overhead power lines: (a) Porcelain (b) Toughened glass (c) Both (a) and (b) (d) None *(Unit III, Exam Dec 2024)*
Ans: Both porcelain and toughened glass.

Q55. Melting point of an insulator should not be high. (True/False) *(Unit III, Exam Dec 2024)*
Ans: False. The melting point of an insulator should be high.

Q56. Polyethylene is produced by: (a) Condensation (b) Condensation polymerization (c) Addition polymerization (d) Co-polymerization of ethylene monomers *(Unit III, Exam Feb 2022)*
Ans: Addition polymerization.

Q57. Polystyrene is: (a) An ester (b) An alcohol (c) A hydrocarbon (d) An alkyl halide *(Unit III, Exam Feb 2022)*
Ans: A hydrocarbon (a polymer of styrene).

Q58. Field coils of electrical motors are insulated by: (a) Varnish (b) Cotton (c) Mica paper (d) Jute *(Unit III, Exam July 2023)*
Ans: Varnish (insulating varnish, usually with cotton tape).

Q59. Air is an example of insulating material. (True/False) *(Unit III, Exam May 2026, Dec 2024, July 2022)*
Ans: True.

Q60. Name any two gaseous insulating materials. *(Unit III, Exam Dec 2024, July 2022)*
Ans: Air and nitrogen (SF_6 is also used).

Q61. Name any two insulating materials. *(Unit III, Exam Feb 2023)*
Ans: Mica and PVC (glass, rubber, porcelain are also insulators).

Q62. PVC stands for ___. *(Unit III, Exam Dec 2024, July 2022, July 2023)*
Ans: Polyvinyl chloride.

Q63. Write any two properties of Teflon. *(Unit III, Exam May 2026)*
Ans: (1) Very high heat resistance, up to about 250 °C. (2) Chemically inert, has low friction and a high dielectric strength.

Q64. Write any two properties of asbestos. *(Unit III, Exam Dec 2024, July 2022)*
Ans: (1) Heat resistant and fireproof. (2) Chemically inert, flexible fibrous structure and good thermal insulation.

Q65. Write any two properties of Bakelite. *(Unit III, Exam Feb 2023)*
Ans: (1) A thermosetting plastic with good dielectric strength. (2) Hard, heat resistant, low cost and easily moulded.

Q66. Write any two properties of glass. *(Unit III, Exam May 2025)*
Ans: (1) High dielectric strength and high resistivity. (2) Hard, brittle, transparent, chemically inert and non-porous.

Q67. Natural rubber is obtained from ___. *(Unit III, Exam July 2023)*
Ans: Latex (milky sap) of the rubber tree (Hevea brasiliensis).

Q68. Define Breakdown Voltage. *(Unit III, Exam May 2025)*
Ans: The minimum voltage at which an insulating material fails and starts conducting. Breakdown voltage per unit thickness is called the dielectric strength (kV/mm).

Unit IV: Magnetic Materials

Q69. Which material is used for making the permanent magnet? (a) Alnico/Cobalt steel (b) Mu-metal (c) Silicon iron/Copper (d) Nickel iron *(Unit IV, Exam May 2026, Dec 2024, Feb 2023, July 2022, July 2023)*
Ans: Cobalt steel (Alnico is also a permanent magnet material); both are hard magnetic materials.

Q70. Hard magnetic materials are used for making permanent magnets. (True/False) *(Unit IV, Exam Dec 2024)*
Ans: True.

Q71. Name any two hard magnetic materials. *(Unit IV, Exam May 2026, Feb 2023)*
Ans: Tungsten steel and cobalt steel (chromium steel, Alnico and hard ferrites are also hard magnetic).

Q72. Iron is a ___ material: (a) ferromagnetic (b) ferrimagnetic (c) paramagnetic (d) antiferromagnetic *(Unit IV, Exam Dec 2024)*
Ans: Ferromagnetic.

Q73. Ferrite is associated with: (a) Ferromagnetic (b) Paramagnetic (c) Diamagnetic (d) Ferrimagnetic material *(Unit IV, Exam Feb 2022)*
Ans: Ferrimagnetic material.

Q74. Which of the following is not ferromagnetic? (a) Nickel (b) Cobalt (c) Germanium (d) Silver *(Unit IV, Exam Feb 2022)*
Ans: Germanium. Silver is also non-ferromagnetic, so the option set is ambiguous; nickel and cobalt are the ferromagnetic ones.

Q75. The magnetic material loses its magnetic properties at ___. *(Unit IV, Exam Dec 2024, Feb 2023, July 2022, May 2025)*
Ans: Curie temperature.

Q76. By laminating the stator/rotor core of an induction motor, which loss is reduced? (a) Hysteresis (b) Eddy current (c) Frictional (d) Copper/All *(Unit IV, Exam May 2026, Dec 2024, Feb 2023)*
Ans: Eddy current losses.

Q77. Addition of 0.3 to 4.5% silicon to iron ___ the electrical resistivity of iron: (a) increases (b) decreases (c) does not change (d) None *(Unit IV, Exam May 2025)*
Ans: Increases (the resistivity, which reduces eddy current loss).

Q78. Define Retentivity. *(Unit IV, Exam July 2023)*
Ans: The ability of a magnetic material to retain its magnetism after the magnetising force is removed.

Q79. Define Permeability. *(Unit IV, Exam July 2023)*
Ans: The ability of a material to allow magnetic flux to pass through it; $\mu = B/H$.

Q80. Define Eddy Current. *(Unit IV, Exam May 2025)*
Ans: Circulating currents induced in a magnetic core by a changing magnetic flux. They cause I^2R heating and power loss, which is reduced by laminating the core.

Q81. Mention S.I. unit of magnetic flux. *(Unit IV, Exam Feb 2022)*
Ans: Weber (Wb).

Unit V: Special Purpose Materials

Q82. Thermocouple works on the principle of: (a) Joule effect (b) Peltier effect (c) Seebeck effect (d) Thomson effect *(Unit V, Exam May 2026, July 2022, July 2023)*
Ans: Seebeck effect.

Q83. Thermocouple is used for measuring ___. *(Unit V, Exam Dec 2024, Feb 2023, July 2022)*
Ans: Temperature.

Q84. Thermocouple is made up of two different types of metal. (True/False) *(Unit V, Exam Dec 2024)*
Ans: True.

Q85. How many junctions are constituted by a thermocouple? *(Unit V, Exam Feb 2022)*
Ans: Two junctions: a hot (measuring) junction and a cold (reference) junction.

Q86. What is Thermocouple? *(Unit V, Exam May 2025)*
Ans: A temperature sensor made of two dissimilar metals joined at both ends. An EMF proportional to the temperature difference between the junctions is produced (Seebeck effect).

Q87. The voltmeter used in thermocouple is of: (a) Large range (b) Low range (c) Medium range (d) Any *(Unit V, Exam July 2023)*
Ans: Low range (a millivoltmeter, because the EMF is only a few millivolts).

Q88. Solder is an alloy of: (a) Tin and lead (b) Copper and lead/aluminium (c) Nickel, copper, zinc (d) Silver, copper and lead *(Unit V, Exam Dec 2024, Feb 2022, Feb 2023, July 2022, May 2025)*
Ans: Tin and lead.

Q89. Define soldering. *(Unit V, Exam Dec 2024)*
Ans: Joining two metal parts using a fusible alloy (solder), with a melting point below that of the metals being joined, with the help of a flux.

Q90. Material used for fuse wire should have ___ melting point: (a) High (b) Low (c) Medium (d) Any *(Unit V, Exam Feb 2022, July 2023)*
Ans: Low.

Q91. Define fuse. *(Unit V, Exam July 2023)*
Ans: A protective device with a thin wire or element that melts and opens the circuit when the current exceeds its rated value.

Q92. Expand HRC. *(Unit V, Exam July 2023)*
Ans: High Rupturing Capacity.

Q93. Body of the kit-kat fuse is made up of ___. *(Unit V, Exam Feb 2023)*
Ans: Porcelain.

Q94. Body of the cartridge fuse is made up of ___. *(Unit V, Exam May 2025)*
Ans: Ceramic/porcelain (glass in small cartridge fuses).

Q95. Transformer core is made up of: (a) Cast iron (b) Silicon steel (c) Plastic (d) Copper *(Unit V, Exam July 2022)*
Ans: Silicon steel (CRGO).

Q96. Transformer winding is made from: (a) Copper (b) Aluminium (c) Iron (d) Silicon steel *(Unit V, Exam July 2023)*
Ans: Copper.

Q97. Transformer bushings are made up of: (a) Porcelain (b) Copper (c) Silicon steel (d) Plastic / Bushings of transformer are made from ___. *(Unit V, Exam July 2023)*
Ans: Porcelain.

Q98. Stator core of 3-phase induction motor is made up of: (a) Cast iron (b) Silicon steel (c) Carbon (d) Copper *(Unit V, Exam Dec 2024)*
Ans: Silicon steel.

Q99. Frame of induction motor is made of: (a) Cast iron/Silver (b) Aluminium (c) Stainless steel/Copper (d) Carbon *(Unit V, Exam Feb 2022, July 2023)*
Ans: Cast iron.

Q100. Frame of DC motor is made of: (a) Copper (b) Carbon (c) Cast iron (d) Silicon steel / The outer frame of DC machine is made of ___. *(Unit V, Exam July 2023)*
Ans: Cast iron.

Q101. Name the material used in making yoke of DC machine. *(Unit V, Exam Feb 2022)*
Ans: Cast iron (or cast steel).

Q102. Brushes of DC machines are made up of: (a) Cast iron (b) Silicon steel (c) Carbon (d) Copper *(Unit V, Exam Feb 2023)*
Ans: Carbon.

Q103. Brushes in a DC machine are made of Bronze. (True/False) *(Unit V, Exam Dec 2024)*
Ans: False. They are made of carbon or graphite.

Q104. Brushes of 3-phase slip-ring induction motor are made up of: (a) Cast iron (b) Silicon steel (c) Carbon (d) Copper *(Unit V, Exam May 2025)*
Ans: Carbon.

Q105. Slip ring of A.C. machine is made up of ___. *(Unit V, Exam Dec 2024)*
Ans: Brass or bronze (copper alloys).

Q106. Commutator of a DC machine is made up of ___. *(Unit V, Exam July 2022, May 2025)*
Ans: Hard-drawn copper.

Q107. Armature winding of DC machine/generator is made up of ___. *(Unit V, Exam Feb 2023, July 2023)*
Ans: Copper.