SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF PHYSICS

QUESTION BANK

VII SEMESTER

1920703 - ELECTRONICS MATERIALS

Regulation 2019

(ECE, EIE, CSE and Medical Electronics)

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SUBJECT: 1920703- ELECTRONICS MATERIALS

SEM / YEAR: VII SEM/AY-2022-2023

UNIT I - INTRODUCTION

Structure: atomic structures and bonding, types of bonding, band formation. Defects and imperfections in solids: Point, Line and Planar defects; Interfacial defects and volume defects. Classification of materials based on bonding: conductors, semiconductors and insulators.

PART – A

Q.No	Questions	BT Level	Competence
1.	Define atomic number and mass number.	BTL 1	Remembering
2.	Why all atoms are neutral?	BTL 2	Understanding
3.	Lead has an atomic number of 82 and a mass number of 207. How many protons, neutrons and electrons does it contain?	BTL 3	Applying
4.	Define atomic mass unit.	BTL 1	Remembering
5.	What is an isotope? Give an example.	BTL 2	Understanding
6.	List the different types of quantum numbers.	BTL 2	Understanding
7.	State Pauli's exclusion principle.	BTL 1	Remembering
8.	What are valence electrons?	BTL 1	Remembering
9.	Differentiate electropositive and electronegative elements.	BTL 2	Understanding
10.	Define bonding energy.	BTL 1	Remembering
11.	How is ionic bond formed? Give an example.	BTL 1	Remembering
12.	Give the maximum number of covalent bonds an atom can form.	BTL 2	Understanding
13.	List any four properties of metallic bond.	BTL 2	Understanding
14.	What are molecular crystals?	BTL 1	Remembering
15.	Define imperfection.	BTL 1	Remembering
16.	List the types of point defects.	BTL 2	Understanding
17.	What is a Frenkel defect?	BTL 1	Remembering
18.	Define dislocation.	BTL 1	Remembering
19.	Define twin boundary.	BTL 2	Understanding

20.	What is an energy band?	BTL 1	Remembering
21.	What are forbidden bands?	BTL 1	Remembering
22.	Define conduction band and valence band.	BTL 1	Remembering
23.	Classify materials on the basis of band gap.	BTL 2	Understanding
24.	Give two examples for conductors, semiconductors and insulators.	BTL 2	Understanding
	PART – B		
1.	Define the following. a) Atom b) Atomic Number c) Mass Number d) Isotopes e) Atomic weight f) Atomic mass unit (13)	BT L 1	Remembering
2.	Explain the type of bonding that occurs in ionic crystals along with its properties. (13)	BT L 4	Analyzing
3.	Discuss in detail about the bonding that involves the complete transfer of electrons from one atom to another so that each atom acquires a stable electronic configuration similar to the nearest inert gas atoms. (13)	BT L 4	Analyzing
4.	With Schematic representation explain the formation of bonding involved in CH_4 – methane molecule. (13)	BT L 4	Analyzing
5.	Illustrate the formation of bonding which involves the mutual sharing of electrons between adjacent atoms each having incomplete outermost shells. (13)	BT L 3	Applying
6.	Explain why metals are good electrical and thermal conductors. Give your answer in terms of structure and bonding. (13)	BT L 4	Analyzing
7.	Describe the band formation that occurs with the help of delocalized electrons. Also mention the properties of the bond formed. (13)	BT L 2	Understanding
8.	Briefly cite the main differences between ionic, covalent and metallic bonding. (13)	BT L 4	Analyzing
9.	With a neat sketch explain the bonding forces that arises from atomic or molecular dipoles. (13)	BT L 3	Applying
10.	(i) What is meant by crystal defects? (2) (ii)Explain the various types of one dimensional defects with neat diagram. (11)	BT L 1 BT L 2	Remembering Understanding
11.	Discuss in brief about point defects. How these defects affect the properties of materials? (13)	BT L 1	Remembering
12.	With a neat diagram explain the defects that occurs due to dislocation or distortion of atoms in a line. (13)	BT L 2	Understanding
13.	Explain in detail the form of different types of dislocations in a crystal and significance of it in determining the properties of the material. (13)	BT L 3	Applying
14.	Analyze and explain about the various types of interfacial defects occurring in a crystal. (13)	BT L 4	Analyzing
15.	Explain in detail about the various surface defects and its influence in determining the mechanical and physical properties of materials. (13)	BT L 2	Understanding
16.	Explain the formation of energy bands in conductors, semiconductors and insulators. (13)	BT L 2	Understanding

17.	How do you classify the materials based on the energy band present in the solid? (13)	BT L 1	Remembering
	PART C		
1.	Elaborate the type of bonding formed with a neat diagram for the following. a) two metals b) two non-metals c) a metal and a non-metal (15)	BT L 3	Applying
2.	Explain in detail the zero dimensional, one dimensional, two dimensional and three dimensional imperfections in crystals. (15)	BT L 3	Applying
3.	Defects are responsible for many of the important properties of materials. List the various types of crystal defects and explain their significance in determining the properties for various applications. (15)	BT L 4	Analyzing
4.	Isolated atoms have discrete energy levels. When atoms are combined the energy levels overlap and form bands. Explain the formation of bands from discrete energy levels and categorize the materials based on the band formation. (15)	BT L 4	Analyzing
5.	Energy levels and bands are the convenient way of representing a solid material. With neat sketch, explain the formation of bands and classification of solids based on it. (15)	BT L 4	Analyzing

UNIT II - CONDUCTING MATERIALS

Introduction, factors affecting the conductivity of materials, classification based on conductivity of materials, temperature dependence of resistivity, Low resistivity materials (graphite, Al, Cu and steel) and its applications, high resistivity materials (manganin, constantan, nichrome, tungsten) and their applications. Superconductors: Meissner effect, classification and applications.

PART – A

Q.No	Questions	BT Level	Competence
1.	Define electrical conductivity.	BTL 1	Remembering
2.	How does age hardening affects the conductivity of materials?	BTL 2	Understanding
3.	List the types of conducting materials.	BTL 1	Remembering
4.	What are low resistive materials?	BTL 1	Remembering
5.	List the properties of low resistive materials.	BTL 1	Remembering
6.	Mention any two applications of copper.	BTL 1	Remembering
7.	Write the characteristics of graphite as a low resistive material.	BTL 2	Understanding
8.	Give the properties of tungsten.	BTL 1	Remembering
9.	Write the characteristics of constantan as a high resistive material.	BTL 2	Understanding
10.	Mention any two applications of manganin.	BTL 1	Remembering
11.	Define superconductivity.	BTL 1	Remembering
12.	What is the defining and deciding property of superconductors?	BTL 2	Understanding

13.	What is transition temperature?	BTL 1	Remembering
14.	How does magnetic field affect the superconducting nature of a material?	BTL 2	Understanding
15.	Superconducting tin has a critical temperature of 3.7 K at zero magnetic field and a critical field of 0.0306 Tesla at 0 K. Calculate the critical field at 2 K.	BTL 3	Applying
16.	Calculate the critical current for a wire of lead having a diameter of 1 mm at 4.2 K. Critical temperature for lead is 7.18 K and $Hc(0) = 6.5\times10^4$ A/m.	BTL 3	Applying
17.	The critical temperature for a metal with isotopic mass 199.5 is 4.185 K. calculate the isotopic mass if the critical temperature falls to 4.133 K.	BTL 3	Applying
18.	Plot the magnetization curves for type-I and type-II superconductors.	BTL 2	Understanding
19.	Superconductors are perfect diamagnetic materials. Justify.	BTL 2	Understanding
20.	Classify the superconducting materials based on the magnetization behavior in an external magnetic field and based on transition temperature.	BTL 1	Remembering
21.	What are high T_C superconductors? Give any two examples.	BTL 1	Remembering
22.	List any two medical applications of Superconductors.	BTL 1	Remembering
23.	Give the principle behind magnetic levitated trains.	BTL 2	Understanding
24.	What is a SQUID?	BTL 1	Remembering
	PART – B		
1.	What is electrical conductivity? Mention the factors that affect the conductivity of materials. (13)	BTL 1	Remembering
2.	Categorize the materials based on resistivity. List the various factors that affect the conductivity of materials. (13)	BTL 1	Remembering
3.	Classify materials based on the conductivity. Explain the temperature dependence of resistivity. (13)	BTL 2	Understanding
4.	(i) Explain the factors that influence the conductivity of materials. (7) (ii) Explain the temperature dependence of resistivity. (6)	BTL 2	Understanding
5.	Define low resistive materials. List out the characteristics, properties and applications of any two low resistive materials. (13)	BTL 2	Understanding
6.	What kind of materials are graphite, Al, Cu and steel based on the resistivity? Give the characteristics and properties of each material. (13)	BTL 4	Analyzing
7.	Define High resistive materials. List the characteristics, properties and applications of any two high resistive materials. (13)	BTL 2	Understanding
8.	Identify the resistivity nature of manganin, constantan, nichrome and tungsten. List any two characteristics and applications of the above materials. (13)	BTL 4	Analyzing
9.	Explain in detail the properties and applications of any two low and high resistive materials. (13)	BTL 2	Understanding
10.	i) What are superconductors? Give an example. (3) ii) Explain the various properties of superconductor. (10)	BTL 1 BTL 2	Remembering Understanding
11.	Explain in detail the various properties of superconductors. (13)	BTL 2	Understanding
12.	Write short notes on the following. a) Persistent current (4) b) Meissner effect (5)	BTL 2	Understanding

	c) Effect on current and magnetic field (4)		
13.	i) Explain Meissner effect. (5) ii)Differentiate between type I & type II superconductors. (8)	BTL 2	Understanding
14.	How do you classify the materials based on the response to the applied external magnetic field? Explain them in detail with a neat sketch. (13)	BTL 2	Understanding
15.	(i) Classify the materials based on the critical temperature. (5) (ii) Distinguish between hard and soft superconductors. (8)	BTL 1	Remembering
16.	Explain in detail the applications of superconducting materials. (13)	BTL 2	Understanding
17.	Explain the working principles of (i) SQUIDS (6) (ii) Magnetic Levitation (7)	BTL 2	Understanding
	PART C		
1.	For windings of electrical machines and transformers, copper is preferred to aluminium. Give the characteristics, properties and applications of Cu and Al. List the advantages of Al over Cu in transformer applications. (15)	BTL 4	Analyzing
2.	Enlist some high resistivity alloys suitable as conductive materials. Compare the nichrome, constantan and manganin from different viewpoints. (15)	BTL 4	Analyzing
3.	The resistivity of mercury suddenly drops to zero when cooled below 4.2 K. Identify the phenomenon that arises within it and explain the properties of the above material. (15)	BTL 3	Applying
4.	(i) When a magnetic field is applied, diamagnetic materials repel back all the lines of force. Superconductors are perfect diamagnetic material. Explain the diamagnetic nature of superconductors. Explain the application which works on this diamagnetic behavior of superconductors. (10) (ii) Prove that the susceptibility of a superconductor is –1. (5)	BTL 3	Applying
5.	Discuss the applications of superconducting materials in the following (i) Fast electrical switching (ii) Detection of very weak magnetic signals (iii) Super-fast trains without frictional loss (15)	BTL 3	Applying
	UNIT III - SEMICONDUCTING AND MAGNETIC MATERIALS		
	Semiconductors: Introduction, types of semiconductors, temperature dependence of semiconductors, compound semiconductors, basic ideas of amorphous and organic semiconductors. Magnetic Materials: classification of magnetic materials, ferromagnetism-B-H curve (Qualitative), hard and soft magnetic materials, magneto materials applications.		
	PART – A		
Q.No	**Questions**	**BT Level**	**Competence**
1.	Define semiconductor in terms of band gap.	BTL 1	Remembering
2.	List the properties of semiconductors.	BTL 2	Understanding

3.	What are elemental and compound semiconductors?	BTL 1	Remembering
4.	Classify the semiconductors based on the impurities present in the material. Give two examples of each semiconductors.	BTL 1	Remembering
5.	Mention the limitations of the intrinsic semiconductors.	BTL 2	Understanding
6.	What is doping?	BTL 1	Remembering
7.	How is an n-type semiconductor formed and give an example?	BTL 2	Understanding
8.	Sketch the energy band diagram of an extrinsic semiconductor.	BTL1	Remembering
9.	Differentiate intrinsic and extrinsic semiconductors.	BTL1	Remembering
10.	What are organic semiconductors?	BTL 1	Remembering
11.	Define amorphous semiconductors.	BTL 1	Remembering
12.	Define magnetic dipole.	BTL 1	Remembering
13.	What is intensity of magnetization?	BTL 1	Remembering
14.	Derive the relation between relative permeability (μ_r) and susceptibility (χ).	BTL 2	Understanding
15.	Categorize the magnetic materials based on magnetic moment.	BTL 2	Understanding
16.	Why diamagnets are called weak magnets?	BTL 1	Remembering
17.	Magnetic field Intensity of a paramagnetic material is 10^4 A/m. At room temperature, its susceptibility is 3.7×10^{-3}. Calculate the magnetization in the material.	BTL 3	Applying
18.	The magnetic susceptibility of a medium is 940×10^{-4}. Calculate its relative permeability.	BTL 3	Applying
19.	What are magnetic domains?	BTL 1	Remembering
20.	Mention the four types of energies involved in the growth of magnetic domains.	BTL 1	Remembering
21.	Recall the term retentivity.	BTL 2	Understanding
22.	What is meant by hysteresis loss?	BTL 1	Remembering
23.	Differentiate soft and hard magnetic materials.	BTL 1	Remembering
24.	Define Giant Magneto-resistance.	BTL 1	Remembering
	PART – B		
1.	What are semiconductors? Classify the semiconductors based on composition of the material, impurities and band gap. (13)	BTL 1	Remembering
2.	(i) Compare and contrast between elemental and compound semiconductors. (8) (ii) Explain the temperature dependence of semiconductors. (5)	BTL 4	Analyzing
3.	What is an extrinsic semiconductor? Sketch the energy band diagram and explain n-type and p-type semiconductor with an example. (3 + 10)	BTL 2	Understanding
4.	(i) Distinguish between intrinsic semiconductors and extrinsic semiconductors. (6) (ii) Compare and contrast n-type and p-type semiconductor. (7)	BTL 2	Understanding

5.	(i) Discuss about compound semiconductors? (6) (ii) Distinguish between elemental and compound semiconductors. (7)	BTL 2	Understanding
6.	Write short notes on the following (i) Compound semiconductors (4) (ii) Organic Semiconductors (4) (iii) Amorphous Semiconductors (5)	BTL 1	Remembering
7.	Give the basic ideas about organic and amorphous semiconductors. (13)	BTL 1	Remembering
8.	Explain the classification of magnetic materials based on their spins. (13)	BTL 2	Understanding
9.	Compare and contrast the characteristics and properties of diamagnetic, paramagnetic and ferromagnetic material. (13)	BTL 2	Understanding
10.	(i)What is meant by Ferromagnetism? (3) (ii) Explain with neat diagrams, how the magnetization occurs in a ferromagnetic magnetic material, after the application of magnetic field. (10)	BTL 2	Understanding
11.	Explain different types of energy involved in domain growth. (13)	BTL 1	Remembering
12.	Explain the different types of energies that are responsible for growth of domains in a ferromagnetic material. (13)	BTL 1	Remembering
13.	(i) Define the term coercivity and retentivity. (3) (ii)Explain the lagging of magnetization behind the magnetizing field with the help of an B-H curve. (10)	BTL 2	Understanding
14.	(i)What are soft and hard magnetic materials? (3) (ii)Write the differences between soft and hard magnetic materials. (10)	BTL 1	Remembering
15.	(i)Write a short note on B-H curve. (6) (ii)Differentiate soft and hard magnetic materials. (7)	BTL 2	Understanding
16.	Describe the working of magnetic hard disc based on GMR sensor. Mention its advantages and disadvantages. (13)	BTL 2	Understanding
17.	Explain the writing and reading of data in magnetic hard disk using GMR sensors. (13)	BTL 3	Applying
	PART C		
1.	Si is used in manufacturing of integrated chips and different electronic components. With a neat diagram, explain about the formation of pure silicon and the formation of n-type and p-type with the help of impurities. (15)	BTL 3	Applying
2.	Spin of the magnetic materials and its arrangement decides the properties of magnetic materials. With necessary diagrams and examples, compare the properties of magnetic materials based on their spins. (15)	BTL 3	Applying
3.	Ferromagnetic magnetic material is similar to a polycrystalline material with a large number of domains in it. Discuss the spontaneous magnetization of ferromagnetic materials with the help of domains. Compile the theory based on energy involved in the ferromagnetic material. (15)	BTL 4	Analyzing
4.	When a ferromagnetic material is placed in a magnetic field (H), the magnetic induction (B) lags behind applied field. Plot an B – H curve and explain the magnetic hysteresis loop formation on the basis of domain theory of ferromagnetism. (15)	BTL 3	Applying

5.	GMR sensors which have a very high magnetic sensitivity, are used to read the data at greater speed. Explain the process of recording binary data (0 and 1) and the process of retrieving the information with the help of a GMR sensor. (15)	BTL 4	Analyzing

UNIT IV - DIELECTRIC AND INSULATING MATERIALS

Dielectric Materials: Introduction, classification, temperature dependence on polarization, properties, dielectric loss, factors influencing dielectric strength and capacitor materials, applications. Insulators: Introduction, thermal and mechanical properties required for insulators, Inorganic materials, organic materials, liquid insulators, gaseous insulators and ageing of insulators, applications.

PART – A

Q. No	Questions	BT Level	Competence
1.	Define dipole moment.	BTL 1	Remembering
2.	What is dielectric constant?	BTL 1	Remembering
3.	What is meant by polarization in a dielectric material?	BTL 1	Remembering
4.	List the different types of polarization.	BTL 1	Remembering
5.	Define ionic polarization.	BTL 1	Remembering
6.	What is space charge polarization?	BTL 1	Remembering
7.	Calculate the electronic polarizability of an isolated Se atom. The atomic radius of an Se atom is 0.12 nm.	BTL 3	Applying
8.	What is the polarization produced in sodium chloride by an electric field of 600 V/mm if it has a dielectric constant of 6?	BTL 3	Applying
9.	If NaCl is subjected to an electrical field of 1000 V m^{-1} and the resulting polarization is 4.3 X 10^{-8} C/m^2, calculate the relative permittivity of NaCl.	BTL 3	Applying
10.	How does temperature affects orientational and ionic polarization?	BTL 2	Understanding
11.	Mention the different types of dielectric materials?	BTL 2	Understanding
12.	Give the factors that affecting dielectric loss.	BTL 2	Understanding
13.	Define dielectric strength.	BTL 1	Remembering
14.	List the properties of dielectrics in capacitor applications.	BTL 1	Remembering
15.	Mention any four uses of dielectrics in transformers.	BTL 1	Remembering
16.	How does the porosity affects the mechanical properties of an insulating material?	BTL 2	Understanding
17.	Mention the effect of thermal conductivity on insulating materials.	BTL 2	Understanding
18.	Categorize the classification of insulators based on the material used.	BTL 1	Remembering
19.	Name some of the organic and inorganic insulating materials.	BTL 1	Remembering
20.	What are askarels?	BTL 2	Understanding
21.	Give the characteristics of silicone fluids.	BTL 2	Understanding
22.	Give the advantages of inorganic fiber materials over organic fibers materials.	BTL 2	Understanding

23.	What is ageing in insulators?	BTL 1	Remembering
24.	Give any four applications of insulators.	BTL 1	Remembering
	PART – B		
1.	Define polarization. Discuss the different types of polarization and the effect of temperature on these polarizations. (3+10)	BTL 1	Remembering
2.	Explain the various types of polarization mechanism involved in dielectrics and their dependence of temperature. (13)	BTL 2	Understanding
3.	What is dielectric loss? Derive an expression for power loss and the factors affecting dielectric loss. (3 +10)	BTL 2	Understanding
4.	Explain the phenomenon of dielectric loss in detail. Give the various factors affecting the power loss in dielectrics. (13)	BTL 2	Understanding
5.	(i) Define dielectric strength and list the factors that influence the dielectric strength of a material. (8) (ii)Discuss the effect of temperature on different polarization mechanism. (5)	BTL 2	Understanding
6.	Discuss the uses of dielectric materials as capacitors and transformers. (13)	BTL 3	Applying
7.	Explain in detail about the application of dielectrics. (13)	BTL 2	Understanding
8.	Define insulators. Mention the thermal and mechanical properties of an insulating material. (3+10)	BTL 2	Understanding
9.	Explain in detail about the various solid insulating materials. (13)	BTL 2	Understanding
10.	Discuss in detail about the organic and inorganic materials used as solid insulating materials. (13)	BTL 2	Understanding
11.	Describe in detail about the various liquid insulation materials. (13)	BTL 2	Understanding
12.	Explain in detail the properties and characteristics of various liquids as an insulating material. (13)	BTL 2	Understanding
13.	List and explain the properties and applications of gases in insulating materials. (13)	BTL 2	Understanding
14.	Write briefly about the gaseous insulating materials. (13)	BTL 2	Understanding
15.	(i) Discuss the thermal and mechanical properties of an insulating material. (8) (ii) Discuss the various ageing phenomenon that can take place in insulators. (5)	BTL 2	Understanding
16.	What is ageing? Explain about the various ageing process that can occur in insulation materials. Give the remedies to avoid ageing in insulators. (13)	BTL 2	Understanding
17.	(i) Write a short note on ageing in insulators. (6) (ii) Discuss the applications of insulators. (7)	BTL 2	Understanding

PART - C			
1.	The displacement between positively and negatively charged particles by a small distance on the application of electric field produces electric dipoles. Discuss the polarization phenomenon occurring in various dielectric and the effect of temperature on these polarizations. (15)	BTL 4	Analyzing
2.	The power loss in an ideal capacitor is zero, but it is difficult to manufacture ideal capacitors. Explain the power loss in dielectric materials when an ac voltage is applied and arrive an expression for the power loss in commercial dielectrics. (15)	BTL 4	Analyzing
3.	Identify the properties of dielectric that makes it suitable for capacitor and transformer applications. Discuss the applications of dielectrics in capacitors and transformers. (15)	BTL 3	Applying
4.	Explain in detail about the different types of insulating materials along with their characteristics and applications. (15)	BTL 2	Understanding
5.	(i) Explain the thermal and mechanical properties of insulating materials. (10) (ii) Mention the applications of insulating materials. (5)	BTL 2	Understanding

UNIT V - OPTOELECTRONIC AND NANO ELECTRONIC MATERIALS

Optoelectronic materials. Introduction, properties, factor affecting optical properties, role of optoelectronic materials in LEDs, LASERs, photo detectors, solar cells. Nano electronic Materials: Introduction, advantage of nanoelectronic devices, materials, fabrication, challenges in Nano electronic materials.

PART - A

Q.No	Questions	BT Level	Competence
1.	What are optical materials?	BTL 1	Remembering
2.	Classify the optical materials based on their interaction with visible light.	BTL 2	Understanding
3.	What are translucent materials?	BTL 1	Remembering
4.	Why are metals opaque in nature?	BTL 1	Remembering
5.	Are all insulators transparent in nature? Justify.	BTL 3	Applying
6.	What are optoelectronic devices?	BTL 1	Remembering
7.	Justify why LEDs are preferred to have hemispherical shape?	BTL 3	Applying
8.	Calculate the wavelength of radiation emitted by an LED with band gap energy 2.8 eV.	BTL 3	Applying
9.	Which material is most suitable for producing blue LEDs? Explain why?	BTL 2	Understanding
10.	What is a heterojunction laser?	BTL 1	Remembering
11.	List the applications of laser diodes.	BTL 1	Remembering
12.	Define photodetectors.	BTL 1	Remembering
13.	Write the working principle of solar cell.	BTL 2	Understanding
14.	Mention any two merits of solar cell.	BTL 1	Remembering
15.	The wavelength of light emission in an LED is 1.55 μm. Calculate the	BTL 3	Applying

	band gap in eV?		
16.	State Moore' law.	BTL 1	Remembering
17.	What are the major drawbacks of microelectronics?	BTL 2	Understanding
18.	Define nanoelectronics.	BTL 1	Remembering
19.	Mention any four advantages of nanoelectronics devices.	BTL 1	Remembering
20.	List some of the commonly used materials in nanoelectronics devices.	BTL 2	Understanding
21.	What is top-down and bottom-up approach of nanomaterials synthesis?	BTL 1	Remembering
22.	Give any two advantages of ball milling method.	BTL 2	Understanding
23.	What is meant by lithography?	BTL 1	Remembering
24.	List any two applications of sol-gel method.	BTL 1	Remembering
	PART – B		
1.	Enlist various optical phenomena that are observed when light falls on a material? Briefly explain each of them. Explain: reflectivity, absorptivity and transmissivity. (13)	BTL 2	Understanding
2.	Differentiate between transparent, translucent and opaque materials. Quote examples of each of them. (13)	BTL 2	Understanding
3.	Discuss the optical properties of non-metals, metals, semiconductors and insulators. Why does the gold appear yellow, but silver appears white? (13)	BTL 3	Applying
4.	What is meant by minority charge carrier injection? Explain how a P-N junction diode acts as a LED. (13)	BTL 2	Understanding
5.	Explain the principle and working of LED with a neat diagram and mention its advantages and disadvantages. (13)	BTL 2	Understanding
6.	What is a laser diode? Explain the construction and working of Ga-As laser. (13)	BTL 1	Remembering
7.	Explain the principle, construction and working of a semiconductor diode laser. (13)	BTL 2	Understanding
8.	Describe the principle, construction and working of a solar cell with a neat diagram. Also mention any four applications. (13)	BTL 2	Understanding
9.	Explain the principle and working of a large area photo-voltaic device which converts sunlight directly into electricity. (13)	BTL 2	Understanding
10.	Describe the construction and working of a p-i-n photo detector. (13)	BTL 2	Understanding
11.	Describe the construction and working of an avalanche photo detector. (13)	BTL 2	Understanding
12.	(i) What is nanoelectronics? State Moore's law and the need for nanotechnology in electronics. (5) (ii) List the advantages of nanoelectronics devices. (8)	BTL 2	Understanding
13.	Describe with a neat sketch how the nanoparticles are prepared employing transfer of design of patterns on a semiconductor substrate by lithography. (13)	BTL 3	Applying
14.	Describe the conventional method of particle size reduction by mechanical crushing. (13)	BTL 2	Understanding

15.	Explain in detail about chemical vapor deposition technique for fabrication of nanomaterials. (13)	BTL 2	Understanding
16.	Explain the synthesis of nanoparticles using sol-gel method. (13)	BTL 2	Understanding
17.	Explain any one method for the synthesis of nanomaterials. (13)	BTL 2	Understanding
	PART-C		
1.	Explain the principle of injection luminescence. Describe the theory and working of LED. What are the advantages of using LED in electronic display? (15)	BTL 2	Understanding
2.	Can light be used in materials processing like cutting, welding etc. List the properties to be modified in a light to make it suitable for material processing. With necessary description and explain the construction and working of a solid state laser source used for cutting complex shapes. (15)	BTL 3	Applying
3.	Communication satellites require an electric power source to work in the vacuum of space. Design a photovoltaic cell circuit using a semiconducting material to power the satellites. With a neat diagram explain the operation of the above circuit when exposed to sunlight along with its advantages and disadvantages. (15)	BTL 3	Applying
4.	A detector circuit in the street lights uses switch –on relays to turn on the street lights and turn off the lights when the diode fails to conduct. Construct a circuit for the above said detector and explain its operation along with the advantages and disadvantages. (15)	BTL 3	Applying
5.	Describe a technique to synthesize nanophase materials. Discuss their applications in various fields. (15)	BTL 2	Understanding