VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF PHYSICS

QUESTION BANK

II SEMESTER

PH6251 – ENGINEERING PHYSICS - II

Regulation – 2013

Academic Year 2016 – 17

Prepared by

Dr.H.Krishnan, Dr.M.Anbuchezhiyan , Dr.K.Sarojini , Dr.K.Thiruppathi,
Ms.S.Gandhimathi , Mrs.D.Praveena, Ms.R.Sasireka, Ms.R.NithyaBalaji
Ms.S.Sowmiya & Ms.M.P.Ramya Rajan

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DEPARTMENT OF PHYSICS

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SUBJECT : ENGINEERING PHYSICS - II

SEM / YEAR: II Sem / I Year

UNIT I - CONDUCTING MATERIALS			
Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.			
PART - A			
Q.No	**Questions**	**BT Level**	**Competence**
1.	What are the sources of the resistance in a metal?	BTL1	REMEMBERING
2.	What are free electrons and bound electrons?	BTL1	REMEMBERING
3.	Give any three postulates of classical free electron theory.	BTL2	UNDERSTANDING
4.	Define drift velocity. How is it different from thermal velocity of an electron?	BTL1	REMEMBERING
5.	Define the terms relaxation time, collision time and Mean free path of an electron.	BTL1	REMEMBERING
6.	Define Electrical resistivity and mobility.	BTL1	REMEMBERING
7.	How does electrical resistivity of a metal vary with temperature?	BTL3	APPLYING
8.	The mobility of electron in copper is $3x10^{-3}$ m^2/Vs. Assuming e = $1.6x10^{-19}$C and m_e= $9.1x10^{-31}$ kg, calculate the Mean free time.	BTL4	ANALYSING
9.	Differentiate between electrical conductivity and thermal conductivity.	BTL1	REMEMBERING
10.	What are the merits of classical free electron theory of metals?	BTL2	UNDERSTANDING
11.	Find the drift velocity of electrons in a copper wire whose cross sectional area is 1 mm^2. When the wire carries a current of 10 A. Assume that each copper atom contributes one electron of the electron gas. Given n = $8.5x10^{28}$ /m^3	BTL3	APPLYING
12.	A conducting rod contains $8.5x10^{28}$ electrons per m^3. Calculate the electrical conductivity at room temperature if the collision time for electron is 2 X 10^{-14} s.	BTL3	APPLYING
13.	State any three assumptions of quantum free electron theory.	BTL1	REMEMBERING

14.	Define Fermi level and Fermi Energy with its importance.	BTL1	REMEMBERING
15.	Write down the expression for Fermi-Dirac distribution function and plot it as a function of energy.	BTL5	EVALUATING
16.	Why we have energy bands in solids and energy levels in gases.	BTL4	ANALYSING
17.	Define Lorentz number	BTL1	REMEMBERING
18.	The thermal conductivity of a metal is 123.92 W/m/k. Find the electrical conductivity and Lorentz number when the metal possess relaxation time 10^{-14} seconds and 300 K.(Density of electrons = 6 x 10^{28} /m^3).	BTL3	APPLYING
19.	The Fermi temperature of a metal is 24600 K. Calculate the Fermi velocity.	BTL3	APPLYING
20.	The Fermi level for potassium is 2.1eV. Calculate the velocity of electrons at the Fermi level.	BTL3	APPLYING

PART - B

1.	i) Define Electrical conductivity. Derive an expression for electrical conductivity of a metal by using classical free electron theory. (2+10)	BTL2	UNDERSTAND
	ii) Find the mobility of electrons in copper if there are 9x10^{28} valence electrons/m^3 and the conductivity of copper is 6x10^7 mho/m. (4)	BTL3	APPLYING
2.	i) Define thermal conductivity. Derive an expression for thermal conductivity of a metal. (2+10)	BTL2	UNDERSTAND
	ii) Calculate the electrical and thermal conductivities for a metal with a relaxation time 10^{-14} second at 300 K. Also calculate Lorentz number using the above result. (Density of electrons = 6x10^{28} m^{-3}). (4)	BTL3	APPLYING
3.	Deduce mathematical expression for electrical conductivity and thermal conductivity of a conducting material and hence obtain Wiedemann-Franz law. (6+6+4)	BTL2	UNDERSTAND
4.	Starting with the classical free electron theory of metals obtain the expression for electrical and thermal conductivity and deduce the value for Lorentz number. (4+10+2)	BTL5	EVALUATING
5.	Derive an expression for the density of states and based on that calculate the carrier concentration in metals. (12+4)	BTL1	REMEMBER
6.	i) Starting with the density of energy states obtain the expression for the Fermi energy of an electron at 0 K and hence obtain the expression for the average energy of an electron. (12)	BTL2	UNDERSTAND
	ii) The Fermi energy of silver is 5.51 eV. What is the average energy of a free electron at 0 K. (4)	BTL3	APPLYING
7.	(i) Explain the meaning of density of states. Derive an expression for the number of allowed states for unit volume of a solid. (12)	BTL2	UNDERSTANDING

	(ii) Show that at 0 K, the average energy is $(3/5^{th})$ of the electrons of the Fermi energy. (4)	BTL3	APPLYING
8.	Define density of states. Derive an expression for density of states in a metal and hence obtain the Fermi energy in terms of density of free electrons. (2+14)	BTL2	UNDERSTAND
9.	i) Discuss in detail about quantum free electron theory. (6)	BTL2	UNDERSTAND
	ii) Calculate the number of states per unit volume in an energy interval of 0.01 eV above the Fermi energy of sodium metal. The Fermi energy of sodium at 0 K is 3 eV. (6)	BTL1	REMEMBER
	iii)A uniform silver wire has a resistivity of 1.54×10^{-8} ohm/m at room temperature. For an electric field along the wire of 1 Volt/cm, compute the average drift velocity of electron assuming that there is 5.8×10^{28} conduction electrons/m^3. Also calculate the mobility. (4)	BTL5	EVALUATING
10.	Write an expression for the Fermi energy distribution function F(E) and discuss its behaviour with change in temperature. Plot F(E) versus E for T = 0 K, and T > 0 K. (12+4)	BTL5	EVALUATING
11.	What are Fermi particles or Fermions? Based on Fermi dirac statistics, state the nature of fermi distribution function. How does it vary with temperature? (2+14)	BTL5	EVALUATING
12.	i) Explain Fermi dirac distribution for electrons in a metal. (4)	BTL5	EVALUATING
	ii) Obtain an expression for Fermi energy at temperature T = 0 K and relate it to Fermi energy at non zero temperature. (12)	BTL2	UNDERSTANDING
13.	i) List the drawbacks of classical free electron theory and discuss the merits of quantum free electron over classical theory. (8)	BTL1	REMEMBERING
	ii)Use the Fermi distribution function to obtain the value of F(E) for the level just 0.01eV above the Fermi level at 200 K. (4)	BTL5	EVALUATING
	iii) Evaluate the Fermi function of an energy K_BT above the Fermi energy . (4)	BTL5	EVALUATING
14.	i) The density of silver is 10.5×10^3 kg/m^3. The atomic weight of silver is 107.9. Each silver atom provides one conduction electron. The conductivity of silver at 20°C is $6.8 \times 10^7 ohm^{-1}m^{-1}$. Calculate the density of electron and also the mobility of electrons in silver. (4)	BTL3	APPLYING
	ii) Calculate the electrical and thermal conductivities of a metal with the relaxation time of 10^{-14} second at 300 K. The electron density is 6×10^{26} m^{-3}. (4)	BTL3	APPLYING
	iii) Calculate the Fermi energy and Fermi temperature in a metal. The Fermi velocity of electrons in the metal is 0.86×10^6 m/s. (4)	BTL5	EVALUATING
	iv) Calculate the Fermi energy of copper at 0° K if the concentration of electrons is 8.5×10^{28} m^{-3} (4)	BTL5	EVALUATING

UNIT II - SEMICONDUCTING MATERIALS

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

PART - A

Q.No	Questions	BT	Competence
1.	Define semiconductor. Write any four properties of semiconducting materials?	BTL2	UNDERSTANDING
2.	Compare with Ge, Si is widely used to manufacture the elemental device. Why?	BTL1	REMEMBERING
3.	Differentiate elemental and compound semiconductors.	BTL4	ANALYZING
4.	Why compound semiconductors are called direct band gap semiconductors?	BTL5	EVALUATING
5.	Compare intrinsic and extrinsic semiconductors.	BTL4	ANALYZING
6.	What are the limitations of intrinsic semiconductor?	BTL4	ANALYZING
7.	Calculate the conductivity of an intrinsic semiconductor if the mobilities of electrons and holes in it are 8.6 x10^6 $m^2V^{-1}s^{-1}$ and 1.7 x10^6 $m^2V^{-1}s^{-1}$ respectively. The electron and hole densities in the sample is 2.2 x$10^{19}/m^3$.	BTL3	APPLYING
8.	The resistivity of intrinsic semiconductor Germanium at 300 K is 0.47 Ω m. If the electron and hole mobilities are 0.38 and 0.18 $m^2V^{-1}s^{-1}$. Calculate the carrier density at 300 K.	BTL3	APPLYING
9.	Find the resistance of an intrinsic Ge rod 1 cm long ,1mm wide and 0.5 mm thick at 300K.For Ge: n_i =2.5 x$10^{19}/m^3$,μ_e= 0.39 $m^2V^{-1}s^{-1}$, μ_h= 0.19 $m^2V^{-1}s^{-1}$ at 300 K.	BTL3	APPLYING
10.	Give any four differences between n-type and p-type semiconductors.	BTL4	ANALYZING
11.	Define donors and acceptors & give its ionisation energy.	BTL1	REMEMBERING
12.	Define mobility.	BTL1	REMEMBERING
13.	The conductivity of a semiconductor increases with increases in temperature, while that of metal decreases .Justify.	BTL5	EVALUATING
14.	Draw the diagram to show the variation of Fermi level with temperature in the case of p-type semiconductor for high and low doping level.	BTL6	CREATING
15.	Define Fermi level. Mention the position of Fermi level in the case of intrinsic and extrinsic semiconductors at 0 K.	BTL1	REMEMBERING
16.	What is Hall voltage?	BTL2	UNDERSTANDING
17.	How can you identify an n-type and p-type semiconductors using Hall effect method?	BTL5	EVALUATING

18.	Mention any four applications of Hall effect.	BTL1	REMEMBERING
19.	An n-type semiconductor has Hall Co-efficient = $4.16x10^{-4}$ m^3/C. The conductivity is 108 Ω^{-1} m^{-1}. Calculate the carrier density n_e and electron mobility at room temperature.	BTL3	APPLYING
20.	A magnetic flux density of 0.5 wb/m^2 applied from front to back perpendicular to largest faces of a specimen. A current of 20 mA flows length wise and, the voltage measured across its width is found to be 37μV. The dimensions of the specimen are 12 mm long, 1 mm wide and 1mm thick. Find the Hall coefficient.	BTL3	APPLYING
	PART - B		
1.	Derive an expression for density of electrons in the conduction band and density of holes in the valence band in an intrinsic semiconductor. (16)	BTL1	REMEMBERING
2.	Derive the intrinsic carrier concentration for intrinsic semiconductor and also calculate the Fermi level and its variation with temperature. (16)	BTL1	REMEMBERING
3.	Write the expression for electron and hole concentration in an intrinsic semiconductor and hence derive the expression : $E_f = \left(\frac{E_c+E_v}{2}\right) + \frac{3}{4}kTln\left(\frac{m_h^*}{m_e^*}\right)$ for the Fermi level in the intrinsic semiconductor. (16)	BTL2	UNDERSTANDING
4.	i) Derive the Electrical Conductivity of an intrinsic semiconductor. (6)	BTL2	UNDERSTANDING
	ii) Discuss the variation of electrical conductivity with temperature. (5)	BTL2	UNDERSTANDING
	iii) Find the intrinsic carrier concentration and position of Fermi energy level in silicon with respect to the Valence Band edge. Given $m_e^* = 0.49\ m_o$ and $m_h^* = 0.92\ m_o$ $N_c = 2.21 \times 10^{25}/m^3$, $N_v = 8.60 \times 10^{24}/m^3$ and T= 300 K. (5)	BTL3	APPLYING
5.	Explain the method of determining the band gap of a semiconductor. Also describe the experimental determination of Band gap. (16)	BTL4 & BTL2	ANALYZING & UNDERSTANDING
6.	Write an expression for electrical conductivity of an intrinsic semiconductor interms of forbidden energy gap. How can one mearsure energy gap experimentally? (16)	BTL1	REMEMBERING
7.	Derive an expression for the carrier concentration of electrons in the conduction band of n-type semiconductor. (16)	BTL1	REMEMBERING
8.	Obtain an expression for the density of electrons in the conductance band of an n-type semiconductors and show that it is proportional to square root of donor concentration at low temperatures. Also state what happens at high temperatures. (16)	BTL1	REMEMBERING

9.	Derive an expression for the carrier concentration of holes in the Valence band of p type semiconductor. (16)	BTL1	REMEMBERING
10.	Obtain an expression for the density of holes in the valence band of p-type semiconductors and show that it is proportional to square root of acceptor concentration at low temperatures. Also state what happens at high temperatures. (16)	BTL1	REMEMBERING
11.	With neat sketches, explain the variation of Fermi level with impurity concentration and temperature in n-type and p-type semiconductor. (16)	BTL2	UNDERSTANDING
12.	i) Explain the variation of carrier concentration with temperature and impurity in a semiconductor. (8)	BTL2	UNDERSTANDING
	ii) Explain the variation of electrical conductivity in extrinsic semiconductor. (8)	BTL2	UNDERSTANDING
13.	i)What is Hall Effect ?Derive an expression of Hall coefficient and mobility of charge carriers. Describe an experimental setup for the measurement of Hall coefficient. (12)	BTL2	UNDERSTANDING
	ii) The Hall co-efficient of certain silicon was found to be -7.35×10^{-5} m^3C^{-1} from 100 to 400 K. Determine the nature of the semiconductor. If the conductivity was found to be 200 m^{-1} Ω^{-1}, Calculate the density and mobility of the charge carriers. (4)	BTL3	APPLYING
14.	Derive an expression for the charge density in terms of Hall voltage and explain how the mobility of charge carriers can be evaluated by knowing the conductivity. (16)	BTL1 & BTL2	REMEMBERING & UNDERSTANDING

UNIT III - Magnetic and Superconducting Materials

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High T_c superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

PART - A

Q.No	Questions	BT	Competence
1.	Classify magnetic materials based on their magnetic moments.	BTL4	ANALYSING
2.	What is Bohr Magneton? Write its value.	BTL6	CREATING
3.	What are paramagnetic materials? Give examples.	BTL1	REMEMBERING
4.	Define intensity of magnetization and flux density.	BTL1	REMEMBERING
5.	A magnetic field of 2000 A/m is applied to a material which has a succeptibility of 1000. Calculate the (i) Intensity of Magnetisation and (ii) Flux density	BTL3	APPLYING

6.	Define magnetic susceptibility and permeability.	BTL1	REMEMBERING
7.	A magnetic field of 1800 ampere/metre produces a magnetic flux of $3x10^{-5}$ weber in an iron bar of cross sectional area 0.2 cm^2. Calculate permeability.	BTL3	APPLYING
8.	Define retentivity and coercivity.	BTL1	REMEMBERING
9.	Define hysteresis. What is meant by hysteresis loop and What do you infer from it?	BTL5	EVALUATING
10.	Distinguish Ferro and anti-ferromagnetic materials.	BTL2	UNDERSTANDING
11.	Define superconductivity.	BTL1	REMEMBERING
12.	Mention the condition for the material to behave as a superconductor.	BTL4	ANALYSING
13.	Define critical temperature and critical field.	BTL1	REMEMBERING
14.	What is isotope effect?	BTL1	REMEMBERING
15.	What is meant by persistent current?	BTL1	REMEMBERING
16.	What are cryotron switches?	BTL1	REMEMBERING
17.	Define cooper pairs.	BTL1	REMEMBERING
18.	How can you change a superconductor from Type I to Type II	BTL4	ANALYSING
19.	Calculate the critical current for a wire of lead having a diameter of 1mm at 4.2 K. Critical temperature for lead is 7.18 K and $H_0 = 6.5x10^4$ A/m.	BTL3	APPLYING
20.	The critical temperature for Hg with isotopic mass 199.5 at 4.184 K. Calculate the critical temperature when its mass changes to 203.4.	BTL3	APPLYING
PART - B			
1.	i)State the origin of magnetic moment (4)	BTL1	REMEMBERING
	ii) How are magnetic materials classified based on magnetic moments? Compare their properties. Give also their characteristics and examples. (12)	BTL2	UNDERSTANDING
2.	Distinguish between various magnetic materials in terms of permanent dipole moment. (16)	BTL6	CREATING
3.	Explain ferromagnetic domain theory. Briefly explain different types of energy involved in domain growth. (16)	BTL4	ANALYSING
4.	Discuss the domain structure in ferromagnetic materials. Show how the hysteresis curve is explained on the basis of domain theory. (16)	BTL2	UNDERSTANDING
5.	i) Draw the B-H curve (Hysteresis) for a ferromagnetic material and explain the Retentivity and Coercivity fields in the B-H curve. (8)	BTL2	UNDERSTANDING
	ii) Discuss the hysteresis curve on the basis of domain theory of ferromagnetism. (8)	BTL2	UNDERSTANDING
6.	i) Compare soft and hard magnetic materials. (8)	BTL6	CREATING
	ii) Prove $\mu_r = 1 + \chi_m$. (4)	BTL3	APPLYING
	iii) What is antiferromagnetism? Give examples. Mention its	BTL2	UNDERSTANDING

	characteristics. (4)		
7.	i) What are ferrites? Explain the structure of ferrites, properties and its applications. (14)	BTL1	REMEMBERING
	ii) Why are Ferrites advantages for use as transformer core? (2)	BTL3	APPLYING
8.	Explain the different properties of superconductors in detail. (16)	BTL4	ANALYSING
9.	Write an essay on different types of superconducting materials, their properties and their applications. (16)	BTL1	REMEMBERING
10.	i) What is Meissner effect? Prove that all superconductors are perfect dia-magnet in superconducting state. (8)	BTL6	CREATING
	ii) Discuss the important features and the prediction of BCS theory. (8)	BTL6	CREATING
11.	i) What are cooper pairs? Give an outline of BCS theory of superconductivity. (10)	BTL1	REMEMBERING
	ii) Explain in detail about hard and soft superconductors. (6)	BTL6	CREATING
12.	i) Differentiate the Type I and Type II superconductor's (8)	BTL6	CREATING
	ii) Write an essay on High temperature superconductors. (8)	BTL5	EVALUATING
13.	i) Discuss the applications of superconductors in detail. (14)	BTL2	UNDERSTANDING
	ii) 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. Find the critical field at 2 K. (2)	BTL3	APPLYING
14.	Explain the following in detail (4+ 4+ 4+ 4) i) AC and DC Josephson Effect ii) SQUID ii) Cryotron iv) Magnetic Levitation	BTL2	UNDERSTANDING

UNIT IV - Dielectric Materials

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

PART - A

Q.No	Questions	BT	Competence
1.	Define dielectrics.	BTL1	REMEMBERING
2.	Distinguish Lorentz and Coloumb force in Dielectrics.	BTL2	UNDERSTANDING
3.	Define dielectric susceptibility and polarizability of a dielectric.	BTL1	REMEMBERING
4.	Distinguish between active and passive dielectrics.	BTL2	UNDERSTANDING
5.	Define dielectric constant.	BTL1	REMEMBERING
6.	What is mean by relaxation frequency in dielectrics?	BTL1	REMEMBERING
7.	Write short note on space charge polarization.	BTL1	REMEMBERING

8.	What are different mechanisms of polarization in dielectric?	BTL2	UNDERSTANDING
9.	Differentiate dielectric loss and dielectric breakdown.	BTL2	UNDERSTANDING
10.	Explain the important requirements of insulators.	BTL5	EVALUATING
11.	Show that the electronic polarizability for a monoatomic gas increases as the size of the gas increases.	BTL3	APPLYING
12.	The polarizability of krypton atom is 2.18 $\times 10^{-40}$ Fm^2.Calculate its dielectric constant at 0^0C and 1 atmosphere. The number of krypton atoms at NTP is $2.69 \times 10^{25} / m^3$.	BTL3	APPLYING
13.	Define dipole moment and classify dielectric materials on its basis.	BTL4	ANALYZING
14.	Explain polar and non polar dielectrics.	BTL4	ANALYZING
15.	Calculate the electronic polarizability of an argon atom whose $\varepsilon_r = 1.0024$ at NTP and $N = 2.7\times 10^{25}$ atoms per m^3. Given $\varepsilon_0 = 8.85 \times 10^{-12}$F/m.	BTL5	EVALUATING
16.	The dielectric constant is 80. Is water a good dielectric? Is it useful for energy storage in capacitors? Justify your answer.	BTL1	REMEMBERING
17.	List the properties of ferroelectric materials.	BTL4	ANALYZING
18.	An atom has a polarizability of $10^{-40}Fm^{-2}$.It finds itself at a distance of 1.0 nm from proton. Calculate the dipole moment induced in the atom ($\varepsilon_0 = 8.85 \times 10^{-12}$F/m).	BTL3	APPLYING
19.	Compare the properties of Pyroelectrics and piezo electrics.	BTL6	CREATING
20.	Name a few uses of dielectrics.	BTL6	CREATING
PART - B			
1.	Define the following: a) Polarizability b) Polarization vector. c) Electric flux density d) Electric Succeptibility. Give the necessary equations relating the above quantities. (16)	BTL1	REMEMBERING
2.	Discuss electronic and ionic polarizations with examples in detail. (10+6)	BTL2	UNDERSTANDING
3.	Explain the different types of polarization mechanisms involved in a dielectric material. (16)	BTL1	REMEMBERING
4.	(i). Explain the frequency and temperature dependence of all type of polarization in dielectrics. (12)	BTL2	UNDERSTANDING

	(ii). The relative dielectric constant of sulphur is 3.75 when measured at 27°C.Assuming the internal field $\gamma = 1/3$, Calculate the electronic polarizability of sulphur, if its density at this temperature is 2050 kg/m^3 .The atomic weight of sulphur being 32. (4)		
5.	(i). Explain the term internal field in solids . Derive an expression for the Lorentz field for elemental dielectrics. (12) (ii). A solid 5×10^{28} identical atoms per m^3, each with the polarizability of 2×10^{-40} F m^2. Assuming that the internal field is given by Lorentz relation, calculate the ratio of internal field to the applied field. (4)	BTL2	UNDERSTANDING
6.	What is meant by local field in a dielectric? And how it is calculated for a cubic structure? Deduce the Clausius – Mosotti relation. (16)	BTL1	REMEMBERING
7.	(i).Define dielectric loss. Derive the expression for dielectric loss and draw graph for power loss changes with frequency. (2+10)	BTL2	UNDERSTANDING
	(ii) A capacitor consists of two conducting plates of area 200 cm^2 each separated by a dielectric constant $\varepsilon = 3.7$ of thickness 1mm. Find the capacitance and the electric flux density when a potential of 300 V is applied. ($\varepsilon_0 = 8.85 \times 10^{-12}$F/m). (4)	BTL2	UNDERSTANDING
8.	(i). Give the detailed discussion on the various types of dielectric breakdown in dielectric materials. (12) (ii). What are the remedies to avoid the breakdown mechanism. (4)	BTL5	EVALUATING
9.	(i) Briefly explain the effect of frequency and temperature on polarization of dielectrics. (12) (ii). Deduce the Clausius-Mossotti relation. (4)	BTL2	UNDERSTANDING
10.	(i).Discuss in detail about the various dielectric breakdown mechanism. (8) (ii).Explain the ionic polarization in a dielectric material. (8)	BTL1	REMEMBERING
11.	(i).Explain the temperature and frequency dependence of polarization. (8) (ii).Explain ferroelectric materials and their properties. (8)	BTL2	UNDERSTANDING
12.	(i). Define thermal breakdown of the dielectrics and explain its characteristics. (6) (ii). What are the different types of dielectric materials used in capacitors? What will be the resulting characteristics? (10)	BTL2	UNDERSTANDING

13.	(i).What is ferroelectricity? Explain the properties of ferro electric materials. (2+10) (ii).Mention any five applications ferro electric materials. (4)	BTL2	UNDERSTANDING
14.	(i).What is ferroelctricity?. Explain the hysteresis curve exhibited by a ferroelectric material with a suitable sketch. Give example for ferroelectric materials. (12) (ii).Write a short note on uses of dielectric materials? (4)	BTL5	EVALUATING

UNIT V - ADVANCED ENGINEERING MATERIALS

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications

PART - A

Q.No	Questions	BT	Competence
1	Define Metallic glasses.	BTL1	REMEMBERING
2	What is meant by glass transition temperature?	BTL2	UNDERSTANDING
3	What do you understand by the term quenching?	BTL2	UNDERSTANDING
4	List the merits of metallic glasses as transformer core materials	BTL1	REMEMBERING
5	Mention any four properties of metallic glasses	BTL1	REMEMBERING
6	State any four applications of metallic glasses	BTL1	REMEMBERING
7	Define transformation temperature?	BTL2	UNDERSTANDING
8	What is meant by shape memory effect?	BTL2	UNDERSTANDING
9	Differentiate Martensite and Austenite phase	BTL4	ANALYZING
10	What is pseudo elasticity?	BTL1	REMEMBERING
11	Differentiate one-way and two-way shape memory alloys?	BTL4	ANALYZING
12	Mention the advantages and disadvantages of shape memory alloys.	BTL4	ANALYZING
13	What are nanophase materials? Give examples.	BTL1	REMEMBERING
14	State few techniques for synthesis of nano phased materials.	BTL1	REMEMBERING

15	Explain top down and bottom up approach in nano materials?	BTL4	ANALYZING
16	Give any four non-linear optical properties.	BTL1	REMEMBERING
17	What is meant by second harmonic generation?	BTL2	UNDERSTANDING
18	What are bio-materials?	BTL1	REMEMBERING
19	Classify the types of bio-materials?	BTL4	ANALYZING
20	What are the applications of biomaterials?	BTL1	REMEMBERING

PART – B			
S.No	**Questions**	**Level**	**Competency**
1	What are metallic glasses? Describe the preparation,properties and applications of metallic glasses.	BTL1	REMEMBERING
2	How are metallic glasses prepared? Explain how the melt spinner device can be used to produce met glasses.	BTL4	ANALYZING
3	Explain the properties and application of metallic glasses also mention its types with examples	BTL4	ANALYZING
4	What are shape memory alloys (SMA)? Describe the characteristics of SMA and its applications?	BTL2	UNDERSTANDING
5	i) Mention the properties of Ni –Ti alloy.	BTL1	REMEMBERING
	ii) Explain the applications of SMA	BTL4	ANALYZING
	iii) Explain the advantages and disadvantages of SMA.	BTL4	ANALYZING
6	What are nanomaterials? Explain the preparation, properties and applications nanomaterials.	BTL1	REMEMBERING
7	Describe the method of producing nano materials using Pulsed laser deposition Chemical vapour deposition.	BTL3	APPLYING
8	i) Explain Birefringence ii) Explain optical Kerr effect. iii) Explain non-linear materials. Give examples.	BTL2	UNDERSTANDING
9	Explain the origin of non-linear optics? How are second harmonic wave generate.	BTL2	UNDERSTANDING
10	Explain the classification and modern applications of biomaterials in the field of medicine.	BTL1	REMEMBERING
11	Write a short note on i) Nanophase materials and their applications ii) Pulsed laser deposition	BTL1	REMEMBERING
12	Give an account on Shape Memory Alloys and their applications.	BTL3	APPLYING
13	i) Give the properties and applications of metallic glasses. ii) Describe the properties and applications of Shape Memory Alloys.	BTL3	APPLYING

14	i) Explain electro-optic and magneto-optic Kerr effect. ii) Write a short note on biomaterials.	BTL1	REMEMBERING