SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF PHYSICS

QUESTION BANK

I SEMESTER

1920103-ENGINEERING PHYSICS

Academic Year 2020 – 2021

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SUBJECT : 1920103- ENGINEERINGPHYSICS

SEM / YEAR: I SEM/AY-2020-2021

UNIT I - PROPERTIES OF MATTER

Elasticity – Stress-strain diagram and its uses – Poisson's ratio- factors affecting elastic modulus and tensile strength – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders

PART – A

Q.No	Questions	BT Level	Competence
1.	Define elasticity.	BTL 2	Understanding
2.	State Hooke's law.	BT L 2	Understanding
3.	Define stress and strain with units.	BTL 2	Understanding
4.	Draw stress-strain diagram for brittle and ductile material.	BT L 2	Understanding
5.	What do you infer from stress and strain diagram?	BT L 4	Analyzing
6.	List the three modulii of elasticity.	BT L 1	Remembering
7.	What force is required to stretch a steel wire to double its length when its area of cross section is 2 cm^2 and young's modulus is 2 x 10^{11} N/m^2 .	BT L 3	Applying
8.	An artificial denture with ultimate strength of 10^7 Nm^{-2} breaks when the jaws exerted a normal force of just 2N while eating. Estimate the area in which the force acted on the denture.	BT L 3	Applying
9.	An elastic wire is cut into half of its original length. How will it affect the maximum load the wire can support?	BT L 4	Analyzing
10.	What is Poisson's ratio?	BT L 1	Remembering
11.	Define tensile strength.	BT L 1	Remembering
12.	List any two factors which affect elastic modulus and tensile strength.	BTL 2	Understanding
13.	Two solid cylinders of same material having same radii with length ℓ and 2 ℓ are joined coaxially. Under an applied couple between free ends the shorter cylinder shows a twist of 20°. Calculate the angle of twist in longer cylinder.	BT L 3	Applying
14.	What is a beam?	BT L 2	Understanding
15.	What is Neutral axis?	BT L 4	Analyzing
16.	Give the moment of inertia expression for a rectangular and circular cross section of a beam.	BT L 2	Understanding
17.	Calculate the Young's modulus of the material in the cantilever method. The length of cantilever beam is 1m which is suspended with a load of 150 gm. The depression is found to be 4 cm. The thickness of the beam is 5 mm and breadth is 3 cm.	BT L 3	Applying
18.	What is non-uniform bending and why is said to be non-uniform?	BT L 1	Remembering
19.	How will you reduce depression in an I-shaped girder?	BT L 1	Remembering
20.	When a wire is bent back and forth it becomes hot. Why?	BT L 4	Analyzing

	PART – B		
1.	Draw stress - strain diagram and discuss the behavior of a ductile material under loading. (13)	BT L 2	Understanding
2.	Explain the factors which affect the elasticity of the material. (13)	BT L 2	Understanding
3.	Derive an expression for the couple per unit angular twist when a cylinder is twisted. (13)	BT L 1	Remembering
4.	(i) Derive an expression for twisting couple of a cylinder. (10) (ii) A wire of length 1 m and diameter 1 mm is clamped at one of its ends. Calculate the couple required to twist the other end by 90°. Given modulus of rigidity = 298 GPa. (3)	BT L 1 BT L 4	Remembering Analyzing
5.	Derive an expression for the period of oscillation of a torsional pendulum. How it is used to determine the torsional rigidity of a wire? (13)	BT L 2	Understand
6.	Derive an expression for rigidity modulus of a wire using a torsion pendulum. (13)	BT L 1	Remembering
7.	What is meant by bending moment of a beam? Derive an expression for the bending moment of a beam. (13)	BT L 1	Remembering
8.	Derive an expression for the depression at the free end of a cantilever due to load. (13)	BT L 1	Remembering
9.	Derive with relevant theory how a cantilever can be used to determine the Young's modulus of the material of a bar. (13)	BT L 1	Remembering
10.	Derive an expression for the elevation at the centre of a beam which is loaded at both ends. (13)	BT L 1	Remembering
11.	Derive an expression for Young's modulus of a material by uniform bending method. (13)	BT L 1	Remembering
12.	Explain with necessary theory and experimental part the determination of Young's modulus of the material of a beam supported at its ends and loaded in the middle. (13)	BT L 2	Understanding
13.	How will you determine the Young's modulus of a material of a bar by non-uniform bending method? Explain the theory and experiment behind the determination of Young's modulus. (13)	BT L 2	Understanding
14.	i) Write a short note on I-shaped girders. What are the advantages and applications of an I-shaped girder? (10) ii) A circular and a square cantilever are made of same material and have equal area of cross section and length. Find the ratio of their depression, for a given load. (3)	BT L 2 BT L 4	Understanding Analyzing
	PART C		
1.	A disc suspended by a wire, which twists first in one direction and then in the reverse direction, in the horizontal plane. How this method is used to determine the : a) Moment of inertia of the disc and b) Rigidity modulus of the wire using moment of inertia. (15)	BT L 6	Creating
2.	Cranes are necessary when a considerable area has to be served as in steel stockyards and ship building berths. Derive an expression to find Young's modulus of the given method along with the experimental technique. (15)	BT L 6	Creating

3.	A beam forms an arc of a circle and its gets elevated, when it is loaded. Mention the type of the bending formed while loading. Describe an experiment with necessary theory to find the Young's modulus of the givenbeam. (15)	BT L 6	Creating
4.	Centrally loaded beam will not form an arc of a circle. Justify. Derive an expression to find Young's modulus of the given beam and also describe an experiment to find the Young's modulus of the given beam. (15)	BT L 6	Creating

UNIT II - LASERS AND FIBER OPTICS

Lasers: population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Nd-YAG laser-Semiconductor lasers: homojunction and heterojunction – Applications.

Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, and mode) – losses associated with optical fibers–Fiber optic communication- fibre optic sensors: pressure and displacement- Endoscope.

PART – A

Q.No	Questions	BT Level	Competence
1.	State the properties of Laser beam.	BTL 2	Understanding
2.	What are the conditions required for Laser action?	BTL 1	Remembering
3.	Why focusing of Laser Light is better than ordinary light?	BTL 3	Applying
4.	Write the difference between spontaneous emission and stimulated emission.	BTL 4	Analyzing
5.	Find the ratio of population of the two states in a Nd –YAG laser that produces light of wavelength 1064Å at 27°C.	BTL 3	Applying
6.	What is meant by population inversion and metastable state?	BTL 1	Remembering
7.	Why a three level laser normally provides pulsed output?	BTL 1	Remembering
8.	Why we prefer four level laser over three level laser even if its efficiency is low?	BTL 2	Understanding
9.	What is an optical resonator cavity? Mention its role in a laser.	BTL 3	Applying
10.	Calculate the wavelength of light emission from GaAs whose band gap is 3 eV.	BTL 3	Applying
11.	What are the main sections of an optical fibre? Explain the function of each section.	BTL 1	Remembering
12.	List out the conditions to be satisfied for total internal reflection.	BTL 2	Understanding
13.	Explain the term acceptance cone of an optical fiber	BTL 3	Applying
14.	What is meant by modes? Compare a single mode and multimode fiber	BTL 4	Analyzing
15.	Why does intermodal dispersion occur?	BTL 5	Evaluating

16.	A fiber optic cable has an acceptance angle of 30° and a core index of refraction of 1.4. Calculate the refractive index of the cladding	BTL 3	Applying
17.	A silica optical fiber has a core refractive index of 1.51 and a cladding refractive index of 1.48. Determine the critical angle at the core cladding interface.	BTL 3	Applying
18.	How will you classify optical fibres based on the materials?	BTL 2	Understanding
19.	What is an active and passive fibre optic sensor?	BTL 1	Remembering
20.	Why data carrying capacity of optical fiber is more than that of radio waves?	BTL 2	Understanding
	PART – B		
1.	Find the relation between Einstein's coefficient of spontaneous and stimulated emissions. (13)	BTL 2	Understanding
2.	For atomic transitions, derive Einstein's relation and hence deduce the expressions for the ratio of spontaneous emissions rate to stimulated emission rate. (13)	BTL 1	Remembering
3.	Explain the principle, construction and working of a Nd-YAG laser. Also give its advantages. (13)	BTL 4	Analyzing
4.	With the help of an energy diagram, explain the construction and working of a four level solid laser , where the Nd^{3+} ions act as the active centers. (13)	BTL 5	Evaluating
5.	Explain the principle, construction and working of a semiconductor diode laser. Mention its advantages and disadvantages. (13)	BTL 4	Analyzing
6.	Compare a homojunction semiconductor laser with hetero junction semiconductor laser and detail their features. (13)	BTL 4	Analyzing
7.	Define numerical aperture and derive an expression for numerical aperture and angle of acceptance of fibre in terms of refractive index of the core and cladding. (13)	BTL 1	Remembering
8.	What is an optical fiber? Give the basic principles of light guidance through the optical fiber. Derive an expression for numerical aperture of an optical fiber. (13)	BTL 2	Understanding
9.	i) Discuss the following losses in optical fibres. a). Scattering loss b). Bending loss c). Absorption loss (9) ii) The optical power after propagating through a fibre of 1.5 km length is reduced to 25 % of its original value. Compute the fibre loss in db/km. (4)	BTL 2 BTL 5	Understanding Evaluating
10.	Explain the optical fibre communication system with a suitable block diagram. (13)	BTL 2	Understanding
11.	Explain the construction and working of pressure and displacement sensors. (13)	BTL 4	Analyzing
12.	What is attenuation? Discuss the different mechanisms which are responsible for attenuation in the optical fiber. (13)	BTL 2	Understanding

13.	What are the different types of fibre optic sensors? Explain the working of any two sensors. (13)	BTL 1	Remembering
14.	With neat diagram, Explain the construction and working of fibre optic endoscope. (13)	BTL 2	Understanding
	PART C		
1.	Germanium and Silicon have four valence electrons, when doped with trivalent or pentavalent impurities they form P type and N type semiconductors. Is it possible to use these materials for producing for a intense, monochromatic and coherent beam. if so, with necessary theory construct a laser source using these semiconductors and explain the working with neat diagram (15)	BT L 6	Creating
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 4	Analyzing
3.	If a person decides to use light as mode of communication, list out the various losses in detail that has to been taken care while using optical fibre as wave guide in communication. (15)	BTL 4	Analyzing
4.	The invention of laser made a boom in communication technology. By total internal reflection the laser can be made to pass through an optical fibre, with necessary block diagram explain how an optical fibre can be used in communication? Also mention the advantages of optical fibre communication over other conventional communication system. (15)	BT L 6	Creating

UNIT III - THERMAL PHYSICS

Transfer of heat energy – thermal conduction, convection and radiation – Newton's law cooling (qualitative) -heat conductions in solids – thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

PART – A

Q.No	Questions	BT Level	Competence
1.	Define the three modes of heat transfer.	BTL 1	Remembering
2.	Distinguish between conduction and convection.	BTL 4	Analyzing
3.	Define radiation and give an example	BTL 2	Understanding
4.	State the Newton's Law of Cooling.	BTL 2	Understanding
5.	Define coefficient of thermal conductivity and mention its unit.	BTL 1	Remembering
6.	Explain the term steady state.	BTL 1	Remembering
7.	What is meant by thermal gradient?	BTL1	Remembering
8.	Explain why the specimen used to determine thermal conductivity of a bad conductor should have a large area and small thickness.	BTL 2	Understanding
9.	Calculate the thicknesss of the slab of area $90x10^{-4}m^2$ through	BTL 3	

	which 6 Joules of heat is flowing per second through the opposite faces maintained at a temperature difference of 20K. The coefficient of thermal conductivity of the material of the slab is 0.04 $Wm^{-1}K^{-1}$.		Applying
10.	How are heat conduction and electrical conduction analogous to each other?	BTL 4	Analyzing
11.	Is it possible for two objects to be in thermal equilibrium if they are not in contact with each other? Explain.	BTL 3	Applying
12.	What is the principle involved in Lee's disc method to determine the thermal conductivity of bad conductors?	BTL 2	Understanding
13.	What is meant by thermal insulation?	BTL 1	Remembering
14.	What are the important properties of thermal insulating materials?	BTL 2	Understanding
15.	The roof building is often painted white during summer. Why?	BTL 4	Analyzing
16.	A slab with area of 73 x 10^{-4} m^2 through which 16 J of heat is flowing through the both faces in 15 seconds and a temperature difference of 27 K is maintained. Calculate the thickness of the slab where its thermal conductivity is 0.01 $Wm^{-1}K^{-1}$	BTL 3	Applying
17.	What is meant by heat exchangers? How the heat is measured using it?	BTL 1	Remembering
18.	What is meant by solar power? How will you estimate it?	BTL 5	Evaluating
19.	Explain the principle of refrigeration.	BTL 2	Understanding
20.	Define oven.	BTL 1	Remembering
	PART – B		
1.	i) Explain conduction, convection and radiation processes. (10) ii) A rod of 0.25 m long and 0.892 × 10^{-4} m^2 area of cross section is heated at one end through 120 °C while the other end is kept at 50 °C. The quantity of heat which will flow in 15 minutes along the rod is 8.811× 10^3 J. Calculate thermal conductivity of the rod. (3)	BTL1 BTL4 BTL2	Remembering Analyzing Understanding
2.	i) Mention the applications of Newton's Law of Cooling and also mention the limitation of Newton's Law of Cooling (5) ii) Explain with examples, various modes of heat transmission. (8)	BTL 3 BTL 2	Applying Understanding
3.	How will you determine then thermal conductivity of a poor conductor using Lee's disc method? Give the necessary theory. (13)	BTL 2	Understanding
4.	With a neat diagram, Explain a method to determine the thermal conductivity of a bad conductor. (13)	BTL 1	Remembering
5.	Describe Forbe's method to determine thermal conductivity of a conductor in the form of a long bar. (13)	BTL 2	Understanding
6.	Explain the method of determining thermal conductivity of good conductors. (13)	BTL 3	Applying
7.	Derive an expression for the quantity of heat flow through a metal slab whose faces are kept at two different temperatures. Use this expression to determine the thermal conductivity in parallel and series mode. (13)	BTL 2	Understanding

8.	Derive the expression for effective thermal conductivity through compound media in series and parallel. Also discuss the application of it. (13)	BTL 3	Applying
9.	Explain in detail the concept of thermal insulation	BTL 1	Remembering
10.	Explain : heat exchangers with neat diagram	BTL 2	Understanding
11.	How are heat exchangers helpful in refrigerators, ovens, solar water heater? (13)	BTL4	Analyzing
12.	Describe the working of a refrigerator. Give a few applications of Refrigerators. (13)	BTL 3	Applying
13.	What is the principle used in oven? Mention any two advantages and disadvantages of it. (13)	BTL 1	Remembering
14.	Describe the principle, construction and working of solar water heater. Mention two advantages and Disadvantages of it. (13)	BTL 3	Applying
	PART C		
1.	a) Write in detail how transfer of heat taking place from one point to other point. Give your idea why heat is not transferred in vacuum through conduction and convection? why its transferred through only radiation? (5) b) How will you effectively design the house, auditorium and other structural components based on the concepts of thermal insulation? (10)	BTL 5	Evaluating
2.	Explain the principle of heat exchangers. Describe the working of any one application of heat exchangers. (15)	BTL 4	Analyzing
3.	What are the types of ovens? Describe the working of any type of oven with its applications. Specify the safety precautions during handling of the ovens. (15)	BTL 3	Applying
4.	Consider the boilers made up of different layers of conducting materials. How the heat conduction takes place in such an arrangement when they are connected in series and parallel? (15)	BTL 4	Analyzing

UNIT IV - QUANTUM PHYSICS

Black body radiation – Planck's theory (derivation)- deduction of Wien's and Rayleigh jeans law – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations –particle in a one-dimensional - three dimensional potential box– tunnelling (qualitative) - scanning tunnelling microscope.

PART – A

Q. No	Questions	BT Level	Competence
1.	What do you mean by a black body?	BTL 1	Remembering
2.	Define Wien's displacement law.	BTL 1	Remembering
3.	State Rayleigh - Jeans law. What are its limitations?	BTL 4	analyzing
4.	Give an brief account on Compton effect.	BTL 1	Remembering
5.	Write the expression for Compton shift. Why it is not observable in the visible region of electromagnetic spectrum?	BTL 2	Understanding

6.	A photon of frequency ν_o scatters from an electron at rest and moves in a direction making an angle of 60° with the incident direction with the incident direction. If the frequency of the scattered photon is half that of incident photon, calculate the frequency of the incident photon.	BTL 3	Applying
7.	Find the change in wavelength of an X-ray photon when it is scattered through an angle of 135^0 by free electron.	BTL 4	Analyzing
8.	Differentiate between Ψ and $\|\Psi\|^2$	BTL 5	Evaluating
9.	What are matter-waves? Mention its significance with change in mass of particles.	BTL 4	Analyzing
10.	What is wave particle duality?	BTL 1	Remembering
11.	An electron at rest is accelerated through a potential of 5000 V. Calculate de-Broglie wavelength of matter wave associated with it.	BTL 3	Applying
12.	List the applications of Schrodinger wave equation.	BTL 1	Remembering
13.	Calculate the minimum energy an electron can possess in an infinitely deep potential well of width 4 nm.	BTL 5	Evaluating
14.	A cylinder filled with helium is heated up to 27^0 C. If a beam of helium atoms emerges out of the cylinder, then calculate the de Broglie wavelength associated with the helium atoms. Given that mass of one helium atom is 6.7×10^{-27} kg and $k = 1.38 \times 10^{-23}$ J/K.	BTL 3	Applying
15.	For a free particle moving within a one dimensional potential box, the ground state energy cannot be zero. Why?	BTL 3	Applying
16.	Calculate the energy required for an electron to jump from ground state to second excited state in a potential well of width "L".	BTL 3	Applying
17.	What are Eigen values and Eigen function?	BTL 2	Understanding
18.	Brief about the tunnelling phenomenon.	BTL 2	Understanding
19.	What is the principle of scanning tunnelling microscope?	BTL 1	Remembering
20.	Mention the major applications of quantum tunnelling.	BTL 1	Remembering
	PART – B		
1.	Write the postulates of Planck's quantum theory of radiation. Using quantum theory derives an expression for the average energy emitted by a black body and arrives at Planck's radiation law in terms of frequency. (5 + 8)	BTL 2	Understanding
2.	Derive an equation for Planck's quantum theory of radiation. (13)	BTL 2	Understanding
3.	What is Compton Effect? Give the theory of Compton effect and show that the Compton shift $\Delta\lambda = \frac{h}{m_0 c}(1 - \cos\theta)$. (13)	BTL4	Analyzing
4.	Derive an expression for the change in wavelength suffered by an X-ray Photon when it collides with an electron and describe the experimental part with necessary diagrams. (13)	BTL 3	Applying
5.	Describe G.P Thomson experiment for verifying de Broglie's concept of matter waves. (13)	BTL 3	Applying
6.	Derive the expression for de-Broglie wavelength for matter waves. Express the de-Broglie Wavelength in terms of energy and voltage. (13)	BTL 5	Evaluating

7.	a) Explain the physical significance of wave function. (6) b) What are matter waves? Write the properties of matter waves. (7)	BTL 2 BTL 1	Understanding Remembering
8.	Derive Schrodinger's time independent wave equation. (13)	BTL 6	Creating
9.	Derive Schrodinger's time dependent wave equation. (13)	BTL 6	Creating
10.	Derive Schrodinger's time independent & time dependent wave equation. (13)	BTL 6	Creating
11.	Solve time independent Schrodinger's wave equation for a particle trapped in a potential well and obtain Eigen functions and energy Eigen values for the particle. Also show that energy values are quantized. (13)	BTL 3	Applying
12.	Discuss the case of particle in a box on Schrodinger wave equation. Applying this to electron in metal. (13)	BTL 1	Remembering
13.	Explain in short the phenomenon of tunneling and elaborate the working of Scanning Tunneling Microscope with its applications and limitations. (13)	BTL 2	Understanding
14.	Discuss the construction, working and applications of Scanning Tunneling Microscope. Also mention its advantages and disadvantages. (13)	BTL 1	Remembering
	PART - C		
1.	With the concepts of quantum theory of black body radiation show how Planck's radiation law limits to the shorter wavelength and longer wavelength in their specific limits. (15)	BTL4	Analyzing
2.	Apply the Schrodinger wave equation for energy levels enclosed in a one-dimensional potential box of infinite height to obtain eigen values and the corresponding eigen function. (15)	BTL 3	Applying
3.	i) Calculate the energy of the electron in the energy level immediately after the lowest energy level, confined in a cubical box of 0.1 nm side. Also, find the temperature at which the energy of the molecules of a perfect gas would be equal to the energy of the electrons in the above-said level. (10) ii) Determine the velocity and kinetic energy of neutron having de Broglie wavelength 2 Å (mass of a neutron= 1.67×10^{-27} kg, h= 6.63×10^{-34} Js). (5)	BTL 3 BTL 3	Applying Applying
4.	Give the formulation of time independent Schrodinger equation for a free particle. Conceptualize mathematically the interpretation of position, probability density and normalization of wave function. (15)	BTL4	Analyzing

UNIT V - CRYSTAL PHYSICS

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances- coordination number and packing factor for SC, BCC, FCC, HCP and diamond structure (qualitative) - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – growth of single crystals: solution and melt growth techniques - Importance of crystal physics.

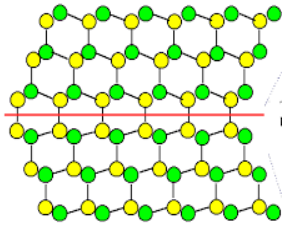
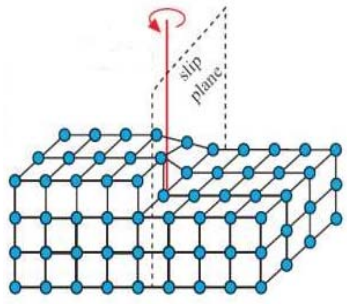
PART - A

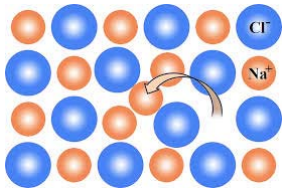
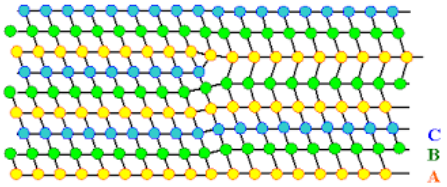
Q.No	Questions	BT Level	Competence
1.	What are single crystalline materials? Give example.	BTL1	Rememberin g

2.	Distinguish between crystalline and non-crystalline materials.	BTL4	Analyzing
3.	What is meant by primitive and non-primitive cell? Give an example.	BTL1	Rememberin g
4.	Define: unit cell.	BTL1	Rememberin g
5.	What are Bravais lattice?	BTL1	Rememberin g
6.	What are lattice parameters for a unit cell?	BTL1	Rememberin g
7.	Define space lattice. How it is useful to describe a crystal structure?	BTL1	Rememberin g
8.	Show the atomic positions in FCC and HCP crystal structures in a sketch.	BTL3	Applying
9.	For a cubic system, sketch the planes with Miller Indices (101), (110) and (011).	BTL2	Understandi ng
10.	A crystal plane cut at 3a, 4b and 2c distances along the crystallographic axes. Find the Miller Indices of the plane.	BTL4	Analyzing
11.	Distinguish between inter- planar spacing and inter atomic spacing.	BTL3	Applying
12.	Lead exhibits FCC structure. Each side of the unit cell is of 4.95 Å. Calculate the radius of Lead atom.	BTL4	Analyzing
13.	How carbon atoms are arranged in diamond structure?	BTL3	Applying
14.	Defects in crystals are not always harmful. Justify.	BTL5	Evaluating
15.	What is meant by crystal defect?	BTL 2	Understanding
16.	What are Schottky defects?	BTL 2	Understanding
17.	What are dislocations?	BTL 2	Understanding
18.	Define Burger's vector.	BTL1	Remembering
19.	What are the major practical factors to be considered during the growth of crystals from melt?	BTL1	Remembering
20.	Write any two applications of Czochralski and Bridgmann techniques.	BTL1	Remembering

PART - B

1.	Describe the seven systems of crystals with suitable diagrams and give the relation of lengths of axes and the relation between the axes of a unit cell in each type. (13)	BTL 2	Understanding
2.	Show that FCC is the most closely packed of the three cubic structures by working out the packing factor. (13)	BTL 2	Understanding
3.	What is atomic packing factor? Obtain atomic packing factor (APF) for SC, BCC and FCC structures. (2+3+4+4)	BTL 1	Remembering
4.	i) Describe BCC structure. Derive expression for the number of atoms, co-ordination number, atomic radius and packing factor. (10) ii) The density of copper is 8980 kg/m^3 and unit cell dimension is 3.61 Å, atomic weight of Cu is 63.54. Determine its crystal structure. Calculate the atomic radius and inter planar spacing of (110) plane. (3)	BTL2 BTL3	Understanding Applying

5.	i) Describe FCC structure. Derive the details about number of atoms, co- ordination number, atomic radius and packing factor. (10) ii) Metallic iron changes from BCC to FCC at 910 °C and corresponding atomic radii vary from 1.258 Å to 1.292 Å. Calculate the percentage volume change during this structural change. (3)	BTL2 BTL3	Understanding Applying
6.	Explain HCP structure. Show that for an HCP structure c/a = $\sqrt{8}$ /$\sqrt{3}$ and hence calculate packing fraction for HCP structure. (3 + 10)	BTL 2	Understanding
7.	i) Show that atomic packing factor for FCC and HCP are same. (10) ii) Show that for a simple cubic system d_{100}: d_{110}: d_{111} = $\sqrt{6}$:$\sqrt{3}$:$\sqrt{2}$. (3)	BTL 3 BTL 3	Applying Applying
8.	i) Derive the expression for the inter-planar spacing or d-spacing for (h k l) planes of a cubic structure. (9) ii) Determine lattice constant for FCC Lead crystal of radius 1.746 Å. Also find the spacing of (a) (1 1 1), (b) (2 0 0) and (c) (2 2 0). (4)	BTL 2 BTL 3	Understanding Applying
9.	Explain diamond cubic structure and obtain its number of atoms per unit cell, atomic radius, co-ordination number and atomic packing factor. (13)	BTL 4	Analyzing
10.	What is meant by crystal defects? Explain the various types of crystal defects with neat diagram. (2+11)	BTL 2	Understanding
11.	Explain about point defects and line defects with neat diagram. (13)	BTL 2	Understanding
12.	i) Write a note on point imperfections in crystals. (7) ii) Discuss a suitable method to grow single crystal of semiconducting materials. (6)	BTL 2	Understanding
13.	Explain the various solution growth techniques along with its merits and demerits. (13)	BTL 2	Understanding
14.	Explain the two melt growth techniques. i) Czochralski's method ii) Bridgmann technique (7 + 6)	BTL 2	Understanding
	PART-C		
1.	The lattice constant for a unit cell of NaCl is "a". The Miller indices are (h k l). Make up a relation between the lattice constant and Miller Indices.	BTL 2	Understanding
2.	A Zinc unit cell has a stacking sequence of AB AB AB. Deduce the c/a ratio and packing factor of Zinc.	BTL3	Applying
3.	In different types of crystals, the following defects are identified. Predict the defects and elaborate. **a.**  **b.** 	BTL 2	Understanding

	c.  **d.** 		
4.	Adapt a method to grow highly soluble crystals and elaborate.	BTL3	Applying