SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF PHYSICS

QUESTION BANK

I SEMESTER

1920103-ENGINEERING PHYSICS

Academic Year 2021 – 2022

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SUBJECT : 1920103- ENGINEERING PHYSICS

SEM / YEAR: I SEM/AY-2021-2022

UNIT I - PROPERTIES OF MATTER			
Elasticity – Hooke's law-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 1	Remembering
2.	State Hooke's law.	BTL 2	Understanding
3.	Define shearing strain.	BTL 1	Remembering
4.	Draw stress-strain diagram for brittle and ductile material.	BTL 2	Understanding
5.	What do you infer from stress and strain diagram?	BTL 2	Understanding
6.	Define elastic limit and plastic limit.	BTL 1	Remembering
7.	What is meant by yield point?	BTL 1	Remembering
8.	A copper wire of 3 m length and 1 mm diameter is subjected to a tension of 5 N. Calculate the elongation produced in the wire if the Young's modulus of copper is 120 GPa.	BTL 2	Understanding
9.	What force is required to stretch a steel wire to double its length when its area of cross section is 1 cm^2 and Young's modulus of elasticity is 2 x 10^{11} N/m^2.	BTL 2	Understanding
10.	State Poisson's ratio.	BTL 2	Understanding
11.	List any two factors which affects the tensile strength of the material.	BTL 1	Remembering
12.	What happens to the time period, if the diameter of the suspension wire is doubled without changing the length of a torsion pendulum?	BTL 2	Understanding
13.	A cylindrical wire of length 1 m and radius 5 mm is rigidly clamped at one end. Calculate the couple required to twist the free end through an angle 45 ° . Rigidity modulus of the material of the wire is 200 x 10^9 Pa.	BTL 2	Understanding
14.	Define torque.	BTL 2	Understanding
15.	What is a beam?	BTL 1	Remembering
16.	Define Neutral axis.	BTL 2	Understanding

17.	How various filaments of a beam get affected when it is loaded?	BTL 1	Remembering
18.	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.	BTL 2	Understanding
19.	What is non-uniform bending and why is it said to be non-uniform?	BTL 2	Understanding
20.	How can you reduce depression in an I-shaped girder?	BTL 2	Understanding
PART – B			
1.	Draw stress - strain diagram and discuss the behavior of a ductile material under loading. (13)	BT L 4	Analyzing
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	Applying
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 3	Analyzing Applying
5.	(i) Derive an expression for the period of oscillation of a torsional pendulum. (10) (ii) How will you find the rigidity modulus of a wire using torsion pendulum? (3)	BT L 3	Applying
6.	How could you determine the rigidity modulus of a wire using a torsion pendulum? (13)	BT L 4	Analyzing
7.	(i) Derive an expression for the bending moment of a beam. (7) (ii) Deduce bending moment of a beam for rectangular and circular cross sections. (6)	BT L 3 BT L 3	Applying Applying
8.	Derive an expression for the depression produced at the end of a cantilever beam. (13)	BT L 2	Understanding
9.	(i) Derive with relevant theory how a cantilever can be used to determine the Young's modulus of the material of a bar. (10) (ii) The end of a given strip, cantilever depresses 10 mm under a certain load. Calculate the depression under the same load for another cantilever of the same material, 2 times its length, 2 times in width, 3 times its thickness. (3)	BT L 3 BT L 3	Applying Applying
10.	Derive an expression for the elevation at the center of a beam which is loaded at both ends. (13)	BT L 4	Analyzing
11.	Deduce an expression for Young's modulus of a material by uniform bending method. (13)	BT L 3	Applying
12.	(i) Explain the theory and experiment to find the Young's modulus of a material by non-uniform bending method? (10) (ii) A rectangular bar of 0.02 m breadth, 0.01 m depth and 1 m length, is supported at the ends and a load of 2 kg is applied at its middle. Calculate	BT L 2 BT L 3	Understanding

	the depression, if the Young's modulus of the material of the bar is $2 \times 10^{11} Nm^{-2}$. (3)		Applying
13.	Explain with necessary theory and experimental part to determine the Young's modulus of the material of a beam supported at its ends and loaded in the middle. (13)	BT L 3	Applying
14.	(i) Write a short note on I-shaped girders. What are the advantages and applications of an I-shaped girder? (7) (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. (6)	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. (8) b) Rigidity modulus of the wire using moment of inertia. (7)	BT L 3	Applying
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 3	Applying
3.	A beam forms an arc of a circle and it 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 given beam. (15)	BT L 4	Analyzing
4.	i) Centrally loaded beam will not form an arc of a circle. Justify. Derive an expression to find the Young's modulus of the given beam. (8)	BT L 4	Analyzing
	ii) Describe an experiment to find the Young's modulus of the centrally loaded beam. (7)	BTL 3	Applying

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 fibers (material, refractive index, and mode) – losses associated with optical fibers–Fiber optic communication- fiber optic sensors: pressure and displacement- Endoscope.

PART – A

Q.No	Questions	BT Level	Competence
1.	List out the four characteristics of Laser beam.	BTL 1	Remembering
2.	Recall the conditions required for Laser action.	BTL 1	Remembering
3.	Define population inversion.	BTL 1	Remembering
4.	Discuss the difference between spontaneous emission and stimulated emission.	BTL 2	Understanding

5.	Laser action occurs by the transition from an excited state (E_2) to the ground state (E_1= 0). If the transition produces a light of wavelength 6930 Å, find the energy level of the excited state.	BTL 2	Understanding
6.	List the different pumping schemes for creating population inversion.	BTL 1	Remembering
7.	Paraphrase the term 'active material' in Laser?	BTL 2	Understanding
8.	Recite the role of optical resonator cavity in laser.	BTL 1	Remembering
9.	Differentiate between a homojunction and a heterojunction laser	BTL 2	Understanding
10.	Calculate the wavelength of light emission from GaAs whose band gap is 3 eV.	BTL 2	Understanding
11.	Tabulate the main sections of an optical fiber and list the function of each section.	BTL 1	Remembering
12.	List out the conditions to be satisfied for total internal reflection.	BTL 1	Remembering
13.	Define the term ' acceptance angle' of an optical fiber.	BTL 2	Understanding
14.	Tabulate the optical fiber type based on the material.	BTL 1	Remembering
15.	Compare and contrast single mode and multimode fiber.	BTL 2	Understanding
16.	Identify the reasons for intermodal dispersion to occur.	BTL 1	Remembering
17.	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 2	Understanding
18.	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 2	Understanding
19.	Define active and passive fiber optic sensor.	BTL 1	Remembering
20.	Identify the reason for the fastest data carrying capacity of an optical fiber than that of radio waves.	BTL 2	Remembering
	PART – B		
1.	Using the correct expressions, infer the relation between Einstein's coefficient of spontaneous and stimulated emissions. (13)	BTL 3	Applying
2.	(i) Define stimulated absorption and spontaneous emission (3) (ii) For atomic transitions, derive Einstein's relation and hence deduce the expressions for Einstein's coefficient. (10)	BTL 1 BTL 4	Remembering Analyze
3.	(i) Outline the principle, construction and working of an Nd-YAG laser. (10) (ii) List any three advantages of Nd-YAG laser. (3)	BTL 4 BTL 1	Analyzing Remembering
4.	With the help of an energy diagram, illustrate the construction and working of a four level solid state laser, where the Nd^{3+} ions act as the active centers. (13)	BTL 3	Applying
5.	(i) Explain the principle, construction and working of a semiconductor diode laser. (10) (ii) Mention the advantages and disadvantages of semiconductor diode lasers. (3)	BTL 4 BTL 1	Analyzing Remembering

6.	(i) With a neat sketch, explain homojunction semiconductor laser. (7) (ii) Summarize on heterojunction semiconductor laser with suitable diagram. (6)	BTL 4	Analyzing
7.	(i) Define numerical aperture with expression. (3) (ii) Deduce an expression for numerical aperture and angle of acceptance of fiber in terms of refractive index of the core and cladding. (10)	BTL 1 BTL 3	Remembering Applying
8.	Recite on 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.	Give a detailed classification of the optical fiber based on material, mode and refractive index. (13)	BTL 4	Analyzing
10.	(i) Discuss the following losses in optical fibers. a) Scattering loss b) Bending loss c) Absorption loss (10) (ii) The optical power after propagating through a fiber of 1.5 km length isreduced to 25 % of its original value. Compute the fiber loss in db/km. (3)	BTL 2 BTL 3	Understanding Applying
11.	Explain the optical fiber communication system with suitable block diagram. (13)	BTL 4	Analyzing
12.	(i) Explain the construction and working of pressure sensor. (7) (ii) Sketch the displacement sensor and discuss its working. (6)	BTL 2 BTL 3	Understanding Applying
13.	List the different types of fiber optic sensors? Explain the working of any two sensors. (13)	BTL 1	Remembering
14.	i) Summarize the working of fiber optic pressure sensor with neat sketch. (6) ii) With neat diagram, explain the construction and working of fiber opticendoscope. (7)	BTL 4	Analyzing
	PART C		
1.	Consider a laser source constructed with Germanium and Silicon. Is it possible to use these materials for producing an intense, monochromatic and coherent beam? If so, categorize the types of afford mentioned lasers with necessary theory, working and diagram. (15)	BTL 4	Analyzing
2.	With necessary description, describe the construction and working of a solid state laser source used for cutting complex shapes. (15)	BTL 4	Analyzing
3.	List out and summarize the various losses that has to be taken care while using optical fiber as wave guide in communication. (15)	BTL 4	Analyzing
4.	i) With necessary block diagram, illustrate how an optical fiber can be used in communication? (8) ii) Analyze the advantages of optical fiber communication over other conventional communication system. (7)	BTL 3 BTL 2	Applying Analyzing

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 2	Understanding
3.	Give the reason for the specimen used to determine thermal conductivity of a bad conductor should have a large area and small thickness.	BTL 2	Understanding
4.	What are the basic entities responsible for thermal conduction of a solid?	BTL 2	Understanding
5.	Define thermal diffusivity.	BTL 1	Remembering
6.	Define coefficient of thermal conductivity and mention its unit.	BTL 1	Remembering
7.	State Newton's law of cooling.	BTL 1	Remembering
8.	Discuss the term 'thermal gradient'.	BTL 2	Understanding
9.	A rod of length 50 cm is heated at one end to 98 °C, while the other end is kept at the room temperature. The area of cross section of rod is 0.67 cm^2. The thermal conductivity of the rod is 81 $Wm^{-1}K^{-1}$. Calculate the amount of heat conducted through the rod in 3 ½ minutes.	BTL 1	Remembering
10.	How are heat conduction and electrical conduction analogous to each other?	BTL1	Remembering
11.	Is it possible for two objects to be in thermal equilibrium if they are not in contact with each other? Explain.	BTL1	Understanding
12.	Mention the principle involved in Lee's disc method to determine the thermal conductivity of bad conductors.	BTL 2	Understanding
13.	Recite on the classification of thermal insulating material.	BTL 1	Remembering
14.	List two important properties of thermal insulating materials.	BTL 2	Understanding
15.	The roof building is often painted white during summer. Why?	BTL 2	Understanding
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 2	Understanding
17.	Write the principle of heat exchangers.	BTL 1	Remembering

18.	Give the principle of solar water heater.	BTL 1	Remembering
19.	State the principle of refrigeration.	BTL 1	Remembering
20.	Define oven.	BTL 1	Remembering
	PART – B		
1.	(i) Describe conduction, convection and radiation processes. (10)	BTL 4	Analyzing
	(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)	BTL 3	Applying
2.	(i) Outline various modes of heat transmission with examples. (10)	BTL 3	Applying
	(ii) Mention the applications and limitations of Newton's Law of Cooling. (3)	BTL 4	Analyzing
3.	How will you determine the thermal conductivity of a poor conductor using Lee's disc method? Give the necessary theory. (13)	BTL 3	Applying
4.	With a neat diagram, demonstrate a method to determine the thermal conductivity of a bad conductor. (13)	BTL 4	Analyzing
5.	Describe Forbe's method to determine thermal conductivity of metals with relevant theory and experiment. (13)	BTL 3	Applying
6.	Summarize a method of determining thermal conductivity of good conductors. (13)	BTL 4	Analyzing
7.	Give an expression for the quantity of heat flow through a metal slab whose faces are kept at two different temperatures. Using this, determine the thermal conductivity of a bad conductor. (13)	BTL 4	Analyzing
8.	Derive the expression for effective thermal conductivity through compound media in series and parallel. (13)	BTL 3	Applying
9.	Brief about the following i) Thermal insulation to walls, ceilings and floors. (7) ii) Thermal insulation to doors and windows. (6)	BTL 3	Applying
10.	With neat diagram, discuss the types of heat exchangers. (13)	BTL 4	Analyzing
11.	How are heat exchangers helpful in refrigerators and solar water heater? (13)	BTL 4	Analyzing
12.	Describe the working of a refrigerator. Give few applications of refrigerators. (13)	BTL 3	Applying
13.	Describe the type of oven which is used for sterilization of medical instruments. (13)	BTL 4	Analyzing
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.	(i) 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 it is transferred through only radiation? (8) (ii) How will you effectively design the house, auditorium and other structural components based on the concepts of thermal insulation? (7)	BTL 3 BTL 4	Applying Analyzing
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.	Define black body radiation.	BTL 1	Remembering
2.	Give any two characteristics of black body radiation spectrum.	BTL 1	Remembering
3.	Define Wien's displacement law.	BTL 1	Remembering
4.	State Rayleigh - Jeans law.	BTL 1	Remembering
5.	State Compton effect.	BTL 1	Remembering
6.	Write the expression for Compton shift. Why it is not observable in the visible region of electromagnetic spectrum?	BTL 2	Understanding
7.	Find the change in wavelength of an X-ray photon, when it is scattered through an angle of 135° by free electron.	BTL 3	Applying
8.	What are matter waves?	BTL 1	Remembering
9.	Calculate the de-Broglie wavelength(λ) of the earth, taking the mass of the earth to be 6×10^{24} kg and the orbital velocity of the earth is 3×10^{4} m/s.	BTL 2	Understanding

10.	List any two characteristics of matter waves.	BTL 1	Remembering
11.	Differentiate between Ψ and $\|\Psi\|^2$.	BTL 2	Understanding
12.	List any two applications of Schrodinger wave equation.	BTL 1	Remembering
13.	Calculate the lowest energy that a neutron can possess while it is confined inside the nucleus of an atom.	BTL 3	Applying
14.	Calculate the voltage applied to an electron microscope to produce electrons of wavelength 0.5 Å.	BTL 3	Applying
15.	The ground state energy cannot be zero for a free particle moving within a one-dimensional potential box. Justify.	BTL 2	Understanding
16.	Give the condition for normalization of wave function.	BTL 2	Understanding
17.	Define Eigen values and Eigen function.	BTL 2	Understanding
18.	Calculate the minimum energy of the particle moving in one-dimension in an infinitely high potential box of width 1 Å.	BTL 2	Understanding
19.	Write the principle of scanning tunneling microscope.	BTL 1	Remembering
20.	Mention any two applications of quantum tunneling.	BTL 1	Remembering
	PART – B		
1.	(i) Write any three postulates of Planck's quantum theory of radiation. (3) (ii) Using Planck quantum theory, derive an expression for the average energy emitted by a black body and arrives at Planck's radiation law in terms of frequency. (10)	BTL 4	Analyzing
2.	Deduce an equation for Planck's quantum theory of black body radiation. (13)	BTL 4	Analyzing
3.	Using the conservation laws, derive an expression for Compton shift and show that it is independent of the wavelength of incident photon. (13)	BTL 3	Applying
4.	(i) Derive an expression for the change in wavelength of an X-ray photon when it collides with an electron. (10) (ii) Describe the experimental part of Compton effect. (3)	BTL 3	Applying
5.	(i) Discuss about the de-Broglie hypothesis and determine an expression for wavelength of matter waves. (7) (ii) Illustrate, how the matter waves are experimentally verified using G.P Thomson experiment. (6)	BTL4	Analyzing
6.	Derive an expression for de-Broglie wavelength of matter waves in terms of (i) Energy (6) (ii) Voltage. (7)	BTL 3	Applying
7.	(i) Derive an expression for de-Broglie wavelength. (7) (ii) Outline the physical significance of wave function. (6)	BTL 3 BTL 4	Applying Analyzing

8.	Starting with classical wave equation associated with a moving particles, formulate the time independent wave equation. (13)	BTL4	Analyzing
9.	Obtain time dependent Schrodinger's wave equation for a free particle of mass m and energy E. (13)	BTL4	Analyzing
10.	Deduce the following: (i) Schrodinger's time independent wave equation (7) ii) Schrodinger's time dependent wave equation. (6)	BTL4	Analyzing
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. (13)	BTL 3	Applying
12.	Deduce an expression for the wave function and energy of the particle confined in a one-dimensional potential box using Schrodinger's wave equation. (13)	BTL 3	Applying
13.	(i) With a neat sketch, explain the working of Scanning Tunneling Microscope. (10) (ii) Categorize the advantages and disadvantages of Scanning Tunneling Microscope. (3)	BTL4	Analyzing
14.	Outline the construction, working and applications of Scanning Tunneling Microscope. (13)	BTL4	Analyzing
	PART - C		
1.	(i) With the concepts of quantum theory of black body radiation derive an expression for energy distribution. (8) (ii) Deduce Wien's displacement law and Rayleigh – Jeans law from the quantum theory of black body radiation. (7)	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.	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
4.	Explain the microscopic technique which use quantum tunneling principle to scan the samples with a focused electron beam. (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 an example.	BTL 1	Remembering
2.	Distinguish between crystalline and non-crystalline materials.	BTL 2	Understanding
3.	Contrast primitive and non-primitive cell?	BTL 2	Understanding
4.	Define: unit cell.	BTL 1	Remembering
5.	What are Bravais lattice?	BTL 1	Remembering
6.	Sketch the lattice parameters for a unit cell?	BTL 1	Understanding
7.	Define space lattice.	BTL 1	Remembering
8.	Show the atomic positions in FCC and HCP crystal structures in a sketch.	BTL 2	Understanding
9.	For a cubic system, sketch the planes with Miller Indices (101), (110) and (011).	BTL 2	Understanding
10.	A crystal plane cut at 3a, 4b and 2c distances along the crystallographic axes. Find the Miller Indices of the plane.	BTL 2	Understanding
11.	Distinguish between inter- planar spacing and inter atomic spacing.	BTL 2	Understanding
12.	Lead exhibits FCC structure. Each side of the unit cell is of 4.95 Å. Calculate the radius of Lead atom.	BTL 3	Applying
13.	How carbon atoms are arranged in diamond structure?	BTL 2	Understanding
14.	How do you justify that defects in crystals are not always harmful?	BTL 2	Understanding
15.	Define crystal imperfections.	BTL 2	Understanding
16.	What are Schottky defects?	BTL 2	Understanding
17.	Recall dislocations.	BTL 2	Understanding
18.	Define Burger's vector.	BTL 1	Remembering
19.	List out the different types of crystal growth techniques.	BTL 1	Remembering
20.	Summarize the advantages of solution growth techniques.	BTL 2	Understanding

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 4	Analyzing
2.	Show that FCC is the most closely packed of the three cubic structures by working out the packing factor. (13)	BTL 3	Applying
3.	Calculate the Atomic Packing Factor (APF) for SC, BCC and FCC structures. (13)	BTL 3	Applying
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 the crystal structure and calculate the atomic radius (3)	BTL 2 BTL 3	Understanding Applying
5.	Identify the crystal structure of tungsten and chromium. Derive the details about number of atoms, co- ordination number, atomic radius and packing factor for the above crystals. (13)	BTL 4	Analyzing

6.	Explain HCP structure. Show that for an HCP structure c/a = $\sqrt{8}/\sqrt{3}$ and hence calculate packing fraction for HCP structure. (13)	BTL 3	Applying
7.	Show that atomic packing factor for FCC and HCP are same. (10) Prove that for a simple cubic system $d_{100}: d_{110}: d_{111} = \sqrt{6}:\sqrt{3}:\sqrt{2}$. (3)	BTL 3	Applying
8.	(i) Deduce an expression for the inter-planar spacing for (h k l) planes of a cubic structure. (10) (ii) Determine lattice constant for FCC Lead crystal of radius 1.746 Å. Also find the spacing of (2 2 0). (3)	BTL 3 BTL 3	Applying Applying
9.	(i) Outline diamond cubic structure and give the details of its number of atoms per unit cell, atomic radius, co-ordination number and atomic packing factor. (7) (ii) List the steps to find the miller indices of a plane with a suitable example. (6)	BTL 4 BTL 2	Analyzing Understanding
10.	Classify and explain the various types of crystal defects with neat diagram. (13)	BTL 4	Analyzing
11.	Analyze about point defects and line defects with neat diagram. (13)	BTL 4	Analyzing
12.	(i) Write a note on point imperfections in crystals. (7) (ii) Illustrate one of the melt growth methods to grow single crystal of semiconducting materials. (6)	BTL 4	Analyzing
13.	Outline the various solution growth techniques along with its merits and demerits. (13)	BTL 4	Analyzing
14.	Demonstrate about the following crystal growth techniques. (i) Czochralski's method (7) (ii) Bridgmann technique (6)	BTL 4	Analyzing
	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. (15)	BTL3	Applying
2.	A zinc unit cell has a stacking sequence of AB AB AB. Deduce the c/a ratio and packing factor of zinc. (15)	BTL 3	Applying
3.	Illustrate about the following with suitable diagrams. (i) Point defects (8) (ii) Line defects (7)	BTL 4	Analyzing
4.	With a neat diagram categorize and explain about the various melt growth techniques to grow the technologically important crystals. (15)	BTL 4	Analyzing