

MOTHER TERESA COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF SCIENCE AND HUMANITIES

PH8151-ENGINEERING PHYSICS

Question Bank

I Semester

2017 -2018



MTCEET

DEPARTMENT OF PHYSICS

QUESTION BANK

SUBJECT : PH8151- ENGINEERING PHYSICS

SEM / YEAR: I SEM/AY-2017-2018

UNIT I - PROPERTIES OF MATTER

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – 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 - stress due to bending in beams.

PART - A

Q.No	Questions	BT Level	Competence
1.	Define elasticity and plasticity.	BT L 2	Understand
2.	Define stress and strain and write down their units.	BT L 2	Understand
3.	What are the different types of stress and strain?	BT L 1	Remember
4.	Define elastic fatigue.	BT L 2	Understand
5.	State Hooke's law.	BT L 2	Understand
6.	What do you infer from stress and strain diagram?	BT L 4	Analyse
7.	List the three moduli of elasticity.	BT L 1	Remember
8.	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 $2 \times 10^{11} \text{ N/m}^2$.	BT L 3	Apply
9.	What is Poisson's ratio?	BT L 1	Remember
10.	How do temperature and impurity affect the elasticity of materials?	BT L 4	Analyse
11.	Define torque.	BT L 2	Understand
12.	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.	BT L 3	Apply
13.	Define torsional stress.	BT L 1	Remember
14.	What is a beam?	BT L 2	Understand
15.	How are the various filaments of a beam affected when the beam is loaded?	BT L 4	Analyse
16.	Define cantilever.	BT L 2	Understand
17.	When a wire is bent back and forth it becomes hot? Why?	BT L 5	Evaluate
18.	Calculate the young's modulus of the material in the cantilever depression 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	Apply
19.	An elastic wire is cut into half of its original length. How will it affect the maximum load the wire can support?	BT L 5	Evaluate
20.	What are the advantages of I- shaped girders?	BT L 5	Evaluate

PART - B

1.	How will you classify three types of elastic moduli? Explain with necessary diagrams. Write the relationship between three moduli of elasticity. (13)	BT L 5	Evaluate
2.	Draw stress strain diagram and discuss the behaviour of ductile material under loading. (13)	BT L 2	Understand
3.	Explain the factors affecting the elasticity of the material. (13)	BT L 2	Understand
4.	Derive an expression for the torsional couple per unit angular twist when a cylinder is twisted. (13)	BT L 5	Evaluate
5.	Derive an expression for the period of oscillation of a torsional pendulum. How can it be used to determine the torsional rigidity of a wire. (13)	BT L 5	Evaluate
6.	What is torsional pendulum? How it is used to determine the a) Moment of inertia of the disc. b) Rigidity modulus of the wire using moment of inertia c) moment of inertia of a irregular body. (13)	BT L 1	Remember
7.	Give the theory of torsional pendulum and describe a method to find the moment of inertia of an irregular body. (13)	BT L 2	Understand
8.	What is meant by bending moment of a beam? Derive the expression for the bending moment of a beam. (13)	BT L 1	Remember
9.	Derive the expression for the depression at the free end of a cantilever due to load. Describe an experiment to determine the young's modulus of the cantilever using this expression. (13)	BT L 1	Remember
10.	i) Derive with relevant theory how a cantilever may be used to determine the Young's modulus of the material of bar? (10)	BT L 4	Analyse
	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 the given load. (3)		
11.	Explain with necessary theory the determination of young's modulus of elasticity of the material of the beam supported at its ends and loaded in the middle. Describe an experiment to determine the young's modulus of the material using this method. (13)	BT L 5	Evaluate
12.	Discuss the method to determine the young's modulus of elasticity of the material of the beam supported at both the ends which are equidistant from the centre and also describe an experiment to determine the young's modulus of the material using this method. (13)	BT L 5	Evaluate
13.	How will you determine the young's modulus of material of a bar by non-uniform bending method? Explain briefly the theory behind the determination of young's modulus. (13)	BT L 4	Analyse
14.	i) Write a short note on I shaped girders. Give its applications and advantages. (10)	BT L 1	Remember
	ii) Explain stress due to bending in beams. (3)		

PART-C

1.	Derive an expression for couple per unit twist on a thin cylinder and show that a hollow cylinder is better than the solid cylinder of same material, same mass and same length for manufacturing shafts. (15)	BT L 4	Analyse
	i) Explain how the thickness of the beam affects the depression in I shaped girders. Also discuss the application and advantages of Girders. (10)	BT L 5	Evaluate
2.	ii) A cantilever of length 50 cm fixed at one end is depressed by 20 mm at the loaded end. Calculate the depression at a distance of 40 cm from the fixed end. (5)	BTL 5	Evaluate
	i) How will you compare the depression produced at the ends of the cantilever with the depression produced in non- uniform type of bending? (10)	BT L 5	Evaluate
3.	ii) The geometric moment of inertia of circular cross-section is $0.491 \times 10^{-11} \text{ m}^4$. Find the radius of the circular section. (5)	BTL 5	Evaluate
	i) A metal disk of 0.1 m radius and mass 1 Kg is suspended in a horizontal plane by a vertical wire attached to its centre. If the diameter of the wire is 10^{-3} m, its length 1 m and period of torsional vibrations is 4 s find the rigidity modulus of the wire.(5)	BT L 4	Analyse
4.	ii) Two solid cylinders of same material having same radii with length 1 and 2l 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.(5)	BTL 4	Analyse
	iii) How can you differentiate buckling and bending? (5)	BTL 4	Analyse

UNIT II - WAVES AND FIBER OPTICS

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers : population of energy levels, Einstein’s A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – losses associated with optical fibers - fibre optic sensors: pressure and displacement.

PART - A

AMCET

1.	Define the terms i) Time period ii) Frequency.	BTL 1	Knowledge
6.	2. Explain the principle of construction and working of a semiconductor diode laser. Mention its advantages and Disadvantages. Give examples.	BTL 4	Knowledge
3.	3. Differentiate between free and forced vibrations.	BTL 2	Analyse
7.	4. With suitable diagram, explain how the laser action is achieved in a laser.	BTL 4	Understand
4.	5. Differentiate between free and forced vibrations.	BTL 4	Analyse
8.	5.i) For a hetero junction SiMn diode laser, the band gap of the semiconductor is 1.14 eV . By doping, the band gap of the semiconductor is increased by 0.2 eV . Calculate the change in the wavelength of the laser.	BTL 3	Apply
6.	6. State the properties of laser beam.	BTL 1	Knowledge
7.	ii) Differentiate between homo junction and hetero junction laser.	BTL 2	Analyse
8.	8. Spatial and temporal coherence are major attributes of a laser beam. Comment.	BTL 4	Understand
9.	9. Write the difference between spontaneous emission and stimulated emission.	BTL 6	Creating
10.	10. What is meant by population inversion and metastable state?	BTL 4	Analyse
11.	11. Can a two level system be used for the production of laser? Why?	BTL 1	Knowledge
12.	12. What is an optical resonator cavity? Mention its role in a laser?	BTL 2	Understand
13.	13. Calculate the wavelength of light emission from GaAs whose band gap is 1.44 eV .	BTL 3	Apply
14.	14. List out the conditions to be satisfied for total internal reflection.	BTL 4	Analyse
15.	15. What do you mean by the acceptance angle for an optical fibre? Show that it is related to the numerical aperture.	BTL 3	Apply
16.	16. Differentiate between single mode and multi mode fibre.	BTL 4	Analyse
17.	17. A silica optical fibre 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	Apply
18.	18. The maximum angle of acceptance for an optical fibre is 11.54° . Find the refractive index of cladding if the core refractive index is 1.60 .	BTL 3	Apply
19.	19. Distinguish between step- index and graded index fibres.	BTL 4	Analyse
20.	20. What is an active and passive fibre optic sensor?	BTL 1	Knowledge

PART – B

1.	Obtain the differential equation of damped harmonic oscillation and discuss the special cases of oscillatory motion. (13)	BTL 2	Understand
2.	2. Discuss the theory of forced harmonic oscillations. How does sharpness of resonance depend on damping? (13)	BTL 4	Analyse
3.	3. Establish a differential equation of motion for a damped harmonic oscillator. Discuss the conditions for over damped, critical damped and under damped oscillations. (13)	BTL 1	Knowledge
4.	4. Derive the expression for the wave equation of a plane progressive wave. (13)	BTL 2	Understand
5.	i) Derive an expression for Einstein's coefficient of spontaneous and stimulated emissions. (10)	BTL 2	Understand
	(ii) How laser light differ from ordinary light? (3)	BTL 4	Analyse

9.	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. Mention any six advantages of optical fibre for communication as a wave guide. (13)	BTL 1	Knowledge
10.	How optical fibers are classified based on modes, material and refractive index profile? (13)	BTL 2	Understand
11.	i) Discuss the following losses in optical fibres. a). Scattering loss b). Bending loss c). Absorption loss (10)	BTL 2	Understand
	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. (3)	BTL 5	Evaluation
12.	Explain the construction and working of pressure and displacement sensors. (13)	BTL 4	Analyse
13.	What is attenuation? Discuss the different mechanisms which are responsible for attenuation in the optical fiber. (13)	BTL 2	Understand
14.	What are the different types of fibre optic sensors? Explain the working of any two sensors. (13)	BTL 1	Knowledge

PART-C

1.	Most of the oscillations in air or in any medium are damped .How can you maintain the period of oscillation. Derive the differential equation and its solution for that oscillation, with the three different cases. (15)	BTL 3	Apply
2.	You might have seen fiber optical cables buried in the ground. Attenuation of optical fibers has proved to be one of the most important factors of the wide acceptance in communications. Explain the signal attenuation within the optical fibers. (15)	BTL 3	Apply
3.	The laser output could be modulated within the diode itself. Comparing with the other types of laser the construction of this laser is simple and cheap. Explain with neat diagram, construction, working and applications of the above mentioned laser. Compare the two types of diode lasers. (15)	BTL 3	Apply
4.	Calculate the number of modes at 830 nm in a graded index (GI) fiber having a parabolic index profile and core radius of 25 μ m with core and cladding indices 1.50 and 1.48 respectively. How does this compare to a step index (SI) fiber. (15)	BTL 5	Evaluation

UNIT-III THERMAL PHYSICS

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips – thermal conduction, convection and radiation – 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.	What are the modes of heat transferred from one place to another?	BTL 1	Knowledge
2.	Mention the types of thermal expansion of solids.	BTL 1	Knowledge
3.	Define coefficient of linear expansion of solids.	BTL 1	Knowledge
4.	Define coefficient of superficial expansion.	BTL 1	Knowledge
5.	Define coefficient of cubical expansion.	BTL 1	Knowledge
6.	Explain the term co-efficient of apparent and real expansion of liquid.	BTL 2	Understand
7.	A circular hole of diameter 2.00 cm is made in an aluminium plate at 0 °C. What will be the diameter at 100 °C? Linear expansion for aluminium = $2.3 \times 10^{-3} / ^\circ\text{C}$	BTL 3	Apply
8.	What is thermal conduction?	BTL 1	Knowledge
9.	Define coefficient of thermal conductivity and mention its unit.	BTL 1	Knowledge
10.	How are heat conduction and electrical conduction analogous to each other?	BTL 4	Analyze
11.	Define thermal resistance.	BTL 1	Knowledge
12.	What is bimetallic strip? Give its use.	BTL 1	Knowledge
13.	What is meant by thermal insulation?	BTL 1	Knowledge
14.	The roof building is often painted white during summer. Why?	BTL 4	Analyze
15.	What are the factors to be considered in order to maintain a comfortable inside the building?	BTL 3	Apply
16.	How much heat will be conducted through a slab of area $90 \times 10^{-4} \text{ m}^2$ and thickness $1.2 \times 10^{-3} \text{ m}$ in one second when its opposite faces are maintained at difference in temperature of 20 K. The coefficient of thermal conductivity of that material is $0.04 \text{ Wm}^{-1}\text{K}^{-1}$	BTL 3	Apply
17.	Mention the properties of the thermal insulating materials.	BTL 1	Knowledge
18.	What is meant by solar power?	BTL 2	Understand
19.	Explain the principle of refrigeration.	BTL 2	Understand
20.	Define oven.	BTL 1	Knowledge

PART – B

1.	i). Explain the different modes of transferring heat energy with example. (8)	BTL 2	Understand
	ii). Derive the expression for thermal conductivity with unit. (5)	BTL 4	Analyze
2.	Define expansion of joints. What are the types of expansion joints and write in detail about it. (13)	BTL 1	Knowledge
3.	i) Write the principle and working of bimetallic strip. (6)	BTL 2	Understand
	ii) Describe the application and advantages of bimetallic strips. (7)		
4.	Describe Forbe's method to determine thermal conductivity of metals with relevant theory and experiment. (13)	BTL 2	Understand
5.	Explain the method of determining thermal conductivity of good conductors. (13)	BTL 4	Analyze
6.	Describe Lee's disc method for determining thermal conductivity of bad conductors. (13)	BTL 2	Understand
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	BTL 5	Evaluate

to determine the thermal conductivity of a bad conductor.	(13)		
8. Derive the expression for effective thermal conductivity through compound media in series and parallel. Also discuss the application of it.	(13)	BTL 5	Evaluate
9. i) Write an essay about thermal insulation inside a room. ii) The total area of a glass window pane is 0.8 m^2 . Calculate how much heat is conducted per hour through the glass window pane if thickness of glass is 3 mm. The temperature of the inside surface is $25 \text{ }^\circ\text{C}$ and outside surface is $4 \text{ }^\circ\text{C}$. The thermal conductivity of glass is $1.1 \text{ Wm}^{-1}\text{K}^{-1}$.	(10)	BTL 2	Understand
	(3)	BTL 3	Apply
10. Write in detail about thermal insulation.	(13)	BTL 2	Understand
11. What is heat exchanger? Explain in detail about heat exchangers.	(13)	BTL 4	Analyze
12. Define refrigeration. Describe the principle and working of refrigeration.	(13)	BTL 4	Analyze
13. Write short note on i) Solar water heater ii) Oven	(7) (6)	BTL 2	Understand
14. i) How the solar power can be used in our domestic life point out the important methods?	(5)	BTL 5	Evaluate
ii) A rod of 0.25 m long and $0.892 \times 10^{-4} \text{ m}^2$ area of cross section is heated at one end through 393 K while the other end is kept at 323 K. The quantity of heat which will flow in 15 minutes along the rod is 8.811×10^3 joule. Calculate the thermal conductivity of the rod.	(4)	BTL 3	Apply
iii) Two metal bars A and B are 50 cm and 70 cm long respectively and have thermal conductivities $385 \text{ Wm}^{-1}\text{K}^{-1}$ and $296 \text{ Wm}^{-1}\text{K}^{-1}$ respectively. They are joined together by welding. The outer end of A		BTL	Apply

respectively. They are joined together by welding. The outer end of A is at 363 K and the outer end of B is at 303 K. Calculate the temperature at the welded joint assuming that their cross sections are equal.

BTL

(4)

PART-C

- | | | | | |
|----|--|------|-------|------------|
| 1. | Explain the method to determine the thermal conductivity of metals (Good conductor) with relevant theory and experiment. | (15) | BTL 4 | Analyze |
| 2. | How to determine the thermal conductivity of ebonite (Bad conductor) and describe the method to determine thermal conductivity of the bad conductor? | (15) | BTL 4 | Analyze |
| 3. | How does a thermal insulator work? Explain in detail about the thermal insulation, advantage, disadvantage and applications. | (15) | BTL 3 | Apply |
| 4. | Write down the working of Oven, solar water heater and refrigerators and mention their uses. | (15) | BTL 2 | Understand |

UNIT IV - QUANTUM PHYSICS

Black body radiation – Planck’s theory (derivation) – 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 rigid box – tunnelling (qualitative) - scanning tunnelling microscope.

PART – A

Q.No	Questions	BT Level	Competence
1.	What is meant by energy spectrum of a black body? What do you infer from it?	BTL 1	Knowledge
2.	What are the postulates of Planck’s quantum theory?	BTL 1	Knowledge
3.	Define Wien’s displacement law.	BTL 1	Knowledge
4.	State Rayleigh - Jeans law. What are its limitations?	BTL 1	Knowledge
5.	What is Compton wavelength? Give its value.	BTL 1	Knowledge
6.	State the expression for Compton shift. Why it is not observable in the visible region of electromagnetic spectrum?	BTL 2	Understand
7.	X -ray photon of wave length 0.3 \AA is scattered through an angle 45° by a loosely bound electron. Find the wave length of the scattered photon.	BTL2	Understand
8.	Write any two physical significance of wave function.	BTL 5	Evaluate
9.	How are matter-waves different from electromagnetic waves?	BTL 4	Analyze
10.	What is wave particle duality?	BTL 2	Understand

11. Write down the expression for the wavelength of matter waves.	BTL 2	Understand
12. List the applications of Schrodinger wave equation.	BTL 3	Apply
13. A proton is moving with a speed of 2×10^8 m/s. Find the wavelength of the matter wave associated with it.	BTL 2	Understand
14. A cylinder filled with helium and heated up to 27°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 2	Understand
15. For a free particle moving within a one dimensional potential box, the ground state energy cannot be zero. Why?	BTL 3	Apply
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 1	Knowledge
17. What are Eigen values and Eigen function?	BTL 4	Analyze
18. What is the principle of scanning tunnelling microscope?	BTL 5	Evaluate
19. Mention the major applications of quantum tunnelling.	BTL 3	Apply
20. List out the limitations of scanning tunnelling microscope.	BTL 4	Analyze

PART – B

1. Write the postulates of Planck's quantum theory of radiation. Using quantum theory derive an expression for the average energy emitted by a black body and arrive at Planck's radiation law in terms of frequency. (3 + 10)	BTL 2	Understand
2. i) Derive the expression for Planck's quantum theory of radiation. (10)	BTL 2	Understand
ii) Deduce Wien's displacement law & Rayleigh-Jeans law from Planck's quantum theory of radiation. (3)		
3. What is Compton Effect? Give the theory of Compton effect and show that the Compton shift (13)	BTL 4	Analyze
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	Analyze
5. Explain Compton effect and its physical significance. Derive the relation giving the change of wavelength the energy of recoil electron and recoil angle. (13)	BTL 2	Understand
6. Derive the expression for de-Broglie wavelength for matter waves. Express the de-Broglie Wavelength in terms of energy and voltage. (13)	BTL 2	Understand
7. i) Explain the physical significance of wave function. (7)		
ii) What are matter waves? Write the properties of matter waves.(6)	BTL 5	Evaluate
8. Derive Schrodinger's time independent wave equation. (13)	BTL 4	Evaluate
9. Derive Schrodinger's time dependent wave equation. (13)	BTL 3	Apply

10. Derive Schrodinger's wave equation for a particle in a one dimensional box. Solve it to obtain Eigen function and show that Eigen values are discrete. (13)	BTL 2	Understand
11. Discuss the case of particle in a box on Schrodinger wave equation. Apply this to electron in metal. (13)	BTL 3	Apply
12. Show that wave function for a particle confined in an infinite one dimensional potential well of length 'L' is given. Hence discuss the energy levels and their discreteness. (13)	BTL 3	Apply
13. Explain the phenomenon of quantum tunnelling with schematic diagram explain the construction and working of Scanning Tunnelling Microscope. (13)	BTL 1	Knowledge
14. Discuss the construction, working and applications of Scanning Tunnelling Microscope. Also mention its advantages and disadvantages. (13)	BTL 2	Knowledge

PART-C

1. i) What is the wave function? what are the necessary conditions for physically acceptable wave function? (5)
- ii) Explain the barrier tunnelling of electron on the basis of quantum

2. Derive the expression for Compton shift. why it is not observable in the visible region of electromagnetic spectrum? (15)	BTL 3	Apply
3. Show that the energy of a microparticle confined in a infinite one dimensional well of length 'l' is given by $E_n = n^2 \frac{h^2}{8ml^2}$ where symbols have their usual meaning. in the above situation the particle cannot have zero energy. Explain why? (15)	BTL 3	Apply
4. Derive Planck's law of radiation in terms of wavelength. (15)	BTL3	Apply

(iii)
iv)
v)

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 structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

PART - A

Q.No	Questions	BT Level	Competence
1.	What are single crystalline materials?	BTL1	Knowledge
2.	Distinguish between crystalline and non-crystalline materials.	BTL4	Analyse
3.	What is meant by primitive and non-primitive cell? Give an example.	BTL1	Knowledge
4.	Define unit cell.	BTL1	Knowledge
5.	Based on the criteria find out the crystal structure for the following.		
(i)	$a = b = c = 4.74 \text{ \AA}$ and $\alpha = \beta = \gamma = 60^\circ$	BTL4	Analysing

$$(ii) \quad a = b = c = 4.74 \text{ \AA} \quad \text{and} \quad \alpha = \beta = \gamma = 90^\circ$$

6.	What are Bravais lattice?	BTL1	Knowledge
7.	What are lattice parameters for a unit cell?	BTL1	Knowledge
8.	Define space lattice. How it is useful to describe a crystal structure?	BTL1	Knowledge
9.	Draw the planes for Miller Indices (100), (110) and (111).	BTL2	Understand
10.	A crystal plane cut at 3a, 4b and 2c distances along the crystallographic axes. Find the Miller Indices of the plane.	BTL4	Analyse
11.	Distinguish between inter planar spacing and inter atomic spacing.	BTL3	Apply
12.	Iron has BCC structure with atomic radius 0.123Å. Find the lattice constant.	BTL4	Analyse
13.	How carbon atoms are arranged in diamond structure?	BTL3	Apply
14.	Defects in crystals are not always harmful. Justify.	BTL3	Apply
15.	What is meant by crystal defect?	BTL6	Creative
16.	What are Schottky defects?	BTL1	Knowledge
17.	Define Burger vector.	BTL1	Knowledge
18.	What is the cause of plastic deformation?	BTL1	Knowledge
19.	Write any two applications of Czochralski and Bridgmann techniques.	BTL1	Knowledge
20.	What are Bravais lattice?	BTL3	Applying

PART - B

1.	Explain Seven Crystal System with neat diagram.	(13)	BTL 2	Understand
2.	Explain the No. of atoms, atomic radius, Co-ordination number and packing factor for SC, BCC and FCC structures.	(13)	BTL 2	Understand
3.	i) Define the following terms a). Number of atoms per unit cell b). Atomic Radius c). Co-ordination number d). Atomic packing factor.	(8)	BTL 1	Knowledge
	ii) Calculate the volume of an FCC unit cell in terms of atomic radius 'r'.	(3)	BTL 3	Apply
	iii) An element has HCP structure. If the radius of the atom is 1.605 Å. Find the volume of the unit cell.	(2)	BTL 3	Apply
4.	i) Describe BCC structure. Derive expression for the number of atoms, co-ordination number, atomic radius and packing factor.	(10)	BTL 2	Understand
	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)	BTL 3	Apply
5.	i) Describe FCC structure. Derive the details about number. of atoms, co- ordination number, atomic radius and packing factor.	(8)	BTL 2	Understand

ii) Metallic iron changes from BCC to FCC at 910 °C and corresponding atomic radii vary from 1.258Å to 1.292Å. Calculate the percentage volume change during this structural change. (3)	BTL 3	Apply
iii) α- iron of atomic weight 55.85 solidifies into BCC structure and has a density of 7860 kg/m ³ . Calculate the radius of an atom. (2)	BTL 3	Apply
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	Understand
7. i) Show that atomic packing factor for FCC and HCP are same. (6)	BTL 3	Apply
ii) What are Bravais lattices? List out the axial length and interfacial angles of seven crystal systems. (5)	BTL 1	Knowledge
iii) Show that for a simple cubic system $d_{100} : d_{110} : d_{111} = \sqrt{6} : \sqrt{3} : \sqrt{2}$. (2)	BTL 3	Apply
8. i) Derive the expression for the inter planar spacing or d-spacing for (hkl) planes of a cubic structure. (10)	BTL 2	Understand
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), c) (2 2 0). (3)	BTL 3	Apply
9. What is meant by crystal defects? Explain the various types of crystal defects with neat diagram. (2+11)	BTL 2	Understand
10. Explain about point defects and line defects with neat diagram. (13)	BTL 2	Understand
11. Explain the role of imperfections in plastic deformation. (13)	BTL 2	Understand
12. Explain the various solution growth techniques along with its merits and demerits. (13)	BTL 2	Understand
13. Explain diamond cubic structure and obtain its no.of atoms per unit cell, atomic radius, co-ordination number and atomic packing factor. (13)	BTL 4	Analyse
14.) Czochralski's method	BTL 2	Understand
ii) Bridgmann technique (6 + 7)		

PART-C

1. i) Why are HCP materials brittle while FCC materials are ductile? (5)	BTL 3	Apply
ii) What are the similarities and difference between the FCC and HCP Structure? (5)	BTL 4	Analyse
iii) FCC crystals have more packing density than BCC crystal yet why solubility of carbon in FCC form of iron is higher than in its BCC form? (5)	BTL 3	Apply
2. i) What is meant by Crystallography and why to study the structure of crystalline solids? (10)	BTL 1	Knowledge
ii) What are the major differences between an edge & screw dislocation? Which of these can cross slip? (5)	BTL 4	Analyse

3.	i) What do you understand from Crystal directions, Crystal Planes and Miller Indices? (10) ii) How the directions of lattice planes are determined with the help of Miller Indices method? (5)	BTL 2 BTL 3	Understand Apply
4.	i) How crystals are grown by Bridgmann experimental setup? (10) ii) Chromium has BCC structure. Its atomic radius is 0.1249 nm.	BTL 4	Analyse

ANSWERS