# VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203

## DEPARTMENT OF PHYSICS

## QUESTION BANK



**I SEMESTER**

**PH8151-ENGINEERING PHYSICS**

**Regulation – 2017**

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**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. | BTL2 | Understand |
| 2. | Define stress and strain and write down their units. | BTL2 | Understand |
| 3. | What are the different types of stress and strain? | BTL1 | Remember |
| 4. | Define elastic fatigue. | BTL2 | Understand |
| 5. | State Hooke's law. | BTL2 | Understand |
| 6. | What do you infer from stress and strain diagram? | BTL4 | Analyse |
| 7. | List the three modulii of elasticity. | BTL1 | 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 $2 \times 10^{11}$ $N/m^2$. | BTL3 | Apply |
| 9. | What is Poison's ratio? | BTL1 | Remember |
| 10. | How do temperature and impurity affect the elasticity of materials? | BTL4 | Analyse |
| 11. | Define torque. | BTL2 | 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. | BTL3 | Apply |
| 13. | Define torsional stress. | BTL1 | Remember |
| 14. | What is a beam? | BTL2 | Understand |
| 15. | How are the various filaments of a beam affected when the beam is loaded? | BTL4 | Analyse |
| 16. | Define cantilever. | BTL2 | Understand |
| 17. | When a wire is bent back and forth it becomes hot? Why? | BTL5 | 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. | BTL3 | Apply |
| 19. | An elastic wire is cut into half of its original length. How will it affect the maximum load the wire can support? | BTL5 | Evaluate |
| 20. | What are the advantages of I- shaped girders? | BTL5 | 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) | BTL5 | Evaluate |
| 2. | Draw stress strain diagram and discuss the behaviour of ductile material under loading. (13) | BTL2 | Understand |
| 3. | Explain the factors affecting the elasticity of the material. (13) | BTL2 | Understand |
| 4. | Derive an expression for the torsional couple per unit angular twist when a cylinder is twisted. (13) | BTL5 | 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 awire. (13) | BTL5 | 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) | BTL1 | Remember |
| 7. | Give the theory of torsional pendulum and describe a method to find the moment of inertia of an irregular body. (13) | BTL2 | Understand |
| 8. | What is meant by bending moment of a beam? Derive the expression for the bending moment of a beam. (13) | BTL1 | 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) | BTL1 | Remember |
| 10. | i) Derive with relevant theory how a cantilever may be used to determine the Youngs modulus of the material of bar? (10)<br>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) | BTL4 | Analyse |
| 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) | BTL5 | 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) | BTL5 | 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) | BTL4 | Analyse |
| 14. | i) Write a short note on I shaped girders. Give its applications and advantages. (10)<br>ii) Explain stress due to bending in beams. (3) | BTL1 | Remember |

**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**

| Q.No | Questions | BT Level | Competence |
|---|---|---|---|
| 1. | Define the terms i) Time period ii) Frequency. | BTL 1 | Knowledge |
| 2. | What is meant by damped vibrations? Give examples. | BTL 1 | Knowledge |
| 3. | What do you understand by the term Dead Beat? Give Examples. | BTL 2 | Understand |
| 4. | Differentiate between free and forced vibrations. | BTL 4 | Analyse |
| 5. | A particle is executing SHM of amplitude 0.2 cm. If its velocity at the mean position is 5 m/s, then find its frequency. | BTL 4 | Analyse |
| 6. | Define plane progressive wave. | BTL 1 | Knowledge |
| 7. | State the properties of laser beam. | BTL 2 | Understand |
| 8. | Spatial and temporal coherence are major attributes of a lasing beam. Comment. | BTL 6 | Creating |
| 9. | Write the difference between spontaneous emission and stimulated emission. | BTL 4 | Analyse |
| 10. | What is meant by population inversion and metastable state? | BTL 1 | Knowledge |
| 11. | Can a two level system be used for the production of laser? Why? | BTL 2 | Understand |
| 12. | What is an optical resonator cavity? Mention its role in a laser? | BTL 3 | Apply |
| 13. | Calculate the wavelength of light emission from GaAs whose band gap is 1.44 eV. | BTL 4 | Analyse |
| 14. | List out the conditions to be satisfied for total internal reflection. | BTL 3 | Apply |
| 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. | Differentiate between single mode and multi mode fibre. | BTL 4 | Analyse |
| 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. | 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. | Distinguish between step- index and graded index fibres. | BTL 4 | Analyse |
| 20. | What is an active and passive fibre optic sensor? | BTL 1 | Knowledge |

**PART – B**

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|---|---|---|---|
| 1. | Obtain the differential equation of damped harmonic oscillation and discuss the special cases of oscillatory motion. (13) | BTL2 | Understand |
| 2. | Discuss the theory of forced harmonic oscillations. How does sharpness of resonance depend on damping? (13) | BTL 4 | Analyse |

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| 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. | 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)<br>(ii) How laser light differ from ordinary light? (3) | BTL 2<br>BTL 4 | Understand<br>Analyse |
| 6. | Explain the principle, construction and working of a semiconductor diode laser. Mention its advantages and disadvantages. (13) | BTL 4 | Analyse |
| 7. | With suitable diagram, explain how the laser action is achieved in homo junction and hetero junction lasers? (13) | BTL 4 | Analyse |
| 8. | i) For a hetero junction semiconductor laser, the band gap of the semiconductor used is 1.44 eV. By doping, the band gap of the semiconductor is increased by 0.2 eV. Calculate the change in the wavelength of the laser. (6)<br>ii) Differentiate between homo junction and hetero junction laser. (7) | BTL 3<br>BTL 4 | Apply<br>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.<br>a). Scattering loss b). Bending loss c). Absorption loss (10)<br>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 2<br>BTL 5 | Understand<br>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 |

**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 |

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| 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 $^0$C. What will be the diameter at 100 $^0$C? Linear expansion for aluminium = 2.3 x $10^{-3}$ / $^0$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 $90x10^{-4}$ $m^2$ and thickness $1.2x10^{-3}$ 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 $Wm^{-1}K^{-1}$ | 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**

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|---|---|---|---|
| 1. | i). Explain the different modes of transferring heat energy with example. (8)<br>ii). Derive the expression for thermal conductivity with unit. (5) | BTL 2<br>BTL 4 | Understand<br>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)<br>ii) Describe the application and advantages of bimetallic strips. (7) | BTL 2 | Understand |
| 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 to determine the thermal conductivity of a bad conductor. (13) | BTL 5 | Evaluate |
| 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 |

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| 9. | i) Write an essay about thermal insulation inside a room. (10)<br>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 °C and outside surface is 4 °C. The thermal conductivity of glass is 1.1 $Wm^{-1}K^{-1}$. (3) | BTL 2<br>BTL 3 | Understand<br>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<br>i) Solar water heater (7)<br>ii) Oven (6) | BTL 2 | Understand |
| 14. | i) How the solar power can be used in our domestic life point out the important methods? (5)<br>ii) A rod of 0.25 m long and $0.892x10^{-4}$ $m^2$ 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 $8.811x10^3$ joule. Calculate the thermal conductivity of the rod. (4)<br>iii) Two metal bars A and B are 50 cm and 70 cm long respectively and have thermal conductivities 385 $Wm^{-1}K^{-1}$ and 296 $Wm^{-1}K^{-1}$ 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. (4) | BTL 5<br>BTL 3<br>BTL | Evaluate<br>Apply<br>Apply |

**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 |

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| 7. | X -ray photon of wave length 0.3 Å 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 | Applying |
| 13. | A proton is moving with a speed of 2 x $10^8$ 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 $^0$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 x $10^{-27}$ kg and k = 1.38x$10^{-23}$ 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 | Applying |
| 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)<br>ii) Deduce Wien's displacement law & Rayleigh-Jeans law from Planck's quantum theory of radiation. (3) | BTL 2 | Understand |
| 3. | What is Compton Effect? Give the theory of Compton effect and show that the Compton shift . (13) | BTL 2 | Understand |
| 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 4 | 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 3 | Analyze |
| 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 |
| | | BTL 2 | Understand |

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| 7. | i) Explain the physical significance of wave function. (7)<br>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. | BTL 1 | Knowledge |
| 14. | Discuss the construction, working and applications of Scanning Tunnelling Microscope. Also mention its advantages and disadvantages. (13) | BTL 2 | Knowledge |

**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 | Analysing |
| 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.<br>(i) $a = b = c = 4.74$Å and $\alpha = \beta = \gamma = 60^\circ$<br>(ii) $a = b = c = 4.74$ Å and $\alpha = \beta = \gamma = 90^\circ$ | BTL4 | Analysing |
| 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 |

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| 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**

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| 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 |

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| 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. | Explain the two melt growth techniques.<br>i) Czochralski's method<br>ii) Bridgmann technique (6+7) | BTL 2 | Understand |