SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF PHYSICS

QUESTION BANK

I SEMESTER

PH3123 – ENGINEERING PHYSICS

Regulation – 2023

Academic Year 2024 - 25

Prepared by

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SUBJECT : PH3123 – Engineering Physics

SEM / YEAR: I SEM / 2024-2025

UNIT I – PROPERTIES OF MATERIALS
Elasticity - Hooke's law - Stress-strain diagram and its uses - Poisson ratio - factors affecting elastic modulus and tensile strength. Single crystalline, polycrystalline and amorphous materials - unit cell - space lattice - crystal systems - Bravais lattice - Miller indices - d-spacing - characteristics of unit cell - SC, BCC, FCC and HCP structure - - thermal and mechanical properties of materials - crystal growth techniques - Czochralski and Bridgmann.

PART – A

Q.No	Questions	CO	BT Level	Competence
1.	Define elasticity.	CO1	BTL 1	Remembering
2.	State Hooke's law of elasticity.	CO1	BTL 2	Understanding
3.	Define stress.	CO1	BTL 1	Remembering
4.	What is the elastic limit?	CO1	BTL 1	Remembering
5.	Draw the stress-strain diagram for brittle and ductile material.	CO1	BTL 2	Understanding
6.	What do you infer from stress and strain diagram?	CO1	BTL 2	Understanding
7.	What is Poisson ratio?	CO1	BTL 1	Remembering
8.	What is the effect of temperature on elasticity of a material?	CO1	BTL 2	Understanding
9.	List any two factors which affect the elastic modulus.	CO1	BTL 1	Remembering
10.	Give any two mechanical and thermal properties of materials.	CO1	BTL 1	Remembering
11.	What are single crystalline materials? Give example.	CO1	BTL 2	Understanding
12.	Distinguish between crystalline and non-crystalline materials.	CO1	BTL 2	Understanding
13.	Define unit cell.	CO1	BTL 1	Remembering
14.	Differentiate primitive and non-primitive unit cell.	CO1	BTL 2	Understanding

15.	What are Bravais lattice?	CO1	BTL 1	Remembering
16.	Name the seven types of crystal systems.	CO1	BTL 1	Remembering
17.	Write the lattice parameters for triclinic system.	CO1	BTL 2	Understanding
18.	Define packing factor.	CO1	BTL 1	Remembering
19.	Determine the lattice constant for FCC Lead crystal of radius 1.746 Å.	CO1	BTL 2	Understanding
20.	What are Miller Indices?	CO1	BTL 1	Remembering
21.	Sketch the planes for a cubic system with Miller Indices (100) and (111).	CO1	BTL 2	Understanding
22.	Define inter- planar spacing.	CO1	BTL 1	Remembering
23.	Spacing between (220) planes is found to be is 1.41Å. Determine the lattice constant.	CO1	BTL 2	Understanding
24.	Write any two melt growth techniques for growing crystals.	CO1	BTL 1	Remembering

PART-B

1.	Draw stress - strain diagram and discuss the behavior of a ductile material under loading. Also mention the uses of stress-strain diagram.	(16)	CO1	BTL 4	Analyzing
2.	Explain the elastic limit, yield point, ultimate strength and breaking point of an elastic material using stress - strain diagram.	(16)	CO1	BTL 3	Applying
3.	(i) Draw the stress – strain diagram and explain the regions in it. (ii) Explain the factors which affect the elasticity of the material.	(8) (8)	CO1 CO1	BTL 4 BTL 4	Analyzing Analyzing
4.	Explain the various types of crystal systems with a neat sketch and examples.	(16)	CO1	BTL 4	Analyzing
5.	Explain the any four characteristics of a simple cubic system and face centered cubic system.	(16)	CO1	BTL 4	Analyzing
6.	Determine the number of atoms per unit cell, atomic radius, co-ordination number and packing factor for SC structure.	(16)	CO1	BTL 3	Applying
7.	(i) Show that FCC is the most closely packed of the three cubic structures by working out the packing factor. (ii) Ni is having FCC structure. Calculate the atomic radius .lattice constant is 3.52 Å.	(13) (3)	CO1 CO1	BTL 4 BTL 4	Analyzing Analyzing
8.	Calculate the number of atoms per unit cell, atomic radius, co-ordination number and packing factor for BCC structure.	(16)	CO1	BTL 3	Applying
9.	Describe FCC structure. Derive the details about number of atoms, co-ordination number, atomic radius and packing factor.	(16)	CO1	BTL 3	Applying
10.	(i) Explain HCP structure. (ii) Show that for an HCP structure c/a = $\sqrt{8}$ /$\sqrt{3}$ and hence calculate packing fraction for HCP structure.	(3) (13)	CO1 CO1	BTL 1 BTL 3	Remembering Applying
11.	Describe the structure of HCP crystal. Calculate the atomic radius, co-ordination number and packing factor for HCP structure.	(16)	CO1	BTL 4	Analyzing
12.	Show that the atomic packing factor for FCC and HCP are equal.	(16)	CO1	BTL 4	Analyzing
13.	(i) What are the steps for finding Miller indices of a plane of a crystal? List the important features of Miller Indices.	(12)	CO1	BTL 4	Analyzing

	(ii) Find the miller indices of a set of planes which make intercepts in the ratio 3a : 4b on the X and Y axes and parallel to Z axis. (4)	CO1	BTL 4	Analyzing
14.	Derive the expression for the inter-planar spacing or d-spacing for (h k l) planes of a cubic structure. (16)	CO1	BTL 3	Applying
15.	Deduce the relation between inter-planar spacing (d) and the Miller indices (h k l) for a cubic structure. (16)	CO1	BTL 4	Analyzing
16.	Give a procedure for finding Miller indices of crystal planes and deduce a relation between inter-planar spacing and Miller indices of a cubic structure. (16)	CO1	BTL 3	Applying
17.	With a neat diagram, explain the Bridgmann and Czochralski's crystal growth techniques. (16)	CO1	BTL 4	Analyzing

UNIT II - ULTRASONICS

Introduction - Properties - Production: Magnetostriction method and Piezoelectric method - Acoustical grating - determination of ultrasonic velocity in liquid - Application**:** Detection of flaw in materials (Non Destructive Testing) - ultrasonic soldering, welding - SONAR - diagnostic sonography - cars' air bag sensor - dispersion of fog - Probe sonication for 2D material formation.

PART – A

Q.No	Questions	CO	BT Level	Competence
1.	What are ultrasonics?	CO2	BTL 1	Remembering
2.	Mention the properties of ultrasonics.	CO2	BTL 1	Remembering
3.	Are the ultrasonic waves electromagnetic waves in nature? Justify your answer.	CO2	BTL 1	Remembering
4.	Why not ultrasonics be produced by passing high frequency alternating current through a loud speaker?	CO2	BTL 2	Understanding
5.	What are the various methods of producing ultrasonic waves?	CO2	BTL 2	Understanding
6.	What is meant by magnetostriction effect?	CO2	BTL 2	Understanding
7.	Calculate the natural frequency of 40 mm length of a pure iron rod used in magnetostriction oscillator. Given that the density of pure iron is 7.25×10^{3} kgm^{-3} and its Young's modulus is 115×10^{9} Nm^{-2}	CO2	BTL 2	Understanding
8.	A nickel crystal of length 10 cm with density 8.1×10^{3} kg/m^{3} and Young's modulus is 8.2×10^{11} Nm^{-2} is used in a magnetostriction oscillator. Determined the frequency of the ultrasonic waves generated.	CO2	BTL 1	Remembering
9.	What is meant piezoelectric effect?	CO2	BTL 2	Understanding
10.	What is inverse piezoelectric effect?	CO2	BTL 2	Understanding
11.	Write any two merits of piezoelectric oscillator.	CO2	BTL2	Understanding
12.	What are the demerits of piezoelectric oscillator?	CO2	BTL2	Understanding
13.	A quartz crystal of thickness 2×10^{-3} m is vibrating at resonance. Calculate fundamental frequency. Assume Young's modulus of the quartz as 8.69×10^{10} Nm^{-2} and its density as 2.65×10^{3} kg m^{-3}.	CO2	BTL2	Understanding

14.	Calculate the fundamental frequency of quartz crystal of thickness 1.5 mm which is vibrating at resonance. Given Young's modulus of the quartz as 7.9×10^{10} Nm^{-2} and its density as 2650 kg m^{-3}.	CO2	BTL2	Understanding
15.	What are the differences in the quality of ultrasonic waves generated by piezoelectric and Magnetostriction method?	CO2	BTL 1	Remembering
16.	Give any four applications of ultrasonic waves.	CO2	BTL 1	Remembering
17.	What is acoustical grating?	CO2	BTL 1	Remembering
18.	Calculate the velocity of ultrasonic waves in a liquid in an acoustic grating experiment using the following data. Wavelength 600 nm, frequency of ultrasonic wave 100 MHz and angle of first order diffraction is 5°.	CO2	BTL2	Understanding
19.	What is SONAR?	CO2	BTL1	Remembering
20.	Given that the velocity of ultrasonic wave in sea water is equal to 1440 m/s find the depth of the submerged submarine, if the ultrasonic pulse reflected from the submarine is received after 0.33 s after being send out.	CO2	BTL2	Understanding
21.	What is the principle of ultrasonic flaw detector?	CO2	BTL1	Remembering
22.	What are types of ultrasonic imaging systems?	CO2	BTL1	Remembering
23.	State the principle of sonogram.	CO2	BTL2	Understanding
24.	Can ultrasonic waves use dispersion of fog? How?	CO2	BTL 1	Remembering
	PART – B			
1.	Discuss the construction and working of magnetostriction oscillator, give its advantages and disadvantages. (16)	CO2	BTL4	Analyzing
2.	Explain how are ultrasonic waves are produced using magnetostriction oscillator and write its advantages. (16)	CO2	BTL3	Applying
3.	How ultrasonic waves are generated using magnetostriction oscillator? Explain with a neat sketch. (16)	CO2	BTL3	Applying
4.	Explain the phenomenon of magnetostriction. How will you produce high-frequency sound waves with its help? (16)	CO2	BTL3	Applying
5.	Draw the circuit diagram of piezoelectric oscillator and explain the production of ultrasonic waves using it. (16)	CO2	BTL4	Analyzing
6.	Explain with a neat sketch the construction and production of ultrasonic waves using piezoelectric oscillator. (16)	CO2	BTL4	Analyzing
7.	What is meant by inverse piezoelectric effect? Explain how are ultrasonic waves are produced using piezoelectric oscillator. (16)	CO2	BTL3	Applying
8.	Describe the method of determining the velocity of ultrasonic waves using acoustic grating. (16)	CO2	BTL 4	Analyzing
9.	(i) What is an acoustic grating? (2) (ii) How is it used in determining the velocity of ultrasonic waves in liquid? (14)	CO2	BTL 3	Applying
10.	Explain the determination of velocity of ultrasonic using an acoustical grating. (16)	CO2	BTL 3	Applying
11.	Explain with neat sketch how the flaw is characterized using the pulse echo technique. (16)	CO2	BTL 3	Applying

12.	What is meant by ultrasonic flaw detector? Explain the different methods of defect display methods with suitable examples.	(16)	CO2	BTL 3	Applying
13.	Detail the applications of ultrasonic in engineering field.	(16)	CO2	BTL 4	Analyzing
14.	Explain in detail how ultrasonic pulse techniques used in SONAR.	(16)	CO2	BTL 4	Analyzing
15.	Explain in detail how SONAR is employed to locate objects. Also, give its advantages.	(16)	CO2	BTL 3	Applying
16.	Write detail note on diagnostic sonography.	(16)	CO2	BTL 4	Analyzing
17.	(i) Explain how ultrasonic waves are used in air bag sensor.	(6)	CO2	BTL 3	Applying
	(ii) With neat diagram explain the working of sonogram.	(10)	CO2	BTL 3	Applying

UNIT III -LASER AND ITS APPLICATIONS

Basic concepts and characteristics - Einstein's A and B coefficients (derivation) - population inversion - Pumping methods - Nd-YAG laser - CO_2 laser - Semiconductor lasers: homo junction and heterojunction - applications: laser welding, laser cutting, laser cooling, pattern formation by laser etching, laser bar code scanner - LIDAR - Laser tissue interaction, laser surgery - Holography - NLO - electro-optic effect.

PART – A

Q. No	Questions	CO	BT Level	Competence
1.	What does the acronym LASER stands for?	CO3	BTL 1	Remembering
2.	Name the four characteristics of a laser beam.	CO3	BTL 1	Remembering
3.	What is meant by population inversion?	CO3	BTL 2	Understanding
4.	Why laser action sometimes called inverted absorption?	CO3	BTL 2	Understanding
5.	Write the components of laser.	CO3	BTL 1	Remembering
6.	Differentiate spontaneous and stimulated emission.	CO3	BTL 2	Understanding
7.	What are the conditions required for laser action?	CO3	BTL 2	Understanding
8.	Define the terms active center.	CO3	BTL 1	Remembering
9.	Define the terms active medium.	CO3	BTL 1	Remembering
10.	What is meant by pumping of atoms in laser?	CO3	BTL 2	Understanding
11.	Name any two pumping methods in laser.	CO3	BTL 1	Remembering
12.	Write the role of resonator in laser.	CO3	BTL 2	Understanding
13.	What are the vibration modes of CO_2 laser?	CO3	BTL 1	Remembering
14.	Differentiate between a homojunction and a heterojunction laser.	CO3	BTL 2	Understanding
15.	Calculate the wavelength of the emission from GaAs semiconductor laser whose band energy is 2.8 eV.	CO3	BTL 2	Understanding
16.	Name any two applications of lasers in engineering and industry field.	CO3	BTL 2	Understanding

17.	Mention any two medical applications of laser.	CO3	BTL 2	Understanding
18.	What is LIDAR?	CO3	BTL 1	Remembering
19.	What is holography?	CO3	BTL 1	Remembering
20.	List the difference between photography and Holography.	CO3	BTL 2	Understanding
21.	Why the wavelength of the source should be same for construction and reconstruction of hologram?	CO3	BTL 2	Understanding
22.	Give any two applications of Hologram.	CO3	BTL 1	Remembering
23.	What is Nonlinear optics?	CO3	BTL 1	Remembering
24.	Define electro-optic effect.	CO3	BTL 1	Remembering

PART-B

1.	Using the correct expressions, infer the relation between Einstein'scoefficient of spontaneous and stimulated emissions.	(16)	CO3	BTL 3	Applying
2.	Specify three types of possible energy transitions between two atomic energy levels and derive conditions for Einstein's coefficients.	(16)	CO3	BTL 3	Applying
3.	Derive the Einstein's relation for stimulated emission to explain the existence of stimulated emission.	(16)	CO3	BTL 3	Applying
4.	Outline the principle, construction and working of an Nd-YAG laser. List any three advantages of the Nd-YAG laser.	(16)	CO3	BTL 4	Analyzing
5.	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 theactive centers.	(16)	CO3	BTL 3	Applying
6.	Explain the working of Nd:YAG laser with neat energy level diagram. What are its applications?	(16)	CO3	BTL 3	Applying
7.	With the help of suitable diagrams, explain the principle, construction and working of a carbon dioxide laser.	(16)	CO3	BTL 3	Applying
8.	Explain in detail the principle, construction and working of a molecular gas laser.	(16)	CO3	BTL 3	Applying
9.	With a neat sketch, explain the principle, construction and working of CO_2 lasers.	(16)	CO3	BTL 3	Applying
10.	(i) Explain the principle, construction and working of any one type of semiconductor diode laser. (ii) Mention the advantages and disadvantages of semiconductor diode laser	(13) (3)	CO3	BTL 4	Analyzing
11.	What is semiconductor laser? Explain Homo junction and hetero junction semiconductor lasers.	(16)	CO3	BTL 4	Analyzing
12.	Explain the construction and reconstruction of a hologram with suitable diagrams.	(16)	CO3	BTL 4	Analyzing
13.	What is meant by hologram? Explain the construction and the reconstruction of hologram using laser source.	(16)	CO3	BTL 4	Analyzing
14.	Describe the principle, construction and working of LIDAR system. Write few applications of LIDAR.	(16)	CO3	BTL 3	Applying
15.	Write notes on i) Laser cutting ii) Laser surgery and iii) Laser tissue interaction	 (5) (5) (6)	CO3	BTL 4	Analyzing

16.	Brief the Physics behind the principle and working of LIDAR. (16) Write some key applications of LIDAR system.	CO3	BTL 4	Analyzing
17.	Write short notes on i) Laser welding (5) ii) Laser cooling and (5) iii) Laser bar code scanner (6)	CO3	BTL 4	Analyzing

UNIT IV - FIBRE OPTICS

Structure and principle - Propagation of light through optical fibre - acceptance angle, numerical aperture - fractional index change - Types of optical fibres (material, mode and refractive index) - Attenuation: absorption, scattering and bending - Dispersion - Fibre optic communication system (Block diagram) and advantages over conventional methods - fibre optic sensors: pressure and displacement- Endoscope.

PART – A

Q.No	Questions		BT level	Competence
1.	What is an optical fiber?	CO4	BTL1	Remembering
2.	What is the basic principle of guiding light through an optical fiber?	CO4	BTL2	Understanding
3.	Explain the phenomenon of total internal reflection.	CO4	BTL2	Understanding
4.	Express Snell's law mathematically.	CO4	BTL1	Remembering
5.	Draw a schematic lay out of optical fiber.	CO4	BTL2	Understanding
6.	List out the conditions of total internal reflection.	CO4	BTL1	Remembering
7.	What is the angle of acceptance for an optical fiber?	CO4	BTL1	Remembering
8.	What is the role of core in an optical fiber?	CO4	BTL2	Understanding
9.	What is the importance of graded index fiber?	CO4	BTL2	Understanding
10.	What are the advantages of multimode fiber?	CO4	BTL2	Understanding
11.	Calculate the acceptance angle for optical fiber with numerical aperture of 0.4.	CO4	BTL3	Applying
12.	What is meant by fractional index change?	CO4	BTL1	Remembering
13.	Define numerical aperture.	CO4	BTL2	Understanding
14.	Calculate the numerical aperture and acceptance angle of a fiber with a core index of 1.54 and cladding 1.50.	CO4	BTL3	Applying
15.	Classify the optical fiber type based on the material.	CO4	BTL2	Understanding
16.	List any four applications of optical fiber.	CO4	BTL1	Remembering
17.	What is meant by attenuation?	CO4	BTL1	Remembering
18.	A light signal of 100 mW is injected into a fibre of length 1 km. The out coming signal from the other end is 49 mW .What is the loss in dB	CO4	BTL2	Understanding
19.	What are the basic attenuation mechanisms?	CO4	BTL2	Understanding
20.	What is intermodal dispersion?	CO4	BTL1	Remembering
21.	Define active and passive fiber optics sensors.	CO4	BTL1	Remembering

22.	Write the advantages of fibre optic communication over radio wave communication.		CO4	BTL2	Understanding
23.	What is endoscope?		CO4	BTL2	Understanding
24.	Give any two medical applications of fibre optic endoscopy.		CO4	BTL2	Understanding
	PART- B				
1.	Explain the principle and propagation of light through optical fibre. Derive an expression for acceptance angle and numerical aperture of an optical fibre	(16)	CO4	BTL4	Analyzing
2.	(i) Define acceptance angle and derive mathematical relation for it. (ii) 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	(13) (3)	CO4 CO4	BTL4 BTL3	Analyzing Applying
3.	Deduce an expression for the numerical aperture and acceptance angle of optical fiber in terms of refractive index of the core and cladding.	(16)	CO4	BTL3	Applying
4.	Derive an equation relating the numerical aperture and acceptance angle of optical fiber in terms of refractive index of the core and cladding.	(16)	CO4	BTL3	Applying
5.	(i) Explain the phenomenon of total internal reflection using a suitable diagram. (ii) Derive an expression for acceptance angle in terms of numerical aperture.	(3) (13)	CO4	BTL4	Analyzing
6.	What is an optical fiber? Classify fibers based on material, modes of propagation and index profile.	(16)	CO4	BTL4	Analyzing
7.	Give a detailed classification of the optical fiber-based on material, mode and refractive index.	(16)	CO4	BTL4	Analyzing
8.	Explain in detail the losses in optical fiber with a basic attenuation mechanism.	(16)	CO4	BTL3	Applying
9.	List out and summarize the various losses that has to be taken care of while using optical fiber	(16)	CO4	BTL4	Analyzing
10.	(i) Discuss the Scattering, Bending and Absorption loss in optical fibers. (ii) The optical power after propagating through a fiber of 1.5 km length is reduced to 25% of its original value. Compute the fiber loss in dB/km.	(13) (3)	CO4 CO4	BTL4 BTL4	Analyzing Analyzing
11.	Describe the fibre optic communication with neat block diagram.	(16)	CO4	BTL4	Analyzing
12.	Give a detailed description of an optical fibre based communication system.	(16)	CO4	BTL4	Analyzing
13.	With a neat sketch, discuss the transmission and reception of information signals and their propagation in a Fiber communication system.	(16)	CO4	BTL4	Analyzing
14.	Describe the pressure and the displacement sensors with neat diagrams.	(16)	CO4	BTL4	Analyzing
15.	Explain the construction and working of the pressure sensor. Sketch the displacement sensor and discuss its working	(16)	CO4	BTL4	Analyzing
16.	List the different types of fiber optic sensors. Explain the working of any two sensors	(16)	CO4	BTL4	Analyzing
17.	Explain the construction and working of fiber optic medical endoscope with neat diagram.	(16)	CO4	BTL4	Analyzing

UNIT V - QUANTUM PHYSICS

Black body radiation and energy distribution spectrum - Planck's theory of radiation - matter waves - de-Broglie wavelength in terms of energy, voltage and temperature - Electron diffraction - G.P.Thomson experiment - wave function and its physical significance - Schrödinger's wave equation - time independent and time dependent equations - Particle in a one-dimensional box- Normalization of wave function - Quantum Tunnelling - Scanning Tunnelling Microscope.

PART – A

Q. No	Questions	CO	BT Level	Competence
1.	Define black body radiation.	CO5	BTL 1	Remembering
2.	List any two characteristics of the black body radiation spectrum.	CO5	BTL 1	Remembering
3.	State Planck's law of radiation.	CO5	BTL 1	Remembering
4.	Write any two postulates of Planck's quantum theory of black body radiation.	CO5	BTL 2	Understanding
5.	What are matter waves?	CO5	BTL 1	Remembering
6.	List the properties of matter waves.	CO5	BTL 1	Remembering
7.	Write about dual nature.	CO5	BTL 2	Understanding
8.	Write de-Broglie wavelength in terms of temperature and explain the terms in it.	CO5	BTL 2	Understanding
9.	Consider a stone of mass 0.1 kg moving at a speed of 1 m/s. Calculate its de-Broglie wavelength.	CO5	BTL 2	Understanding
10.	Calculate the de-Broglie wavelength of the orbital electron of hydrogen atom given that its energy is 13.6 eV.	CO5	BTL 2	Understanding
11.	An electron is accelerated by a potential difference of 150 V. Calculate the wavelength of that electron wave.	CO5	BTL 2	Understanding
12.	What is wave function?	CO5	BTL 1	Remembering
13.	Write the physical significance of wave function.	CO5	BTL 2	Understanding
14.	Write the condition for finding and not finding a particle in a particular region.	CO5	BTL 2	Understanding
15.	List any two applications of the Schrodinger wave equation.	CO5	BTL 1	Remembering
16.	The ground state energy cannot be zero for a free particle moving within a one-dimensional potential box. Justify.	CO5	BTL 2	Understanding
17.	Mention the condition for normalization of the wave function.	CO5	BTL 2	Understanding
18.	What are Eigen value and Eigen function?	CO5	BTL 2	Understanding
19.	Calculate the minimum energy of the particle moving in one dimension in an infinitely high potential box of width 1 Å.	CO5	BTL 3	Applying
20.	Evaluate the energy of a particle of mass 10 g confined in a box of width 10 cm for the first excited state.	CO5	BTL 3	Applying
21.	Write the expression for Eigen energy and wave function for a particle in a one-dimensional potential box.	CO5	BTL 1	Remembering
22.	What is meant by quantum tunneling?	CO5	BTL 1	Remembering

23.	Write the principle of scanning tunneling microscope.		CO5	BTL 1	Remembering
24.	Mention any two applications of quantum tunneling microscope.		CO5	BTL 1	Remembering
	PART – B				
1.	(i) Write the postulates of Planck's quantum theory of radiation (ii) Derive an equation for energy density of Planck's radiation law	(2) (14)	CO5 CO5	BTL 4 BTL 4	Analyzing Analyzing
2.	Derive an equation for Planck's quantum theory of black body radiation basedon the quantum conceps.	(16)	CO5	BTL 3	Applying
3.	Write the Planck's hypotheses. Derive Planck's formula for the distribution ofenergy in black body radiation.	(16)	CO5	BTL 3	Applying
4.	Explain the concept of wave particle duality and obtain an expression forwavelength of matter waves in terms energy, voltage and temperature.	(16)	CO5	BTL4	Analyzing
5.	What are matter waves? Describe the experiment that supports the existenceof matter waves.	(16)	CO5	BTL4	Analyzing
6.	Derive an expression for the wavelength of matter waves. Explain the G.P. Thomson experiment that verifies the wave nature of light.	(16)	CO5	BTL4	Analyzing
7.	Derive an expression for the de-Broglie wavelength of matter waves in termsof (i) Energy (ii) Voltage (iii) Temperature	(6) (5) (5)	CO5	BTL 3	Applying
8.	Deduce an expression for de-Broglie wavelength in terms of velocity,temperature and energy	(16)	CO5	BTL 3	Applying
9.	(i) Write the physical significance of wave function. (ii) Derive an expression for Schrodinger's time-dependent wave equation.	(4) (12)	CO5	BTL 3 BTL 4	Applying Analyzing
10.	Starting with the classical wave equation associated with moving particles;formulate the Schrodinger's time-independent wave equation.	(16)	CO5	BTL4	Analyzing
11.	Derive an expression for Schrodinger's time-independent wave equation.	(16)	CO5	BTL4	Analyzing
12.	Obtain time-dependent Schrodinger's wave equation for a free particle of massm and energy E.	(16)	CO5	BTL4	Analyzing
13.	Derive an expression for Schrodinger's time-dependent wave equation.	(16)	CO5	BTL4	Analyzing
14.	Solve time-independent Schrodinger's wave equation for a particle trapped ina potential well and obtain Eigen functions and energy Eigen values for the particle.	(16)	CO5	BTL 3	Applying
15.	Using Schrodinger's wave equation, deduce an expression for the wavefunction and energy of the particle confined in a one-dimensional potential box.	(16)	CO5	BTL 3	Applying
16.	Explain the principle, construction and working of scanning tunneling electron microscope.	(16)	CO5	BTL 2	Understanding
17.	Discuss with neat diagram the working of scanning tunneling electron microscope and write its applications.	(16)	CO5	BTL 3	Applying