Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Science

End Sem (Even) Examination May-2022

SC6PH03 Material Physics

Programme: Ph.D. Branch/Specialisation: Physics (Course Work).

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. The quantity $|\psi|^2$ represents: **1**

(a) Intensity of wave (b) Charge density
(c) Energy density (d) Probability density

ii. In infinite square well potential, the potential of the spectrum will be: **1**

(a) Mixed (b) Unmixed (c) Separate (d) Bound

iii. The wavelength range corresponding to UV-visible region belongs to: **1**

(a) 400-800 nm (b) 200-800 nm
(c) 25 μm-2.5 μm (d) 2.5 μm – 1mm

iv. Which among the following helps us in getting a three-dimensional picture of the specimen? **1**

(a) TEM (b) Simple Microscope
(c) SEM (d) Compound Microscope

v. MATLAB stands for: **1**

(a) Matrix laboratory (b) Math library
(c) Matric library (d) Matrix library

vi. The basic unit of a worksheet into which you enter data in Excel is called a: **1**

(a) Table (b) Cell (c) Column (d) Box

vii. Which types of lasers use gas as a medium? **1**

(a) Semiconductor Lasers (b) Gas Lasers
(c) Solid State Lasers (d) Dye Lasers

P.T.O.

viii. In Stimulated Absorption, what is the lifetime of atoms ground state? **1**
(a) 1 second (b) 1 Minute (c) 1 Hour (d) infinite

ix. Nonlinear effects which are defined by the intensity – dependent refractive index of the fiber are called as _____. **1**
(a) Scattering effects (b) Kerr effects
(c) Raman effects (d) Tomlinson effects

x. When three wave components co-propagate at angular frequency w1, w2, w3, then a new wave is generated at frequency w4, which is given by? **1**
(a) w4 = w1 – w2 – w3 (b) w4 = w1 + w2 + w3
(c) w4 = w1 + w2 – w3 (d) w4 = w1 – w2 + w3

Q.2 i. A matter wave is always depending on wave function. Write the characteristics of wave function. **2**

ii. When a particle reflected from a potential step then write the resultant Schrödinger wave equation for all conditions. **3**

iii. What is the concept of scattering cross section? How the theory of Born approximation help to solve this problem? Give the condition for validity of Born approximation. **5**

OR iv. Derive the expression for the time independent and time dependent Schrodinger's equations. **5**

Q.3 i. Raman spectroscopy is one of the structural determination characterization techniques. Write the important information one can get from this measurement. **2**

ii. Write three applications of UV-Vis spectroscopy. **3**

iii. You have been provided with a XRD pattern of a unknown sample. What are the different parameter you can determine with that XRD pattern? **5**

OR iv. Define scanning electron microscope. How can we use the SEM technique for the surface analysis? Give its advantages and disadvantages. **5**

Q.4 i. Write the two uses of origin software. **2**

ii. You want to move around in the table from one cell to next cell, previous cell, next row, previous row and creating a new paragraph within the cell. Which keys you have to use if your mouse is not working? **3**

iii. Write the commands to draw a basic 1D plot in MATLAB. **5**

OR iv. Describe commonly used commands for plotting graphs in result analysis. **5**

Q.5 i. What is the role of population inversion in laser action? **2**

ii. How the laser beam propagates? Give its profile. **3**

iii. Discuss the construction and working of He – Ne laser level with help of energy level diagram. What are the various advantages of He-Ne gas laser over the solid-state laser? **5**

OR iv. Define quantum three process. How the laser action takes place in optical resonator. **5**

Q.6 i. What is self-focusing of light? **2**

ii. Write a short note on optical mixing. **3**

iii. What do you mean by non-linear optics harmonic generation? Explain the process of Second Harmonic Generation (SHG). **5**

OR iv. Nano particles can be synthesized by various methods. Explain any one chemical method with process flow diagram. **5**

******

Scheme of Marking

MEDI-CAPS UNIVERSITY Knowledge is Power	Faculty of Science End Sem (Even) Examination May-2022 PH6CW03 Material Physics
Programme: Ph.D. (Course Work).	Branch/Specialisation:

Note: The Paper Setter should provide the answer wise splitting of the marks in the scheme below.

Q.1	i)	d) probability density	1
	ii)	c) separate	1
	iii)	b) 200-800 nm	1
	iv)	a) TEM	1
	v)	a) matrix laboratory	1
	vi)	b) Cell	1
	vii)	b) Gas Lasers	1
	viii)	d) infinite	1
	ix)	b) Kerr effects	1
	x)	c) w4 = w1 + w2 – w3	1
Q.2	i.	A matter wave is always depending on wave function. Write the characteristics of wave function. **One mark for each property**	2
	ii.	When a particle reflected from a potential step then write the resultant Schrödinger wave equation for all conditions. Boundary condition Resultant wave equations (both)	1 2
	iii.	What is the concept of scattering cross section? How the theory of Born approximation help to solve this problem? Give the condition for validity of Born approximation. **Concept of scattering cross section** **Born Approximation** **condition for validity**	1 3 1
OR	iv.	Derive the expression for the time independent and time dependent Schrodinger's equations. **Complete Derivation**	5
Q.3	i.	Raman spectroscopy is one of the structural determination characterization techniques. Write the important information one can get from this measurement. **Any thing related to vibrational structure**	2
	ii.	Write three applications of UV-Vis spectroscopy. **One mark for each Application**	3
	iii.	You have been provided with a XRD pattern of a unknown sample. What are the different parameter you can determine with that XRD pattern? **X- Ray Parameters**	5
OR	iv.	Define Scanning Electron Microscope. How can we use the SEM technique for the surface analysis? Give its advantages and disadvantages. Scanning Electron Microscope surface analysis advantages and disadvantages.	1 2 2
Q.4	i.	Write the two uses of Origin software. **One mark for each use**	2
	ii.	You want to move around in the table from one cell to next cell, previous cell, next row, previous row and creating a new paragraph within the cell. Which keys you have to use if your mouse is not working? **Uses of Arrows**	3
	iii.	Write the commands to draw a basic 1D plot in MATLAB. **Write the complete commands for plotting graph**	5
OR	iv.	Describe commonly used commands for plotting graphs in result analysis. **All the commands for error analysis**	5
Q.5	i.	What is the role of population inversion in laser action? **Importance of population Inversion**	2
	ii.	How the laser beam propagates? Give its profile. **Gaussian beam profile**	3
	iii.	Discuss the construction and working of He – Ne laser level with help of energy level diagram. What are the various advantages of He-Ne gas laser over the solid-state laser? **He-Ne laser construction** **Working** **Comparison**	2 2 1

OR	iv.	Define quantum three process. How the laser action takès place in optical resonator. **All three process** **Laser action**	 3 2
Q.6	i.	What is self-focusing of light? **Definition**	2
	ii.	Write a short note on optical mixing.	3
	iii.	What do you mean by non-linear optics harmonic generation? Explain the process of Second Harmonic Generation (SHG). **optics harmonic generation** **Second Harmonic Generation (SHG).**	 2 3
OR	iv.	Nano particles can be synthesized by various methods. Explain any one chemical method with process flow diagram. **Methods** **Flow Chart**	 3 2

******