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ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU-27

B.Sc. PHYSICS – V SEMESTER

MID SEMESTER TEST: AUGUST 2019

PH5215: Quantum Mechanics, Atomic & Molecular Physics

Time: 1 hour

Max. Marks: 30

This question paper contains 1 printed page and 3 parts

PART-A

Answer any **two** questions.

[2x10=20]

1. With neat diagram, describe G.P Thomson's experiment to prove the existence of matter waves. [10]
2. a) Obtain Schrodinger's time dependent wave equation assuming plane wave equation for a moving particle. [8]
b) Give the Born's interpretation of wave function. [2]
3. a) Write the features that characterize the vector atom model. Give the details of the different quantum numbers associated with vector atom model. [10]

PART-B

Solve any **two** problems.

[2x4=8]

4. The first order Bragg maxima of electron diffraction occurred at 65° in a crystal with planes having interplanar distance of 0.4086 \AA . Calculate the de-Broglie wavelength associated with the electrons. Also find out the potential through which electrons must be accelerated to obtain that wavelength.
5. The position and momentum of 10keV electrons are simultaneously determined. If its position is located within 1\AA , find out the accuracy with which its momentum can be determined?
6. For a two electron system with $l_1=1$, $s_1=1/2$ and $l_2=2$, $s_2=1/2$, find the possible values of j using L-S coupling.

PART-C

7. Answer any **two** questions.

[2x1=2]

- a) Wave nature of matter is not observable in ordinary life. Why?
- b) Can matter waves travel faster than light? Justify
- c) Check whether $2P_1$ is an allowed state or not?