**Registration no:** | | | | | | | | | | |

**Total Number of Pages: 02**



**M.Sc. I**
**FPYC605**

# $6^{TH}$ SEMESTER REGULAR EXAMINATION 2016-17
# FUNDAMENTALS OF QUANTUM MECHANICS-II
## BRANCH(S): M.Sc.I (AP)
## Time: 3 Hours
## Max marks: 70
## Q.CODE:Z415

**Answer Question No.1 which is compulsory and any five from the rest.**
**The figures in the right hand margin indicate marks.**

Q1 **Answer the following questions:** (2 x 10)

a) Define Eigen value spectrum. Write the difference between discrete and continuous spectrum.
b) Prove that Eigen values of Hermitian operators are real .
c) Define the term compatibility.Give example of two operators which are compatible.
d) What are stationary states? Write two properties of stationary states.
e) What do you mean by constants of motion in quantum mechanics? Give two examples.
f) Prove the Hermiticity of parity operator.
g) An electron is completely trapped in a one dimensional region of width $1A^0$.How much energy is supplied to excite the electron from ground state to first excited state?
h) A stream of electrons strikes on a potential energy step of height 0.04ev. Calculate the fraction of electrons reflected if energy of the electrons is 0.05ev.
i) What is the Hamiltonian operator for a free particle? Show that the linear momentum of free particle is conserved.
j) Define normalisation condition for a wave function.

Q2 a) What do you mean by degenerate eigenvalue spectrum ? (3)
b) Outline the Schmidt method of orthogonalisation for degenerate Eigen function. (7)



Q3 a) Explain the term Eigen function expansion. Write the physical significance of expansion coefficient. (4)
b) Obtain the completeness and closure relation for Eigen functions corresponding to discrete Eigen value spectrum of a Hermitian operator. (6)

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| Q4 | a) | Starting from corresponding time dependent Schrodinger waveequation obtain the time independent Schrödinger equation in two dimension and three dimension. | (6) |
| | b) | What is the physical significance of separation constant? | (4) |
| Q5 | a) | Obtain the uncertainty relation for a pair of canonically conjugate observables. Hence obtain the position momentum uncertainty relation. | (6) |
| | b) | Derive the form of a wave packet which can be considered as the minimum uncertainty wave packet. | (4) |
| Q6 | a) | State and prove Ehrenfest's theorem. | (7) |
| | b) | Find out the Eigen function and Eigen values of Parity operator . | (3) |
| Q7 | a) | Using Schrodinger time independent wave equation deduce the energy Eigen value and Eigen function of a particle trapped inside a one dimensional box. | (7) |
| | b) | Plot the graph of wave function and probability density function versus particle's position. | (3) |
| Q8 | a) | Set up the Schrodinger wave equation for a one dimensional linear harmonic oscillator. | (4 ) |
| | b) | Obtain it's energy Eigen values and Eigen functions . | (6) |

END