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10NT43

## Fourth Semester B.E. Degree Examination, Dec.2015/Jan.2016

### Introduction to Quantum Mechanics

Time: 3 hrs.

Max. Marks:100

**Note: Answer FIVE full questions, selecting at least TWO questions from each part.**

#### PART – A

- 1 a. Explain limitations of classical physics. (04 Marks)  
b. State uncertainty principle. Explain the experiment to prove uncertainty principle. (08 Marks)  
c. Explain wave packets in space and time. (08 Marks)
- 2 a. Derive Schrodinger wave equation for a particle in one dimension. (10 Marks)  
b. Obtain an expression for Ehrenfest's theorem. (10 Marks)
- 3 a. Explain Hilbert space with the help of an example. (06 Marks)  
b. Write note on Hermitian, unitary and projection operators. (06 Marks)  
c. Explain matrix representation of an operator. (04 Marks)  
d. Describe Bra and Ket notation for vectors. (04 Marks)
- 4 a. State and explain the fundamental postulates of quantum mechanics. (10 Marks)  
b. Explain Poisson brackets and commutator brackets along with the properties. (05 Marks)  
c. Describe the equation of motion in terms of quantum mechanics. (05 Marks)

#### PART – B

- 5 a. Derive Schrodinger wave equation with respect to a rigid rotator. (10 Marks)  
b. Obtain the wave function and energy eigen value for a particle in three dimensional box. (10 Marks)
- 6 a. Derive the wave equation and corresponding solution for a particle confined to spherical trap. (10 Marks)  
b. Explain energy bands in conductors, semiconductors and insulators. Also explain density of states for solids. (10 Marks)
- 7 a. Derive an expression for time independent perturbation theory for non-degenerate energies. (10 Marks)  
b. Explain WKB approximation. (10 Marks)
- 8 a. Explain turing machines and logic gates. (06 Marks)  
b. Differentiate between reversible and irreversible computation. (05 Marks)  
c. Describe Moore's law. (04 Marks)  
d. Write note on quantum bits. (05 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.