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Reg. No...............................

Name....................................

M.Sc. DEGREE (C.S.S.) EXAMINATION, JUNE 2018

Second Semester

Faculty of Science

Branch II : Physics–A–Pure Physics

PH 2C 06—QUANTUM MECHANICS–I

(2012 Admission onwards)

Time : Three Hours   Maximum Weight : 30

Part A (Short Answer Type Questions)

Answer any **six** *questions.*
Each question carries weight 1.

1. What is linear vector space ?

2. What are inner products ?

3. State the features of a Hermitian operator.

4. What is meant by orthonormal basis ?

5. Write down the operators in Dirac picture.

6. Briefly explain the features of interaction picture.

7. Explain transition amplitude.

8. What are CG coefficients ?

9. Give the commutation relations of J^2.

10. State the perturbation in a non-degenerate case.

$(6 \times 1 = 6)$

Part B

Answer any **four** *questions.*
Each question carries weight 2.

11. Distinguish between hermitian and unitary operators. Show that linear momentum operator is hermitian.

12. Prove that an operator in a linear vector space can be represented by a square matrix.

Turn over

13. Obtain the equation of motion in Schrodinger picture.

14. Show that zero point energy of anharmonic oscillator can be a consequence of uncertainty principle.

15. Bring out orbital angular momentum as a rotation generator.

16. Discuss Zeeman Effect in hydrogen atom as degenerate case of perturbation.

$(4 \times 2 = 8)$

Part C

Answer **all** *questions.*
Each question carries weight 4.

17. (a) Discuss the significance of LVS in the formulation of QM and the operators associated with it.

Or

(b) Describe the Stem-Gerlach experiment and the conclusions which lead to the basics of quantum mechanics.

18. (a) Describe the Heisenberg picture and obtain the equations of motion.

Or

(b) With creation and annihilation operators solve linear harmonic oscillator problem.

19. (a) Discuss the fundamental commutation relations of angular momentum.

Or

(b) Establish the addition of angular momentum and spin angular momentum. Arrive at CG coefficients.

20. (a) Bring out the WKB approximation for hydrogen atom.

Or

(b) Discuss Stark Effect with perturbation theory.

$(4 \times 4 = 16)$