PARUL UNIVERSITY
FACULTY OF APPLIED SCIENCE
M.Sc. Summer 2017-18 Examination

Semester: 2   Date: 07/05/2018
Subject Code: 11204151   Time: 10:30 AM to 01:00 PM
Subject Name: Quantum Mechanics - II and Mathematical Physics – II   Total Marks: 60

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1. A) Essay type   (08)
    (a) Describe Schrodinger picture and Heisenberg picture.
    (b) Write a note on Central field approximation.

Q.1. B) Answer the following questions (Any two)
    (a) Brief note.   (04)
        1. Write a statement of Pauli's principle and which particles obey it?
        2. Write a brief note on Helium atom.
    (b) Write a note on spin functions of two electrons.   (04)
    (c) Write a note on Hartree equations.   (04)

Q.2. A) Answer the following questions.
    (a) Short note.   (04)
        1. Define quantum electrodynamics.
        2. Define creation and annihilation operators along with suitable equation.
    (b) Write a note on Einstein's coefficient.   (04)

Q.2. B) Answer the following questions (Any two)
    (a) Definition.   (03)
        1. Define electric dipole.
        2. Define Life time.
        3. Define momentum transfer.
    (b) Write a detail note along with suitable equations to explain Time dependent perturbation   (03)
        theory.
    (c) Write a note on Interaction picture.   (03)

Q.3. A) Essay type   (08)
    (a) Show that the function u=$x^2 - y^2 + x$ is harmonic and find the corresponding
        analytic function
    (b) Solve green's function in one-dimension.

Q.3. B) Answer the following questions (Any two)
    (a) Short note   (04)
        1. Fredholm integral equation.
        2. Volterra integral equation.
    (b) Convert BVP differential equation into integral $\frac{d^2y}{dx^2} + ly = mx, y(a) = A, y(b) = B$ (04)
    (c) Using residue theorem, evaluate $\int \frac{e^z+z}{z^3-z} dz$ where $C: |z|=\frac{\pi}{2}$.   (04)

Q.4. A) Answer the following questions.
    (a) Short note   (04)
        1. Green function.
        2. Analytic function.
    (b) Find the Laurent series expansion of f(z) = $\frac{1}{(6-z-z^2)}$ in (i) the   (04)
    domain |z| < 2 (ii) the domain 2 < |z| < 3 (iii) |z| > 3

Q.4. B) Answer the following questions (Any two)
    (a) Solve the following   (03)
        1. Find the third root of 1.
        2. Write C-R condition for analytic function.
        3. Write the general value of Log (2 + 3i)
    (b) Find the image of |z−1|=1 under the mapping w=1/z.   (03)

    (c) Write Liouville-Neumann series.   (03)