Seat No:_____   Enrollment No:_____

PARUL UNIVERSITY
FACULTY OF APPLIED SCIENCE
M.Sc. Summer 2018-19 Examination

Semester: 2   Date: (01/04/2019)
Subject Code: 11204151   Time: 10:30 am to 1:00 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) Discuss Wave function for many particle system.
   (b) Discuss Hartree Fock approximation.
Q.1. B) Answer the following questions (Any two)
   (a) Brief note (Each of 02 marks)   **(04)**
     1. Briefly explain Pauli's Exclusion Principle.
     2. Discuss briefly about exchange degeneracy i.e the condition for indistinguishability.
   (b) Short note: Non interacting (Hartree like) electron approximation.   **(04)**
   (c) Discuss Schrodinger Picture.   **(04)**
Q.2. A) Answer the following questions.
   (a) Brief note (Each of 02 marks)   **(04)**
     1. Explain Spontaneous emission.
     2. Explain stimulated emission.
   (b) Short note: Quantum electrodynamics.   **(04)**
Q.2. B) Answer the following questions (Any two)
   (a) Multiple choice questions.   (Each of 01 marks)   **(03)**
     1. Transitions having small life time are referred to as _____.
       a) Allowed transition.
       b) Forbidden transition
       c) Both a) and b)
       d) None of the above
     2. The _____ process can occur only in presence of radiation.
       a) Excitation
       b) Absorption
       c) Both a) & b)
       d) None of the above
     3. The probabilities of stimulated absorption and stimulated emission are _____.
       a) Same.
       b) Different.
       c) Inequal
       d) Both b) & c)
   (b) Short note: Quantization of electromagnetic field.   **(03)**
   (c) Short note: Ladder Method.   **(03)**
Q.3. A) Essay type (Each of 04 marks)   **(08)**
   (a) Show that u(x, y)= $e^{x^2-y^2}$ cos(2xy) is harmonic everywhere and find a conjugate harmonic for u(x, y).
   (b) Find the Laurent series of $\frac{1}{z^2(1-z)}$.
Q.3. B) Answer the following questions (Any two)
   (a) Short note (Each of 02 marks)   **(04)**
     1. Is the function u = xsinxcoshy – ycosxsinhy is harmonic?
     2. Prove that $\sinh^{-1} \alpha = \log (x + \sqrt{x^2 + 1}$
   (b) State the necessary conditions for Analytic function and check whether the function z^2 is analytic or not.   **(04)**
   (c) Short note: Milne Thomson Method.   **(04)**
Q.4. A) Answer the following questions.
   (a) Short note (Each of 02 marks)   **(04)**
     1. Give the statement of Green's theorem.
     2. Prove that : $\tan^{-1} Z= \frac{i}{2} \log (\frac{i+z}{i-z})$.

(b) Short note: Prove Green's theorem in the plane.   **(04)**

Q.4. B) Answer the following questions (Any two)

(a) Short note   (Each of 01 marks)   **(03)**
1. Write the polar form of $\sqrt{3} + 1$.
2. Log $(x+iy) =$ _____.
3. Laurent series of $(1- z)^{-1} =$ _____.

(b) Short note: Liouville Neumann Series   **(03)**

(c) Short note: Find the image of triangular region whose vertices are 2, i+1, 1-I under the   **(03)**
transformation w= z+3-4i.