

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

Semester: 1**Subject Code: 11204101****Subject Name: Quantum Mechanics-I & Mathematical Physics-I****Date: 21/05/2018****Time: 10:30 am to 1:00 pm****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 (Each of 04 marks) (08)**
 (a) Using partial fraction, find the inverse Laplace transform of following-
 1) $\frac{s+10}{s^2-s-2}$
 (b) Derive one-dimensional Schrodinger equation.
- Q.1. B) Answer the following questions (Any two) (04)**
 (a) Define the following
 1. Define Laplace.
 2. Define Stark effect.
 (b) Derive hydrogen molecule. (04)
 (c) Find Laplace inverse of the $\frac{s}{(s+1)^2}$ (04)
- Q.2. A) Answer the following questions. (04)**
 (a) Define the following.
 1. Define exchange interaction.
 2. Define convolution theorem.
 (b) Explain non-degenerate case. (04)
- Q.2. B) Answer the following questions (Any two) (03)**
 (a) Define the following.
 1. Homomorphism.
 2. Isomorphism.
 3. Reducible.
 (b) Explain upper bound on ground state energy. (03)
 (c) Explain in detail WKB. (03)
- Q.3. A) Solve the following- (Each of 04 marks) (08)**
 (a) Solve IVP by Laplace transform
 $y' - 4y = 2e^{2t} + e^{4t}$ $y(0) = 0$
 (b) Explain Bohr-Sommerfeld quantum condition.
- Q.3. B) Answer the following questions (Any two) (04)**
 (a) Short note
 1. Application of Laplace.
 2. Reciprocal tensor.
 (b) Solve by definition Laplace transform $f(t) = t^n$. (04)
 (c) Explain in detail perturbation theory for discrete levels. (04)
- Q.4. A) Answer the following questions. (04)**
 (a) Short note.
 1. Invariant tensor.
 2. Kronecker delta symbol.
 (b) Explain two-electron atoms. (04)
- Q.4. B) Answer the following questions (Any two) (03)**
 (a) Solve the following.
 1. Write formula for Laplace derivative.
 2. Write formula for Laplace integration.
 3. Define Schur's Lemmas.
 (b) Explain symmetric and anti-symmetric tensor. (03)
 (c) Explain superscript and sub-script. (03)