

PARUL UNIVERSITY
FACULTY OF APPLIED SCIENCE
M.Sc. Winter 2019-20 Examination

Semester: 3
Subject Code: 11204201
Subject Name: Nuclear Physics-I, Advanced Quantum
Mechanics-I and Instrumentation

Date: 26/11/2019
Time: 02:00 pm to 04:30 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/ Brief note (4x2) (Each of 04 marks) (08)**
 (a) Explain nuclear magnetic moments.
 (b) Explain hyperfine structure of atomic spectra.
- Q.1. B) Answer the following questions (Any two)**
 (a) Short note/ Brief note (2x2)/ Schematically label the figures (2x2) (Each of 02 marks) (04)
 1. Write a short note on nuclear spin.
 2. What do you mean by electric quadrupole moment? Explain in short.
 (b) Explain the effect of an external magnetic field on the hyperfine structure. (04)
 (c) Explain in short the molecular beam resonance method. (04)
- Q.2. A) Answer the following questions.**
 (a) Short note/ Brief note (2x2)/ Fill in the blanks. (Each of 02 marks) (04)
 1. What do you mean by scattering length? Explain in short.
 2. Write a short note on exchange forces.
 (b) Explain proton-proton scattering at low energy. (04)
- Q.2. B) Answer the following questions (Any two)**
 (a) Short note/ Multiple choice questions. (Each of 01 marks) (03)
 1. Write down the expression of Optical theorem.
 2. Define scattering. What is the unit of scattering cross section?
 3. What is scattering amplitude?
 (b) Write a short note on Meson theory of nuclear forces. (03)
 (c) Explain effective range theory in n-p scattering. (03)
- Q.3. A) Essay type/ Brief note (4x2) (Each of 04 marks) (08)**
 (a) Obtain/derive the following expression of scattering amplitude in terms of phase shifts. $f(\theta) = k^{-1} \sum_{l=0}^{\infty} (2l+1) e^{i\delta_l} \sin \delta_l P_l(\cos \theta)$
 (b) Explain Optical theorem and Ramsauer-Townsend effect.
- Q.3. B) Answer the following questions (Any two)**
 (a) Short note/ Brief note (2x2)/ Schematically label the figures (2x2) (Each of 02 marks) (04)
 1. Explain Born series.
 2. Write a short note on tensor forces.
 (b) Show that how scattering amplitude $f(\theta, \phi)$ plays a central role for the determination of the differential scattering cross-section. (04)
 (c) Explain Kinematics of the scattering Process. (04)
- Q.4. A) Answer the following questions.**
 (a) Short note/ Brief note (2x2)/ Fill in the blanks. (Each of 02 marks) (04)
 1. What is transducer? Give at least two example.
 2. Explain signal to noise ratio.
 (b) Explain desired characteristic of transducer (04)
- Q.4. B) Answer the following questions (Any two)**
 (a) Short note/ Multiple choice questions. (Each of 01 marks) (03)
 1. Give the full name of LVDT.
 2. What is the use of Pyrometer?
 3. Define transducer
 (b) Write a short note on Thermistor. (03)
 (c) Explain piezoelectric transducer. (03)