

FACULTY OF SCIENCE
M. Sc. IV – Semester Examination, May / June 2019

Subject : Physics

Paper – I : Nuclear Physics

Time : 3 Hours

Max. Marks: 80

Note : Answer all questions from Part–A and Part–B. Each question carries 4 marks in Part–A and 12 marks in Part – B.

PART – A (8 x 4 = 32 Marks)
(Short Answer Type)

- 1 Write semi-empirical mass formula and explain it briefly.
- 2 Define Yukawa potential.
- 3 What do you mean by α - decay?
- 4 What do you mean by multipole radiation?
- 5 What are stopping power and range of particle in matter?
- 6 Explain about range-energy relation.
- 7 What do you mean by compound nucleus?
- 8 Explain the Q-value of nuclear reaction.

PART – B (4 x 12 = 48 Marks)
(Essay Answer Type)

- 9 (a) Give the salient feature of nuclear shell model point out its successes and failures.
OR
(b) Explain about electric quadropole moment of nucleus and discuss its physical significance.
- 10 (a) Explain about the fine structure of α -spectrum on the basis of Gamow's theory.
OR
(b) What is the Fermi's theory of β -decay? Give its salient features.
- 11 (a) Mention the processes that are mainly responsible for the attenuation of gamma rays and explain them.
OR
(b) Describe the working principle and construction of scintillation detector.
- 12 (a) Give the classification of elementary particles and discuss the quark model.
OR
(b) Explain the differences between fission and fusion reactions and explain the Lepton number.

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Subject : Physics / Applied Electronics

Paper – II : (CB) Spectroscopy

Time : 3 Hours

Max. Marks: 80

Note : Answer all questions from Part–A and Part–B. Each question carries 4 marks in Part–A and 12 marks in Part – B.

PART – A (8 x 4 = 32 Marks)
(Short Answer Type)

- 1 Explain briefly about L-S and jj coupling schemes.
- 2 Obtain the spectral terms arising in P^2 and P.P configuration.
- 3 Discuss about the types of molecular spectra.
- 4 Discuss briefly about the rotational spectra of a rigid rotation.
- 5 Explain the normal vibrations of CO_2 and H_2O molecules.
- 6 Differentiate between Raman and Infrared spectra.
- 7 What are the applications of ESR?
- 8 What are spin-lattice and spin-spin relaxation process?

PART – B (4 x 12 = 48 Marks)
(Essay Answer Type)

- 9 (a) Evaluate the g-factor in LS and jj coupling schemes.
OR
(b) Obtain the energy expression due to spin-orbit interaction.
- 10 (a) How do you evaluate the rotational constants from the given rotational spectra?
OR
(b) What is the effect of isotopic substitution on rotational spectra ? Give one application of it.
- 11 (a) Explain the principle and working of FTIR spectrophotometer.
OR
(b) Discuss classical and quantum theory of Raman effect.
- 12 (a) What is an NMR? Explain the experimental set-up for study of NMR spectra.
OR
(b) What is resonance condition in ESR? Obtain the expression for resonance condition.
