

FACULTY OF SCIENCE
M. Sc. IV – Semester (CBCS) Examination, October 2020

Subject : Physics

Paper – I : Nuclear Physics

Time : 2 Hours

Max. Marks: 80

PART – A

Note : Answer any five questions.

(5x7=35 Marks)

- 1 State Heisenberg and Yukawa exchange forces.
- 2 Write Semi empirical mass formula and explain it.
- 3 Explain α -decay.
- 4 What is multiple radiation?
- 5 Explain about Range-Energy relation.
- 6 Write a note on solid state detectors.
- 7 Discuss the theory of fission and fusion reactions.
- 8 Write a short note on Lepton and Baryon numbers.

PART – B

Note : Answer any three questions.

(3x15=45 Marks)

- 9 Explain the salient features of liquid drop model and Shell model.
- 10 Discuss the deuteron problem and its contribution to the nuclear force.
- 11 Discuss the Gamow's theory of α -decay and fine structure of α -spectrum.
- 12 State and explain the Fermi's theory of β -decay and Fermi Kurie plot.
- 13 Discuss the interaction of gamma rays with matter and Photoelectric effect.
- 14 Explain in detail scintillation detectors and gamma ray detection with gas.
- 15 Explain the kinematics of nuclear reaction and obtain an expression for Q-value of reaction.
- 16 Discuss the classification of elementary particles and quark model.

FACULTY OF SCIENCE

M. Sc. II – Semester (CBCS) Examination, December 2020

Subject : Physics & Applied Electronics / Astrophysics

Paper – III : Quantum Mechanics-II

Time : 2 Hours

Max. Marks: 80

PART – A

Note : Answer any five questions.

(5x7=35 Marks)

- 1 Define differential and total scattering cross-section terms in scattering process.
- 2 What is optical theorem and write its significance.
- 3 What are the selection rules for dipole transitions?
- 4 What is the principle of method of variations?
- 5 What is Fermi's Golden rule? Write its significance.
- 6 A harmonic oscillator of natural frequency (ω) is placed in a small external potential $(1/2)\alpha x$, then calculate the change in energy of the ground state.
- 7 What are the inadequacies of Klein Gordon equation?
- 8 Explain the Dirac Energy spectrum.

PART – B

Note : Answer any three questions.

(3x15=45 Marks)

- 9 Discuss the method of partial waves and obtain an expression for scattering amplitude and scattering cross section.
- 10 Construct Green's function for an outgoing wave in scattering problem and use it to calculate the amplitude in first Born approximation.
- 11 Discuss the time independent perturbation theory for a non-degenerate stationary system and obtain the corrected eigen functions and energy eigen values.
- 12 Discuss the method of WKB approximation and derive an expression for transition probability through potential barrier and hence explain alpha decay.
- 13 Using the time dependent perturbation theory, derive an expression for the rate of transition to the continuum.
- 14 Discuss the Einstein coefficients of spontaneous and induced emission of radiation. Establish a relationship between A and B coefficients.
- 15 Derive Klein-Gordon relativistic equation for a free particle and write Klein Gordon equation in co-variant form.
- 16 Derive the Dirac's relativistic equation. Obtain the plane wave solutions of Dirac's equation for free particles and explain the existence of spin.

FACULTY OF SCIENCE

M. Sc. II – Semester (CBCS) Examination, December 2020

Subject : Physics & Applied Electronics / Astrophysics

Paper – IV : Electronics

Time : 2 Hours

Max. Marks: 80

PART – A

Note : Answer any five questions.

(5x7=35 Marks)

- 1 Draw the block diagram of series voltage regulator and explain its functioning.
- 2 What is Darlington pair? Explain its working with circuit diagram.
- 3 Discuss the characteristics of an ideal operational amplifier and explain the significance of CMRR in them.
- 4 Explain how Op-amp is used as an integration amplifier.
- 5 Explain the sum-of-product method to write a Boolean equation for a given truth table with suitable illustration.
- 6 Differentiate synchronous and asynchronous counters.
- 7 What are the various registers in 8085 microprocessor and explain their functions.
- 8 Write an Assembly language program for 8-bit addition.

PART – B

Note : Answer any three questions.

(3x15=45 Marks)

- 9 Explain the construction and working of a variable series voltage regulator and obtain the expression for output voltage (V_o), stability factor (S_v) and output resistance (R_o).
- 10 Explain the working of an RC phase shift oscillator with a neat diagram and derive the expressions for the frequency and conditions for sustained oscillations.
- 11 Draw the internal block diagram of IC 555, explain how it can be used to construct of monostable multivibrator and obtain an expression for its pulse width.
- 12 What are inverting and non-inverting modes of operation of Op-Amp. Derive an expression for the voltage gain in non-inverting mode.
- 13 Draw the logic diagrams of J-K and MS-J-K flip-flops and explain their operation with truth tables and timing diagrams. How racing can be avoided in MS J-K flip flop?
- 14 What are the types of registers? Explain the construction and working of a serial-in parallel-out shift register with timing diagram.
- 15 Explain the architecture of intel 8085 by drawing its functional block diagram.
- 16 Give the classification of instruction set of 8085 microprocessor into various groups and explain each one of them with suitable examples.

**