Enrollment No: _____ Exam Seat No:_____

C.U.SHAH UNIVERSITY

Summer Examination-2018

Subject Name: Elements of Modern Physics

Subject Code: 4SC03EMP1 **Branch: B.Sc.(All)**

Semester: 3 **Date: 06/04/2018** **Time: 02:30 To 05:30** **Marks: 70**

Instructions:

(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1 **Attempt the following questions:** **(14)**

a) Give the relation between energy (E) and frequency (f) of light. 01

b) According to Planck's quantum theory, light is said to be a collection of --------- 01

c) The experimental proof of De-Broglies hypothesis was given by 01

i) Davisson and Germer ii) Rutherford iii) Bohr

d) State the Heisenberg's uncertainty principle. 01

e) Nuclear forces are charge ---------- 01

i) Dependent ii) independent

f) Explain the term 'wave-particle duality'. 01

g) Give the operator form of momentum(p) and energy (E) used in quantum mechanics. 01

h) State the De-Broglie's hypothesis. 01

i) Define Compton Shift. 01

j) Define threshold frequency. 01

k) Define Binding energy. 01

l) Give the general formula for the radius of a nucleus. 01

m) What are the constituent particles of an atom? 01

n) Define normalization (of a wave function). 01

Attempt any four questions from Q-2 to Q-8

Q-2 **Attempt all questions** **(14)**

a) Explain the principle, construction and working of photoelectric effect; also (08)

define the terms “Work Function” and “Stopping Potential”.

b) An atom has energy levels (E) of 1eV, 2eV, 3eV.What are the frequencies (f) and wavelengths (λ) of the line spectra emitted by the atom? (06)

Q-3 **Attempt all questions** **(14)**

a) Explain the Bohr’s model of atom. (07)

b) Explain the Dvisson-Germer experiment with proper diagram. (07)

Q-4 **Attempt all questions** **(14)**

a) Derive the formula for Heisenberg’s uncertainty principle. (03)

b) Explain the characteristics of nuclear force. (07)

c) Give two differences between proton-neutron hypothesis and proton-electron hypothesis of a nucleus. (04)

Q-5 **Attempt all questions** **(14)**

a) Derive the time dependent Schrodinger equation. (07)

b) Give the physical interpretation of wave function (ψ). (07)

Determine the normalization constant (A) of a wave function $\psi = A.e^{im\phi}$.

Q-6 **Attempt all questions** **(14)**

a) Determine the energy (E) and wave function (ψ) for a particle confined in a rigid box. (12)

b) Define Tunneling (02)

Q-7 **Attempt all questions** **(14)**

a) Explain the Rutherford’s experiment to understand the model of an atom. (07)

b) Explain the Heisenberg’s gamma ray microscope. (07)

Q-8 **Attempt all questions** **(14)**

a) Explain the concept of tunneling through a rectangular barrier. (07)

b) Explain the Compton effect. (07)