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**B.Sc. Course (CBCS) Ordinance Sem-VI
EXAMINATION APRIL 2023
CHEMISTRY - PHYSICAL CHEMISTRY**

[Time: 2 Hours]

[Max. Marks: 80]

- Instructions:**
1. All questions are compulsory.
 2. Answers to the two sections should be written on separate answer books.
 3. Use of non-programmable calculator is allowed.
 4. Figures to the right indicate full marks.

Physical Constants: $h=6.625 \times 10^{-34}$ Joule sec.
 $N=6.023 \times 10^{23} \text{ mol}^{-1}$
 $c=3 \times 10^8 \text{ m/s}$; $2.303RT/F=0.05916$
 $1\text{MeV}=1.6 \times 10^{-6} \text{ ergs}$
 $1\text{a.m.u.}=931.5\text{Mev}$
 $=1.66 \times 10^{-24} \text{ g}$
 (At. Wt.: C=12, H=1, Li=3, O=16, N=14, Cl=35.5)

SECTION A

(40 Marks)

Q1 Answer any four of the following questions:

(4×4=16)

- Write a short note on nuclear reactors.
- Explain covalent bonding.
- State the characteristics of antibonding orbitals
- How are nuclear reactors classified?
- State the principles involved in Valence Bond Theory.
- Give the Schrodinger wave equation for H-like atom in cartesian co-ordinates and elaborate on energy for hydrogen like atom.

- Q2 A) i) What is the Schrodinger equation for a H-like atom in spherical polar co-ordinates and comment on the radial part of the wave function. (4)
 ii) Discuss quantisation of energy. (2)

OR

- A) iii) Using LCAO-MO method, derive the expression for molecular orbital wave function for H_2^+ ion. (6)
 B) i) Explain the applications of radioactive isotopes as tracers. (4)
 ii) Define nuclear fission with an example. (2)

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- Q3 A) i) Discuss molecular orbital theory. (4)
 ii) What is meant by the most probable distance of the electron from the nucleus. (2)

OR

- A) iii) Explain bonding molecular orbitals. (4)
 iv) Write the expression for Schrodinger wave function for He atom and explain the terms involved. (2)
- B) i) Describe a nuclear chain reaction, and how can it be controlled? (4)
 ii) Give any two biological effects of radiation. (2)

SECTION B

(40 Marks)

- Q4 Answer **any four** of the following: (4×4=16)

- Explain the differences between Fluorescence and Phosphorescence.
- Explain what are solar cells.
- With a suitable example, explain what is an alkaline battery.
- With reference to NMR spectra explain spin-spin Coupling constant.
- Explain what is buffer capacity.
- Explain how free electron model is used for the calculation of electronic transitions of polyenes.

- Q5 A) i) Explain the differences between Nuclear Magnetic Resonance and Electron Spin Resonance. (3)
 ii) Explain what is a triplet state. (3)

OR

- A) iii) With reference to ESR spectra explain what is hyperfine structure (3)
 iv) How many NMR signals would you expect from 1,1-Dichloroethane? (3)
- B) i) Write a note on evidence for the existence of dipolar ions. (3)
 ii) Calculate the ionic strength of 0.1M KCl solution. (3)

- Q6 A) i) With reference to NMR spectroscopy, explain what are equivalent and non-equivalent Protons. (3)
ii) Which of the following species will show ESR spectra? (3)
a) N_2 b) O_2 c) Cu^{+2} d) CH_3 e) He

OR

- A) ii) Describe the different scales that are used for measuring chemical shift. (3)
iv) On what factors does the intensity and width of ESR spectra depend upon. (3)
B) i) State and explain the relation between mean activity coefficient and ionic strength. (3)
ii) Explain the mechanism of buffer action of an acidic buffer. (3)