**0706E444**          Candidate's Seat No :_____

**M.Sc Sem.-2 Examination**
**P - 407**
**Medical Physics**

Time : 2-00 Hours]          **June 2022**          [Max. Marks : 50

Instructions:   All questions in **Section – I** carry equal marks.
Attempt any **Three** questions in **Section – I.**
Questions in **Section – II** is **COMPULSORY.**

## Section – I

Q-I     A.   Describe Thomas Fermi Statistical Model.                                          7

        B.   Define an atomic orbital. State spin orbit interactions.                          7

Q-II    A.   Discuss Hartree and Hartree-Fock Method.                                          7

        B.   Distinguish L-S and j-j couplings.                                                7

Q-III   A.   What is a molecule ? List various types of molecules and discuss each one   7
             briefly.

        B.   Discuss dynamic linear and symmetric top approach of molecules.                  7

Q-IV    A.   Discuss asymmetric top and spherical top approach of molecules.                   7

        B.   Discuss an energy level spectra of non-rigid rotator.                             7

Q-V     A.   Discuss vibrational energy of diatomic molecules.                                 7

        B.   Draw a potential energy diagram of a vibrating diatomic molecule and   7
             discuss the Morse potential energy diagram.

Q-VI    A.   Discuss theory of diatomic molecules as simple harmonic oscillator. Show   7
             that $V(x) = \frac{1}{2} kx^2$

P.T.O

B. Discuss the potential energy function of a diatomic molecules and show   7

that $\bar{v} = \frac{1}{2\pi C}\sqrt{\frac{k}{\mu}}$

Q-VII   A.   Give brief introduction about Raman spectroscopy. Discuss principal and   7
              instrumentation about Raman spectroscopy.

         B.   Give brief introduction about photo spectroscopy. Discuss principal and   7
              instrumentation about X-ray photo electron spectroscopy (XPS).

Q-VIII   A.   What is NMR spectroscopy? Discuss principal and instrumentation about   7
              NMR spectroscopy. List two applications of NMR.

          B.   What do you understand by spectroscopy? Discuss principal of UV-VIS   7
               spectroscopy. List two applications of UV-VIS spectroscopy.

## Section – II

Q-IX   MCQs                                                                               8

1.   Which of the subsequent quantum numbers regulates the spatial orientation of an
     atomic orbital?

     A.   Magnetic quantum number          B.   Spin quantum number

     C.   Azimuthal quantum number         D.   Principal quantum number

2.   Quantum Numbers are explanations of

     A.   Heisenberg's Uncertainty Principle   B.   Schrodinger's Wave Equation

     C.   Einstein's mass energy relation      D.   Hamiltonian Operator

3.   In simple harmonic motion (SHM) the restoring force is _____ to displacement of the
     body.

     A.   Inversely proportional            B.   Proportional

C. Independent
D. Not Proportional

4. If the centre of gravity of molecule change during motion , the molecule possesss_____.

A. Rotation
B. Electronic energy

C. Translational energy
D. Vibrational energy

5. When $O_2$ converts to $O_2^-$, the electron goes to ___ of the orbitals.

A. $\pi$
B. $\sigma$

C. $\pi^*$
D. $\sigma^*$

6. Stability of molecule increase as energy_____.

A. Increases
B. Does not change

C. Decreases
D. First increase then decrease

7. In Mossbauer spectrometer, source emits_____radiation

A. x-ray
B. $\alpha$

C. $\beta$
D. $\gamma$

8. The Mossbauer effect is based on _____

A. Spin effect
B. Doppler effect

C. Meissner efffect
D. Bear-Lambert law

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