



## Avinashilingam Institute for Home Science and Higher Education for Women

Deemed to be University Estd. u/s 3 of UGC Act 1956, Category A by MHRD (now MoE)

Re-accredited with A++ Grade by NAAC. CGPA 3.65/4, Category I by UGC

Coimbatore - 641 043, Tamil Nadu, India

### Master's Degree Examination – May 2025 II Semester

Class : I P.G.  
Major : Bioinformatics

Time: 3 Hours  
Max. Marks: 100

#### 23MBIC09 Structural Bioinformatics and R Programming

##### Course Outcomes:

- CO1. Explain bonding and their arrangements in a molecules.
- CO2. Define the structure of carbohydrate, lipids and its importance
- CO3. Realize the structure of nucleic acids, proteins and its importance
- CO4. Describe the basic principles of experimental methods for the determination of macromolecules structure and use of different types of protein prediction tools
- CO5. Acquire the knowledge of R programming for data analysis and plotting

##### Part A

10 x 1 = 10

##### Choose the Correct Answer

1. Which of the following is a data structure in R that stores elements of different data types in a single object?  
a. Vector                      b. List                      c. Array                      d. Matrix                      CO5K6
2. Term for the process in which a chiral compound loses its optical activity, resulting in a mixture of equal amounts of enantiomers.  
a. Racemization              b. Isomerization              c. Stereoconversion              d. Optical inversion              CO1K3
3. In R programming, what function is commonly used to create a frequency histogram?  
a. histplot()                      b. freqhist()                      c. plotfreq()                      d. hist()                      CO5K2
4. Which computational tools are commonly used for identifying conserved motifs in biological sequences?  
a. BLAST and PSI-BLAST                      b. Clustal Omega and MAFFT  
c. Pfam and PROSITE                      d. HMMER and MEME                      CO3K4
5. What term describes the double helical structure formed by two intertwined parallel strands of DNA.  
a. A-DNA                      b. Z-DNA                      c. B-DNA                      d. C-DNA                      CO3K6
6. In Ramachandran plot, which angle ranges from -180 degrees to +180 degrees and represents the rotation about the bond between the alpha carbon and the nitrogen of the peptide bond?  
a. Alpha angle                      b. Beta angle                      c. Phi angle                      d. Psi angle                      CO4K5
7. Which term refers to the computational technique used to predict the three-dimensional structure of a protein based on its similarity to experimentally determined structures of related proteins?  
a. Comparative modeling                      b. Structural alignment  
c. Fold recognition                      d. Template modelling                      CO4K2
8. A non-polar molecule: common building block of lipids.  
a. Glycerol                      b. Phosphoric acid                      c. Fatty acids                      d. Cholesterol                      CO3K4
9. Find the best statement describe the formation of a covalent bond, conferring to the Valence Bond theory.  
a. Electrons are shared between atoms in overlapping atomic orbitals  
b. Electrons are transferred from one atom to another to achieve stability  
c. Electrons are localized around one atom, creating a polar bond  
d. Electrons move freely between atoms in a metallic lattice                      CO3K1

10. Pick the correct one is not a common building block for carbohydrates. CO1K2  
a. Galactose                      b. Mannose                      c. Threonine                      d. Xylose

**Part B**

**5 x 6 = 30**

**Answer ALL questions**

**Each answer should not exceed 400 words or two pages**

- 11.a. Explain the bounded interactions. CO1K2  
(or)  
11.b. Explain the Valence bond theory with clear picture. CO1K2
- 12.a. Briefly explain conformations of building blocks of Carbohydrates. CO2K5  
(or)  
12.b. Illustrate the Classification of lipids with backbone structure. CO2K1
- 13.a. Sketch the single letter code of amino acids and its classifications. CO3K6  
(or)  
13.b. With Clear diagram and explain the structure of bases and nucleotides. CO3K1
- 14.a. Explain Homology modelling using different templates. CO4K6  
(or)  
14.b. Explain Neural network with an example. CO4K3
- 15.a. How to execute mathematical operations using R programming? CO5K3  
(or)  
15.b. Expand the frequency histograms: R. CO5K4

**Part C**

**5 x 12 = 60**

**Answer ALL questions**

**Each answer should not exceed 800 words or four pages**

- 16.a. Discuss the variations between racemization and optical rotation. CO1K2  
(or)  
16.b. Illustrate Molecular orbital theory and its applications. CO1K1
- 17.a. Briefly explain the Structure and biological importance of glycosaminoglycan. CO2K5  
(or)  
17.b. How structure diversified due to different carbohydrate linkage types? CO2K6
- 18.a. Elaborate protein-ligand interactions with any docking tool. CO3K3  
(or)  
18.b. Discuss the major factors determining the protein stability. CO3K4
- 19.a. Explain: NMR spectroscopy and its applications. CO4K4  
(or)  
19.b. Detail note on HMM with a clear picture. CO4K6
- 20.a. How to represent the R data? Qualitative and quantitative data types. CO5K2  
(or)  
20.b. Discuss : i). 3D plots, ii). Heat map, iii). Pie-chart. CO5K5

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