

IT3GPSC500

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St. Aloysius (Deemed To Be University)

Mangaluru

Semester I – P. G. Examination – M.Sc. BIOINFORMATICS

January - 2025

BASICS OF PROGRAMMING WITH PYTHON

Time: 2½ Hours

Max. Marks: 60

Answer any **FIVE FULL** Questions: **ONE FULL** question from every section.

SECTION - I

1. a) Explain the role of an operating system as a type of system software. How does it facilitate the operation of other software and hardware on a computer? (6)
b) Explain the concept of “high-level programming languages” and provide at least two advantages they have over low-level languages. (6)
2. a) Describe the difference between hardware and software in a computer system. Provide examples of each and explain their interdependence. (6)
b) What is digital data, and why are computers referred to as digital devices? Provide examples of digital data and devices (6)

SECTION - II

3. a) How do you define a function with default arguments in Python? Write an example program. (6)
b) Explain the syntax of a while loop with an example program. (6)
4. a) Explain how functions improve code organization and reusability in Python. Provide an example. (6)
b) Compare the syntax and functionality of if-else and if-elif-else blocks in Python. (6)

SECTION - III

5. a) How can you check if a string is a palindrome? Write a program to demonstrate this. (6)
b) How can you read a file line by line using Python? Illustrate with an example. (6)
6. a) Write a Python program to create a tuple and demonstrate accessing its elements. (6)
b) Write a Python program to copy the content of one file to another. (6)

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SECTION - IV

7. a) Write a Python program to handle a ZeroDivisionError gracefully. (6)
b) How does multilevel inheritance work in Python? Provide an example. (6)

8. a) Write a Python program to retrieve and modify dynamic attributes of a class. (6)
b) Define a class, an object, and an instance in Python. Provide an example to demonstrate their relationships. (6)

SECTION - V

9. a) Demonstrate the use of the mkdir and rmdir commands with examples. (6)
b) Describe the structure of Linux file permissions (e.g., rwxr-xr--). (6)
What does each section represent?
10. a) Write and explain a command to display the contents of a file in Linux. (6)
b) Write down the purpose and usage of the following Linux directories: /home, /etc, /var, and /usr. (6)

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Semester I – P. G. Examination – M.Sc. BIOINFORMATICS

January - 2025

BIOINFORMATICS FOUNDATIONS FROM MOLECULES TO SYSTEMS

Time: 2½ Hours

Max. Marks: 60

Answer any FIVE FULL Questions: ONE FULL question from every section.

SECTION - I

1. a) Explain the major protein sequence database UniProt. (6)
b) Explain the significance of GenBank as a public nucleotide sequence database. (6)
2. a) Write a note on structural databases. (6)
b) Explain the role of bioinformatics in biological research. (6)

SECTION - II

3. a) Explain the role of Entrez in retrieving information from biological databases. (6)
b) Explain PDB format for storing protein structural data. (6)
4. a) Explain multiple sequence alignment. (6)
b) Explain the data retrieval from biological databases like GenBank, UniProt and KEGG. (6)

SECTION - III

5. a) Explain phylogenetic tree with a diagram. (6)
b) Explain the MUSCLE algorithm for multiple sequence alignment. (6)
6. a) Explain the Smith-Waterman algorithm for local sequence alignment. (6)
b) Explain sequence homology. (6)

SECTION - IV

7. a) Describe the methods used to analyze protein-ligand interactions in bioinformatics. (6)
b) Explain the classification of protein structures in SCOP. (6)
8. a) Discuss the applications of homology modeling and ab initio modeling. (6)
b) Explain the importance of protein structure visualization in bioinformatics. (6)

SECTION - V

9. a) Explain the concept of Gene Ontology (GO) and its significance in the functional annotation of genes. (6)
b) Explain the importance of gene expression analysis in bioinformatics. (6)
10. a) Explain the principle of Next generation sequencing (NGS) technology. (6)
b) Explain the limitations and applications of microarray technology. (6)

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Semester I – P. G. Examination – M.Sc. BIOINFORMATICS

January - 2025

ALGORITHMS IN COMPUTATIONAL BIOLOGY

Time: 2½ Hours

Max. Marks: 60

Answer any **FIVE FULL** Questions: **ONE FULL** question from every section.

SECTION - I

1. a) Explain the different types of time complexities using Big-O notation and discuss their importance in evaluating the efficiency of algorithms. (6)
b) What are the advantages and disadvantages of using greedy algorithms in bioinformatics? (6)
2. a) Explain the Needleman-Wunsch algorithm for global sequence alignment. (6)
b) Define an algorithm and explain its importance in Bioinformatics. (6)

SECTION - II

3. a) Explain the Smith-Waterman algorithm for local sequence alignment. How does it differ from the Needleman-Wunsch algorithm? (6)
b) Compare the effects of gap opening and gap extension penalties in affine gap penalty models. (6)
4. a) Explain the algorithm used in BLAST. (6)
b) Describe the scoring system typically used in the Smith-Waterman algorithm. (6)

SECTION - III

5. a) What are the key challenges associated with using the Gibbs Sampling algorithm for motif discovery in large genomic datasets (6)
b) Explain DNA motif. (6)
6. a) Explain the heuristic methods for motif searching. (6)
b) Explain the application of Position Weight Matrices (PWMs) in motif search. (6)

SECTION - IV

7. a) How does the Forward Algorithm contribute to improving the accuracy of Hidden Markov Models in sequence analysis? (6)
b) Discuss the application of Hidden Markov Models (HMMs) in sequence alignment. (6)

8. a) Compare the use of Hidden Markov Models (HMMs) in gene finding and motif discovery. (6)
b) Discuss the types of Markov chains used in sequence analysis. (6)

SECTION - V

9. a) Explain the algorithm of Clustal omega. (6)
b) Describe the concept of genetic distance used in the Neighbour-Joining algorithm. (6)
10. a) Differentiate between Bifurcating and Multifurcating tree. (6)
b) What are the main advantages and disadvantages of using character-based methods for large-scale phylogenetic analysis compared to distance-based methods? (6)

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Semester I – P.G. Examination – M.Sc. BIOINFORMATICS

January - 2025

BASIC BIOCHEMISTRY AND IMMUNOLOGY

Time: 2½ Hours

Max. Marks: 60

Answer any FIVE FULL Questions: ONE FULL question from every section.

SECTION - I

1. a) Explain the structural features of alpha-helices and beta-sheets. (6)
b) Classify proteins based on their size, shape, and complexity. (6)
2. a) Analyze the stability of secondary structures in different environmental conditions. (6)
b) Discuss the role of disulfide cross-links in protein stability. (6)

SECTION - II

3. a) Explain the concept of substrate specificity with examples. (6)
b) Discuss the importance of multi-enzyme complexes in cellular metabolism. (6)
4. a) Analyze how substrate channeling increases the efficiency of metabolic systems. (6)
b) What are multifunctional enzymes, and how do they contribute to metabolism? (6)

SECTION - III

5. a) Explain the regulation of glycolysis in response to cellular energy needs. (6)
b) Analyze how bioenergetics drives cellular processes. (6)
6. a) What are oxidation-reduction reactions, and how are they involved in metabolism? (6)
b) Explain the role of various enzymes in the citric acid cycle. (6)

SECTION - IV

7. a) Differentiate between innate and acquired immunity with examples. (6)
b) Analyze the interplay between innate and acquired immunity during infections. (6)
8. a) Discuss the importance of antigen processing in immune responses. (6)
b) Explain how immune system components collaborate to fight infections. (6)

SECTION - V

9. a) Explain the principle and application of Western Blot. (6)
b) Discuss the importance of antigen-antibody interactions in immune diagnostics. (6)
10. a) Explain the structure and functions of antibodies. (6)
b) Analyze how class switching contributes to antibody diversity. (6)

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January - 2025

CELL AND MOLECULAR BIOLOGY

Time: 2½ Hours

Max. Marks: 60

Answer any **FIVE FULL** Questions: **ONE FULL** question from every section.

SECTION - I

1. a) Explain active transport with examples. (6)
b) Discuss the role of the phospholipid bilayer, membrane proteins, and cholesterol in maintaining membrane fluidity. (6)
2. a) Compare and contrast the structural features of prokaryotic and eukaryotic cells. (6)
b) Explain artificial membranes and its applications. (6)

SECTION - II

3. a) Explain the importance of reduced coenzymes in the formation of ATP. (6)
b) Outline the steps involved in the citric acid cycle (Krebs cycle) and explain its role in ATP production. (6)
4. a) Explain the function of the Electron Transport Chain (ETC) in the mitochondrion and its role in ATP production. (6)
b) Explain the importance of oxidases enzyme present in peroxisomes. (6)

SECTION - III

5. a) Explain the process of photorespiration and how it affects photosynthesis. (6)
b) Explain the mechanism of electron transport in chloroplast. (6)
6. a) Explain the Z scheme of photosynthesis. (6)
b) Explain the importance of carbon dioxide pumps present in the plasma membrane. (6)

SECTION - IV

7. a) Describe the structure and functions of microtubules in the cell. (6)
b) Compare and contrast mitosis and meiosis in terms of cell cycle regulation. (6)
8. a) What is the role of vesicular transport in the function of the Endoplasmic Reticulum and Golgi complex? (6)
b) Explain the composition of lysosomes and their role in intracellular digestion. (6)

SECTION - V

9. a) How does the process of transformation contribute to the spread of antibiotic resistance in bacteria? (6)
b) Describe the process of initiation in translation. What is the role of initiation factors, mRNA, and ribosomes during this stage? (6)
10. a) Explain the role of transcription factors in the regulation of gene expression. (6)
b) Describe the structure of DNA. Explain the significance of the double-helix model. (6)
