

QPCODE:

Reg. No.:

Name:.....

MAHATMA GANDHI UNIVERSITY, KOTTAYAM
MGU-UGP (HONOURS) EXAMINATION MONTH 2026
FIFTH SEMESTER
MG5DSCBIF300 – PERL & BIOPERL PROGRAMMING
(2024 ADMISSION ONWARDS)

Duration: 2 Hours

Maximum Marks: 50

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)
Students should attempt at least one question from each Course Outcome to enhance their overall outcome attainability.

Part A – Short Answer Questions

Answer any 5 questions. Each question carries 2 marks.

1. What are the main features of Perl? Mention any two advantages of Perl. [U][1]
 2. Distinguish between scalar and array variables in Perl with one example each. [U][1]
 3. What is the purpose of the foreach loop in Perl? [U][2]
 4. What is pattern matching in Perl? Mention the role of anchors in regular expressions. [U][4]
 5. What is a Perl subroutine? State how values can be passed to a subroutine. [U][6]
 6. What is BioPerl? Mention any two applications of BioPerl in biological data processing. [U][8]
 7. What is the Bio::Seq class used for in BioPerl? [U][8]
- [5 × 2 = 10]

Part B – Short Essay Questions

Answer any 4 questions. Each question carries 5 marks.

8. Explain Perl data types and variables. Discuss scalars, arrays, numbers and strings with suitable examples. [U][1]
 9. Explain conditional statements and looping constructs in Perl. Illustrate any two loops with examples. [A][2]
 10. Explain Perl file handling. Describe creating, opening, reading, writing and closing files. [A][3]
 11. Explain character sets, ranges, word boundaries and anchors used in Perl regular expressions with suitable examples. [U][4]
 12. Explain how Perl regular expressions are used for finding all occurrences of a pattern and replacing a pattern. [A][5]
 13. Explain built-in string handling functions and user-defined subroutines in Perl. Discuss passing values and returning values. [A][6]
- [4 × 5 = 20]

Part C – Long Essay Questions

Answer any 2 questions. Each question carries 10 marks.

14. Explain Perl programming fundamentals in detail. Discuss data types, variables, operators, operator precedence, conditional statements, loops, input/output and file management with suitable examples. [A][1][2][3]
15. Explain Perl Regular Expressions and Functions in detail. Discuss pattern matching, word boundaries, anchors, character sets, case-insensitive matching, finding and replacing patterns, built-in functions, subroutines and Perl modules. [E][4][5][6][7]

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16. Explain BioPerl in detail. Discuss installation, general BioPerl classes, BioSeq, sequence input/output and manipulation, accessing GenBank, AlignIO and BLAST parsing, with suitable applications in Bioinformatics.

[A][8]

17. Design a Perl/BioPerl-based solution for a biological sequence-processing problem. Explain the steps involved in reading sequence data, manipulating or parsing it, accessing relevant biological database information and producing useful output.

[C][3][8]

[2 × 10 = 20]

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MAHATMA GANDHI UNIVERSITY, KOTTAYAM
MGU-UGP (HONOURS) EXAMINATION MONTH 2026
FIFTH SEMESTER
DSC- MG5DSCBIF301- Systems and Synthetic Biology
(2024 ADMISSION ONWARDS)

Duration: 2hrs

Maximum Marks: 70

Remember(K), Understand(U), Apply(A), Analyse(An), Evaluate(E), Create(C), Skill(S), Interest(I) and Appreciation(Ap)

Students should attempt at least one question from each course outcome to enhance their overall outcome attainability.

Part A

Short Answer Questions

Answer any **5** questions

Each question carries **2** marks

- | | | |
|----|--------------------------------|--------------|
| 1. | Define system biology. | [K] / [CO1] |
| 2. | Describe feedback loops. | [U] / [CO2] |
| 3. | Interpret Regulatory Circuits. | [An] / [CO3] |

- | | | |
|----|--|--------------|
| 4. | Write a note on flux analysis. | [A] / [CO4] |
| 5. | Describe synthetic biology. | [U] / [CO5] |
| 6. | Interpret Robustness. | [An] / [CO6] |
| 7. | Explain Principles of Bacterial Photography. | [U] / [CO7] |

[2x5 = 10]

Part B

Short Essay Questions

Answer any 6 questions

Each question carries **5** marks

- | | | |
|-----|---|--------------|
| 8. | Memorize history of system biology. | [K] / [CO1] |
| 9. | Describe gene control and genetic switches. | [U] / [CO2] |
| 10. | Interpret Protein-Protein Interaction (PPI) Networks. | [An] / [CO3] |
| 11. | Describe definition and Goals of synthetic biology. | [U] / [CO5] |
| 12. | Evaluate Synthetic Biology in Medicine. | [An] / [CO8] |
| 13. | Explain E-Cell Project. | [An] / [CO6] |

- | | | |
|-----|---|------------|
| 14. | Analyze Green Fluorescent Protein (GFP) Project. | [An]/[CO8] |
| 15. | Discover Risks and Benefits of research in Synthetic Biology. | [U]/[CO5] |
| 16 | Explain Flux Analysis in detail. | [A]/[CO4] |

[6x5 = 30]

Part C

Long Essay Questions

Answer any 3 questions

Each question carries **10** marks

- | | | |
|-----|---|--------------|
| 17. | Explain Environmental Applications of Systems and Synthetic Biology | [U] / [CO5] |
| 18. | Explain the biochemical, genetic and the systems paradigm. | [U] / [CO2] |
| 19. | Explain Protein-Protein Interaction (PPI) Networks. | [An] / [CO3] |
| 20. | Explain Bacterial Camera Project. | [A] / [CO3] |

[10x3 = 30]

QPCODE

Reg.No :

Name :

**MAHATMA GANDHI UNIVERSITY, KOTTAYAM
MGU-UGP (HONOURS) EXAMINATION MONTH 2025**

FIFTH SEMESTER

**DSE- MG5DSEBIF300- EVOLUTIONARY BIOLOGY AND MOLECULAR PHYLOGENETICS
(2024 ADMISSION ONWARDS)**

Duration: 2hrs

Maximum Marks: 70

Remember(K), Understand(U), Apply(A), Analyse(An), Evaluate(E), Create(C), Skill(S), Interest(I) and Appreciation(Ap)

Students should attempt at least one question from each course outcome to enhance their overall outcome attainability.

Part A

Short Answer Questions

Answer any **5** questions

Each question carries **2** marks

- | | |
|--|-------------|
| 1. Discuss MSA. | [U] / [CO2] |
| 2. Describe UPGMA. | [A] / [CO3] |
| 3. Differentiate between rooted and unrooted tree. | [U] / [CO1] |
| 4. Relate cladogram. | [U] / [CO2] |
| 5. Indicate the difference between MP and ML tree. | [U] / [CO4] |

- | | | |
|----|--|-------------------|
| 6. | Show different softwares used for tree construction. | [A] / [CO5] |
| 7. | Produce any two applications of phylogenetics in Medicine. | [A] / [CO6] |
| | | [2x5 = 10] |

Part B

Short Essay Questions

Answer any **6** questions

Each question carries **5** marks

- | | | |
|-----|---|-------------|
| 8. | Discuss the theory of molecular evolution. | [U] / [CO1] |
| 9. | Differentiate between cladogram and phylogram. | [U] / [CO2] |
| 10. | Compute distance based methods. | [A] / [CO3] |
| 11. | Describe advantages and disadvantages of different tree building methods. | [U] / [CO4] |
| 12. | Compile the applications of phylogenetic in agriculture. | [A] / [CO6] |
| 13. | Illustrate the maximum parsimony method. | [A] / [CO3] |
| 14. | Use any three tests for estimating phylogenetic tree. | [A] / [CO3] |
| 15. | Write on convergent and divergent evolution. | [U] / [CO1] |

[5x6 = 30]

Part C

Long Essay Questions

Answer any **3** questions

Each question carries **10** marks

- | | |
|--|--------------------|
| 14. Discuss the different steps to construct a phylogenetic tree. | [U] / [CO2] |
| 15. Summarize the basic terminologies of a phylogenetic tree. | [U] / [CO1] |
| 16. Produce the basic applications of phylogenetics in agriculture and medicine. | [A] / [CO6] |
| 17. Summarize the different types of character based methods. | [U] / [CO4] |
| 18. Discuss the Darwin theory of evolution. | [U] / [CO1] |
| | [10x3 = 30] |

MAHATMA GANDHI UNIVERSITY, KOTTAYAM
MGU-UGP (HONOURS) EXAMINATION MONTH 2026
FIFTH SEMESTER
DSE-MG5DSEBIF301 – SOFT COMPUTING TECHNIQUES
(2024 ADMISSION ONWARDS)

Duration: 2 Hours**Maximum Marks:** 70

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

Students should attempt at least one question from each Course Outcome to enhance their overall outcome attainability.

Part A – Short Answer Questions

Answer any 5 questions. Each question carries 2 marks.

1. What is Soft Computing? Mention any two areas in which it is applied. [U][1]
 2. State any four features of Artificial Neural Networks (ANNs). [U][1]
 3. What is a fuzzy set? How does it differ from a classical set? [U][3]
 4. Define membership function in fuzzy logic. Mention any two types. [U][3]
 5. What is an Evolutionary Algorithm? [U][4]
 6. Define dimensionality reduction. Why is it useful in Bioinformatics? [U][2]
 7. What is feature selection in pattern recognition? [U][5]
- [5 × 2 = 10]

Part B – Short Essay Questions

Answer any 6 questions. Each question carries 5 marks.

8. Explain the history, biological motivation and major areas of Soft Computing. [U][1]
 9. Explain supervised and unsupervised neural networks with suitable examples. [U][1]
 10. Explain the structure and working of a Perceptron. How is a Multi-Layer Perceptron different? [A][1]
 11. Explain the properties of fuzzy sets and the basic fuzzy operations. [U][3]
 12. Explain membership functions and their role in fuzzy logic with suitable examples. [U][3]
 13. Describe the major components of an Evolutionary Algorithm. [U][4]
 14. Explain Genetic Algorithms and their basic steps. [A][6]
 15. Explain clustering, classification and dimensionality reduction as pattern recognition techniques in Bioinformatics. [A][5]
- [6 × 5 = 30]

Part C – Long Essay Questions

Answer any 3 questions. Each question carries 10 marks.

16. Explain Artificial Neural Networks in detail. Discuss their features, supervised and unsupervised learning, Perceptron, Multi-Layer Perceptron and the relevance of ANNs in Bioinformatics. [E][1]
 17. Explain Fuzzy Logic in detail. Discuss fuzzy sets, properties, membership functions, fuzzy operations and applications, with suitable examples. [E][3]
 18. Explain Evolutionary Computing in detail. Discuss Evolutionary Algorithms, their components, Genetic Algorithms, Evolutionary Programming and Genetic Programming. [E][4]
 19. Explain Pattern Recognition in Bioinformatics. Discuss clustering, dimensionality reduction, classification, feature selection and their applications. [A][5]
 20. Discuss the role of Soft Computing techniques in Bioinformatics. Explain how ANN, Fuzzy Logic and Evolutionary Computing can be applied to solve Bioinformatics problems. [A][1]
- [3 × 10 = 30]

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MAHATMA GANDHI UNIVERSITY, KOTTAYAM
MGU-UGP (HONOURS) EXAMINATION MONTH 2025
FIFTH SEMESTER
DSE-MG5DSEBIF302-Research Methods in Biological Sciences
(2024 ADMISSION ONWARDS)

Duration: 2hrs

Maximum Marks: 70

Remember(K), Understand(U), Apply(A), Analyse(An), Evaluate(E), Create(C), Skill(S), Interest(I) and Appreciation(Ap)

Students should attempt at least one question from each course outcome to enhance their overall outcome attainability.

Part A

Short Answer Questions

Answer any **5** questions

Each question carries **2** marks

1. Define research. [K] / [CO1]
2. What is a research problem? [K] / [CO2]
3. What is primary data? [K] / [CO1]

- | | |
|--|-------------|
| 4. Define frequency distribution. | [K] / [CO1] |
| 5. What is peer review? | [K] / [CO3] |
| 6. What is plagiarism? | [K] / [CO5] |
| 7. Name any one reference management tool. | [K] / [CO5] |

[2x5 = 10]

Part B

Short Essay Questions

Answer any **6** questions

Each question carries **5** marks

- | | |
|--|-------------|
| 8. Distinguish between basic research and applied research. | [U] / [CO1] |
| 9. Explain the role of a hypothesis in scientific inquiry. | [U] / [CO2] |
| 10. State any two characteristics of a good researcher. | [U] / [CO1] |
| 11. Differentiate between quantitative and qualitative data. | [U] / [CO1] |
| 12. What is sampling? Mention any two sampling methods. | [K] / [CO1] |
| 13. Distinguish between single-blind and double-blind peer review. | [U] / [CO3] |

14. Mention any two types of plagiarism. [K] / [CO5]
15. Explain the major components of an experimental protocol and the importance of controlling variables. [U] / [CO4]

[5x6 = 30]

Part C

Long Essay Questions

Answer any **3** questions

Each question carries **10** marks

16. Explain how charts, graphs, tables and figures can be used to communicate research findings effectively. [A] / [CO6]
17. Differentiate between descriptive statistics and inferential statistics, giving suitable examples. [An] / [CO3]
18. A researcher has collected data from a survey involving 200 participants. [An] / [CO3]
- a)** Explain suitable methods for organizing and tabulating the data.
 b) Suggest appropriate charts or graphs for presenting the findings.
19. A researcher plans to investigate the effect of different concentrations of a biofertilizer on the growth of a crop. [E] / [CO4]
- a)** Identify the independent, dependent and controlled variables.
 b) Outline an appropriate experimental protocol.
20. A research team is preparing a research project for publication and funding. Discuss how effective scientific communication can contribute to successful teamwork, proposal preparation, presentation of findings and publication. [E] / [CO6]

Also explain the ethical responsibilities of researchers in communicating scientific results.

[10x3 = 30]

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**MAHATMA GANDHI UNIVERSITY, KOTTAYAM
MGU-UGP (HONOURS) EXAMINATION MONTH 2026
FIFTH SEMESTER**

**DSE-MG5DSEBIF303-Unveiling Molecular Patterns Through Cheminformatics
(2024 ADMISSION ONWARDS)**

Duration: 2hrs

Maximum Marks: 70

*Remember(K), Understand(U), Apply(A), Analyse(An), Evaluate(E), Create(C), Skill(S), Interest(I) and
Appreciation(Ap)*

Students should attempt at least one question from each course outcome to enhance their overall outcome attainability.

Part A

Short Answer Questions

Answer any **5** questions

Each question carries **2** marks

- | | | |
|----|---|-------------|
| 1. | Describe cheminformatics. | [U] / [CO1] |
| 2. | Write a note on Chemical Structure Databases. | [A] / [CO2] |
| 3. | Interpret Drugbank. | [A] / [CO2] |

- | | | |
|----|--|-------------|
| 4. | Write a note on representation of molecules. | [A] / [CO3] |
| 5. | Discover molecular graphs.. | [A] / [CO4] |
| 6. | Interpret virtual screening. | [A] / [CO5] |
| 7. | Explain ADMET. | [U] / [CO2] |

[2x5 = 10]

Part B

Short Essay Questions

Answer any 6 questions

Each question carries **5** marks

- | | | |
|-----|--|-------------|
| 8. | Discover a note on cheminformatics toolkit. | [U] / [CO6] |
| 9. | Write a note on cheminformatics toolkit. | [A] / [CO2] |
| 10. | Discuss evolution of cheminformatics. | [U] / [CO1] |
| 11. | Interpret molecular descriptors. | [A] / [CO3] |
| 12. | Write a note on 2D drawing tool. | [A] / [CO4] |
| 13. | Discover ADMET prediction in drug discovery. | [U] / [CO6] |

- | | | |
|-----|--|-----------|
| 14. | Discuss Cheminformatics approaches to poly pharmacology. | [U]/[CO6] |
| 15. | Discover history of cheminformatics. | [U]/[CO1] |
| 16 | Discover more on Descriptors used for property prediction in QSAR. | [U]/[CO3] |

[6x5 = 30]

Part C

Long Essay Questions

Answer any 3 questions

Each question carries **10** marks

- | | | |
|-----|---|-------------|
| 17. | Explain applications of cheminformatics. | [U] / [CO1] |
| 18. | Write a note on Chemical Structure representation. | [A] / [CO4] |
| 19. | Explain Drug discovery process and the role of cheminformatics. | [U] / [CO6] |
| 20. | Dicover Descriptors used for property prediction in QSAR. | [A] / [CO3] |

[10x3 = 30]

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Name :

MAHATMA GANDHI UNIVERSITY, KOTTAYAM
MGU-UGP (HONOURS) EXAMINATION MONTH 2025
FIFTH SEMESTER
DSE- MG5DSEBIF304- Genetic Engineering
(2024 ADMISSION ONWARDS)

Duration: 2hrs

Maximum Marks: 70

Remember(K), Understand(U), Apply(A), Analyse(An), Evaluate(E), Create(C), Skill(S), Interest(I) and Appreciation(Ap)

Students should attempt at least one question from each course outcome to enhance their overall outcome attainability.

Part A

Short Answer Questions

Answer any **5** questions

Each question carries **2** marks

1. Define genetic engineering. [K] / [CO1]
2. What is gene knockout? [K] / [CO2]
3. Define gene therapy [K] / [CO3]

4. What is a genetically modified organism (GMO)? [K] / [CO4]
5. What is informed consent in genetic engineering research? [K] / [CO5]
6. What is epigenome editing? [K] / [CO6]
7. Name one emerging application of genetic engineering.. [K] / [CO6]

[2x5 = 10]

Part B

Short Essay Questions

Answer any **6** questions

Each question carries **5** marks

8. Explain the basic scheme of the genetic engineering process. [U] / [CO1]
9. How can gene knockout be used to study the function of a particular gene? [A] / [CO2]
10. Differentiate between somatic and germline gene therapy. [U] / [CO3]
11. Mention two advantages of genetically modified crops in agriculture. [U] / [CO4]
12. State any two ethical concerns associated with genetic engineering. [U] / [CO5]
13. Mention two recent advances in genetic engineering that demonstrate its future potential. [A] / [CO6]

- | | |
|---|-------------|
| 14. Explain the principles and applications of restriction enzymes and DNA ligase in recombinant DNA technology. | [U] / [CO1] |
| 15. A researcher wants to increase the production of a specific protein in <i>E. coli</i> . Suggest an appropriate genetic engineering strategy and explain the major steps involved. | [A] / [CO2] |

[5x6 = 30]

Part C

Long Essay Questions

Answer any **3** questions

Each question carries **10** marks

- | | |
|--|--------------|
| 16. Explain the major approaches used in gene therapy and discuss their applications in human disease management. | [An] / [CO3] |
| 17. Evaluate the potential benefits and risks of genetically modified crops with respect to agriculture and the environment. | [E] / [CO4] |
| 18. Discuss the ethical issues related to privacy, informed consent and germline modification in genetic engineering. | [E] / [CO5] |
| 19. Describe any two emerging advances in genetic engineering and explain how they may contribute to future research and biotechnology. | [E] / [CO6] |
| 20. a) Explain the major steps involved in recombinant DNA technology.
b) Explain the significance of gene editing in modern genetic engineering. | [A] / [CO1] |

[10x3 = 30]

MAHATMA GANDHI UNIVERSITY, KOTTAYAM
MGU-UGP (HONOURS) EXAMINATION MONTH 2026
FIFTH SEMESTER
SEC-MG5SECBIF300 – INTRODUCTION TO R PROGRAMMING
(2024 ADMISSION ONWARDS)

Duration: 1 Hours**Maximum Marks:** 35

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)
Students should attempt at least one question from each Course Outcome to enhance their overall outcome attainability.

Part A – Short Answer Questions

Answer any 5 questions. Each question carries 2 marks.

1. What is RStudio? Mention one advantage of using RStudio for R programming. [U][1]
 2. List any four basic data types in R. [U][2]
 3. What are vectors in R? Give one example of creating a vector. [U][3]
 4. What is the purpose of `install.packages()` in R? [U][4]
 5. Differentiate between a data frame and a matrix in R. [U][5]
 6. What is ggplot? Mention one type of graph that can be created using it. [U][6]
 7. Write the R command used to read a CSV file. [A][5]
- [5 × 2 = 10]

Part B – Short Essay Questions

Answer any 3 questions. Each question carries 5 marks.

8. Explain R operators and operator precedence with suitable examples. [U][2]
 9. Explain decision-making statements in R with examples. [A][1]
 10. Describe lists, data frames and matrices in R, highlighting their major characteristics. [U][3]
 11. Explain dot charts, bar plots and box plots in R. Mention one use of each. [A][6]
 12. Explain the procedure for reading and writing CSV/Excel and other files using R. [A][5]
- [3 × 5 = 15]

Part C – Long Essay Questions

Answer any 1 question. Each question carries 10 marks.

13. Explain R data structures in detail. Discuss vectors, lists, data frames, matrices, arrays and factors with suitable examples. [A][3]
 14. Explain data visualization in R. Discuss the R plot function and ggplot, and describe bar plots, box plots, pie charts, scatter plots, line charts and histograms with suitable applications. [S][6]
 15. Explain loops and functions in R in detail. Illustrate their use with suitable R programming examples and discuss how they support programming logic. [E][4]
- [1 × 10 = 10]