2026

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Date
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ZOOLOGY

(Major)

Paper : ZLG0600404 (A/B/C)

Full Marks : 45

Time : 2 hours

The figures in the margin indicate full marks for the questions.

Answer the questions from any *one* Option.

OPTION—I

Paper : ZLG0600404A

(Fundamentals of Bioinformatics)

1. Answer/Fill in the blanks of the following : 1×5=5

(a) Which scoring matrix is based on global alignment?

(b) Which algorithm is used for local alignment?

(c) The study of small molecules within cells, tissues or organisms is known as _____.

(d) Which matrix method is used to measure the genetic distance between sequences?

(e) The tree which represents taxonomic relationships between organisms is _____.

2. Answer any *five* of the following : 2×5=10

(a) What is genomics?

(b) What is a database? Give an example.

(c) What are the different scoring matrices used to align sequences?

(d) Define transcriptonics.

(e) What is phylogenetics?

(f) What is FASTA?

(g) What is BLAST?

(h) What is human genome project?

(i) What is bootstraping?

(j) What are patents?

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3. Answer any *four* of the following : 5×4=20

(a) What are the different databases used in bioinformatics?

(b) Differentiate between sequence similarity and identity with examples.

(c) Describe the process of next generation sequencing.

(d) What are the different tree building methods?

(e) What are the prerequisites for a molecule to be considered a drug?

(f) Describe the emergence and types of omics in bioinformatics.

(g) What are the different types of protein structures?

(h) What is the importance of molecular docking in drug discovery?

4. Answer any *one* of the following : 10

(a) Perform a local alignment for the given sequences using Smith-Waterman algorithm :

Match = +1 ; Mismatch = –1 ; Gap = –2

ATCTGCT

ATGTGCT

(b) Perform a global alignment for the given sequences using Needleman-Wunsch algorithm :

Match = +1 ; Mismatch = –1 ; Gap = –2

CGTATGA

CGTACGA

(c) Describe in detail the process of DNA sequencing with a diagram.

(d) Describe the different methods used to predict the structure of proteins.

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OPTION—II

Paper : ZLG0600404B

(Advanced Entomology)

1. Choose the correct option : 1×5=5

(a) Tracheae open to the outside of the insect body through

(i) ostia

(ii) taenidia

(iii) spiracles

(iv) alary muscles

(b) Which structure in the insect foregut acts as a gizzard to grind food using chitinous teeth?

(i) Pharynx

(ii) Crop

(iii) Proventriculus

(iv) Mesenteron

(c) What type of circulatory system is found in most insects?

(i) Closed circulatory system

(ii) Open circulatory system

(iii) Semi-closed circulatory system

(iv) Double circulatory system

(d) The use of ladybird beetles to control aphids is an example of

(i) chemical control

(ii) biological control

(iii) pheromonal control

(iv) mechanical control

(e) Which stage of life cycle of Eri silkworm can produce silk?

(i) 5th instar larva

(ii) Moth

(iii) Pupa

(iv) Cocoon

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2. Answer any *five* of the following : 2×5=10

(a) What is the function of the spermatheca in female insects?

(b) Why are most insects uricotelic?

(c) What is the difference between Ovaries and Ovarioles?

(d) What is the difference between Prohemocytes and Plasmatocytes?

(e) What is the 'subesophageal ganglion' and what does it control?

(f) Distinguish between Perennial and Occasional pests.

(g) What do you mean by the Economic Threshold Level (ETL)?

(h) State the damaging stage and host of *Papilio demoleus*.

(i) Mention the four stages of silkworm's life cycle with correct sequence of their development.

(j) Distinguish between male and female moth of Muga silkworm.

3. Answer any *four* of the following : 5×4=20

(a) Describe the general structure of the male reproductive system in insects.

(b) How does the tracheal system enable gas exchange in insects without the use of blood?

(c) Discuss the open circulatory system of insects, highlighting the role of the dorsal vessel and hemolymph.

(d) Mention the commercial and medicinal applications of lac and honey.

(e) Explain the life history of the pulse beetle (*Callosobruchus chinensis*).

(f) Discuss the various stages of host-plant selection by phytophagous insects.

(g) Discuss the life history of the tea mosquito bug (*Helopeltis theivora*) and the nature of damage caused by it on young tea leaves. 4+1=5

(h) Discuss the role of pheromones in Integrated Pest Management (IPM).

4. Answer any *one* of the following : 10

(a) Give a detailed account of the anatomical structure of the insect alimentary canal with suitable diagrams. Describe the process of digestion occurring in the midgut. 7+3=10

(b) Describe the structural organization of the nervous system in insects.

(c) Define the term 'pest' and classify them based on their damage potential. Write about the cultural and biological control of pests. 1+2+4+3=10

(d) Mention the order and family of Eri silkworms. Describe its life history with suitable diagrams. Write the applications of silk. 1+7+2=10

OPTION—III

Paper : ZLG0600404C

(Animal Cell Culture and Genetic Engineering)

1. Choose the correct option : 1×5=5

(a) Which of the following is essential for animal cell culture?

(i) Sterile environment

(ii) Soil medium

(iii) Sunlight exposure

(iv) High salt concentration

(b) Why is Taq polymerase specifically used in PCR?

(i) It is resistant to high temperatures

(ii) It has proofreading activity

(iii) It binds RNA primers

(iv) It terminates DNA chains

(c) DNA microarray technology is mainly used for

(i) protein purification

(ii) gene expression analysis

(iii) cell viability testing

(iv) DNA ligation

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(d) Electroporation introduces DNA into cells by

(i) heat shock

(ii) high-voltage pulses

(iii) enzyme digestion

(iv) centrifugation

(e) How does next-generation sequencing (NGS) improve over Sanger sequencing?

(i) NGS uses ddNTPs exclusively

(ii) NGS sequences millions of fragments simultaneously

(iii) NGS requires radioactive labelling

(iv) NGS produces longer reads

2. Answer any *five* of the following : 2×5=10

(a) List two essential requirements for maintaining sterility in animal cell culture.

(b) Differentiate between monolayer and suspension cultures.

(c) Name two parameters commonly measured to assess cell growth in culture.

(d) What is the role of primers in PCR?

(e) Differentiate between Southern blotting and Northern blotting.

(f) What is the function of restriction enzymes in gene cloning?

(g) Mention two characteristics of plasmids that make them suitable cloning vectors.

(h) How can DNA microarray be used to study gene expression?

(i) Explain how ddNTPs terminate DNA synthesis in Sanger sequencing.

(j) How are genomic and cDNA libraries screened using colony or plaque hybridization?

3. Answer any *four* of the following in brief : 5×4=20

(a) Describe the basic requirements for establishing and maintaining animal cell culture.

(b) Discuss the methods used to measure cell viability and parameters of growth in cultured cells.

(c) Explain the principle and applications of cell proliferation assays in bioassays.

(d) Explain the principle and applications of Polymerase Chain Reaction (PCR).

(e) Discuss the role of DNA fingerprinting in forensic science and biomedical research.

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(f) Discuss the importance of expression vectors and their roles in protein production.

(g) Describe the steps involved in constructing a cDNA library and its applications in functional genomics.

(h) Write a note on harvesting and maintenance of cell lines.

4. Answer any *one* of the following : 10

(a) Evaluate the challenges of maintaining sterility in animal cell culture compared to microbial culture and propose strategies to minimize contamination.

(b) Restriction enzymes and DNA modifying enzymes are central to recombinant DNA technology. Critically assess how their specificity and limitations influence cloning strategies.

(c) Genomic and cDNA libraries are powerful tools. Critically evaluate their constructions, screening methods, and applications, highlighting how they differ in utility for functional genomics.

(d) Explain the principles, procedures and applications of Southern, Northern and Western blotting techniques.

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