R1003

M.Sc. DEGREE EXAMINATION, APRIL – 2024

Second Semester

Biotechnology

GENETIC ENGINEERING

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. The enzyme commonly used for carrying out ligation reaction is ——————   (CO1, K1)

    (a) Transferase   (b) Reverse transciptase

    (c) Ligase   (d) DNase

2. Which of the following DNA polymerase has 3' → 5' exonuclease activity?   (CO1, K1)

    (a) DNA polymerase I

    (b) DNA polymerase II

    (c) DNA polymerase III

    (d) DNA polymerase IV

3. When the viral genome gets inserted into a bacterial host it is termed as ——————   (CO2, K2)

    (a) Replication   (b) Lytic cycle

    (c) Lysogenic cycle   (d) Capsid formation

4. The transduction process is mediated by —————— (CO2, K2)

   (a) F-factors   (b) Cosmids
   (c) Phage vectors (d) Plasmid vectors

5. The PCR technique was developed by —————— (CO3, K3)

   (a) Kohler   (b) Altman
   (c) Milstein   (d) Kary Mullis

6. *Thermus aquatics* is the source of ————————— (CO3, K3)

   (a) Endonuclease   (b) Primase enzyme
   (c) Taq polymerase (d) RNA polymerase

7. Which of the following is the chemical nucleotide sequencing method? (CO4, K3)

   (a) Sanger method
   (b) Maxam and gilbert method
   (c) Edmans method
   (d) Automated sequencing method

8. Which enzyme is used in the unwinding of DNA? (CO4, K3)

   (a) Ligase   (b) Topoisomerase
   (c) Helicase (d) Exonuclease

9. Double-stranded RNA is cleaved by dicer which produces small fragments called ————————— (CO5, K3)

   (a) Short interfering RNA's
   (b) Long interfering RNAs
   (c) Short interspersed RNA's
   (d) Long interspersed RNA's

10. DNA ————————— is also a method for gene silencing through short RNA's. (CO5, K3)

   (a) Acetylation   (b) Phosphorylation
   (c) Methylation   (d) Acylation

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Answer **all** questions not more than 500 words each.

11. (a) Write a short note on northern blotting. (CO1, K2)

Or

(b) Describe briefly about the Type II restriction endonucleases. (CO1, K2)

12. (a) Write an account on the shuttle vector. (CO2, K2)

Or

(b) Explain about the pET-based vector. (CO2, K2)

13. (a) Write a brief note on real-time PCR. (CO3, K3)

Or

(b) Elaborate on the multiplex PCR. (CO3, K3)

14. (a) Write an account on cDNA synthesis. (CO4, K3)

Or

(b) Explain about DNA microarrays. (CO4, K3)

15. (a) Write a short note on gene therapy. (CO5, K4)

Or

(b) Explain about microRNA. (CO5, K4)

Part C $(5 \times 8 = 40)$

Answer **all** questions not more than 1000 words each.

16. (a) Give an elaborate note on the principle and procedure of southern blotting technique. (CO1, K2)

Or

(b) Explain in detail about the radioactive and non-radioactive probes. (CO1, K2)

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17. (a) Write an elaborate note on cosmids with an illustration. (CO2, K2)

Or

(b) Explain about the bacterial artificial chromosome with an illustration. (CO2, K2)

18. (a) Discuss about the single-strand conformational polymorphism. (CO3, K3)

Or

(b) Give a detailed note on RFLP. (CO3, K3)

19. (a) Explain in detail about DNase footprinting. (CO4, K3)

Or

(b) Describe about the chromatin immunoprecipitation. (CO4, K3)

20. (a) Give a detailed note on CRISPR/Cas technology. (CO5, K4)

Or

(b) Explain about the principle and applications of gene silencing using siRNA technology. (CO5, K4)

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M.Sc. DEGREE EXAMINATION, APRIL – 2024

Second Semester

Biotechnology

IMMUNOLOGY

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** the following objective type questions by
choosing the correct option.

1. Which one of the following is organized secondary lymphoid organ   (CO1, K2)

   (a) Tonsil   (b) Appendix

   (c) Peyer's Patch   (d) Spleen

2. Cells performing indirect phagocytosis is   (CO1, K2)

   (a) NK cells   (b) Macrophage

   (c) Basophil   (d) Lymphocytes

3. How many types of antibodies are present in humans?   (CO2, K1)

   (a) THREE   (b) FOUR

   (c) FIVE   (d) SIX

4. Which Ig class has TWO sub-classes?   (CO2, K1)

   (a) IgG   (b) IgA

   (c) IgM   (d) IgD

5. What are the MHC class-II genes in human? (CO3, K1)
   (a) A, B and C   (b) DP, DQ and DR
   (c) DP, DQ and DM   (d) DP, DM and DR

6. MHC Class- I MHC antigen recognize by (CO3, K4)
   (a) CD4 + T-Cell   (b) CD6+ T-Cell
   (c) CD8 + T-Cell   (d) CD16 + T Cell

7. B-cell lymphoma express a unique tumor antigen called
   (CO4, K2)
   (a) Endosialin   (b) SM-3
   (c) Idiotype   (d) p53

8. Transfer of tissue between individuals of different species
   is called (CO4, K4)
   (a) Xenograft   (b) Isograft
   (c) Autograft   (d) Allograft

9. Polio is best example for _____ Vaccine (CO5, K1)
   (a) DNA   (b) Subunit
   (c) mRNA   (d) Live attenuated

10. BCG Vaccine is used to protect against (CO5, K2)
    (a) Rabies   (b) Hepatitis B
    (c) Tuberculosis   (d) Influenza

Part B (5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Write short note on Innate immune system.
    (CO1, K1)

                    Or

    (b) Briefly explain the response of macrophages in Phagocytosis. (CO1, K2)

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12. (a) Explain the process of B cell maturation. (CO2, K4)

Or

(b) Narrate the process of antigen presentation.
(CO2, K4)

13. (a) What are cytokines? List the different classes of cytokines and explain each. (CO3, K3)

Or

(b) Explain the immune response against HIV infection. (CO3, K4)

14. (a) Write the immune response behind the Type I diabetes. (CO4, K4)

Or

(b) Graft rejection – list the possible reasons. (CO4, K3)

15. (a) Write short notes on active immunization. (CO5, K2)

Or

(b) List and explain in brief types of vaccine. (CO5, K2)

Part C $(5 \times 8 = 40)$

Answer **all** questions not more than 1000 words each.

16. (a) Give an account on primary lymphoid organs.
(CO1, K2)

Or

(b) Differentiate antigen, hapten and epitope. (CO1, K5)

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17. (a) How the TCR involved in antigen recognition? Explain. (CO2, K4)

Or

(b) Describe the common gene arrangements of antibody. (CO2, K3)

18. (a) Which points makes the MHC-I and MHC-II differed from each other? – List out. (CO3, K4)

Or

(b) Describe the activation of classical pathway of complement system. (CO3, K2)

19. (a) Write an account on Type I and II hypersensitivity. (CO4, K2)

Or

(b) Point out tumor antigens and their importance in cancer immunotherapy. (CO4, K3)

20. (a) List the advantages and disadvantages of DNA and protein-based vaccines. (CO5, K2)

Or

(b) Explain the method of monoclonal antibody production and its applications. (CO5, K3)

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M.Sc. DEGREE EXAMINATION, APRIL – 2024

Second Semester

Biotechnology

BIOINFORMATICS

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1. Which of the following is not a nucleotide database?
                                                        (CO1, K1)

    (a) NCBI   (b) DDBJ

    (c) PDB   (d) EMBL

2. GenBank and SWISS-PROT are examples of ————
                                                        (CO1, K1)

    (a) protein and nucleotide databases, respectively

    (b) protein databases

    (c) nucleotide databases

    (d) nucleotide and protein databases, respectively

3. Which of the following is not a structural variation of DNA?   (CO2, K2)

    (a) Inversion   (b) Deletion

    (c) Mutation   (d) Translocation

4. The Smith-Waterman algorithm is a local sequence alignment algorithm used to identify ——————. (CO2, K1)

   (a) similar regions between two sequences, either nucleotides or proteins

   (b) similar regions between two sequences, neither nucleotide nor protein

   (c) similar regions between two nucleotide sequences only

   (d) similar regions between two protein sequences only

5. Which version of Clustal, released in 1997, introduced the first graphical user interface (GUI)? (CO3, K2)

   (a) ClustalX

   (b) Clustal2

   (c) Clustal omega

   (d) ClustalW

6. —————— is a widely used method for evaluating the degree of sequence conservation in protein domains. (CO3, K2)

   (a) Phylogenetic analysis

   (b) BLAST

   (c) Multiple sequence alignment

   (d) Protein-protein BLAST

7. RMS stands for —————— (CO4, K2)

   (a) Root Median Square

   (b) Root Mean Square

   (c) Root Mean Speed

   (d) Root Mid Square

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8. Which of the following is not a secondary structure component? (CO4, K2)

   (a) α-helix

   (b) β-sheet

   (c) Random coil

   (d) Disulfide bond

9. Which of the following software/server is used for homology modelling? (CO5, K2)

   (a) BLAST

   (b) PyMOL

   (c) RaptorX

   (d) Visual Molecular Dynamics

10. *In silico* drug design refers to the process of ——————— (CO5, K2)

    (a) Conducting clinical trials for new drugs

    (b) Studying drug interactions in living organisms

    (c) Designing drugs using computer-based methods and simulations

    (d) Synthesizing drugs in a laboratory setting

Part B (5 × 5 = 25)

Answer **all** the questions, not more than 500 words each.

11. (a) What is NCBI, and explain two examples of resources offered by them. (CO1, K1)

Or

    (b) What are the various tools and resources that are offered at EBI? (CO1, K2)

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12. (a) Explain the concept of sequence alignment and its significance in detail. (CO2, K1)

Or

(b) Describe the importance of gene prediction in DNA sequence analysis. (CO2, K2)

13. (a) Define the following: (CO3, K2)

(i) CLUSTALX, (ii) CLUSTALW (iii) SEQUIN, (iv) Phylogenetic analysis, (v) Genome centre.

Or

(b) Explain the different comparison programs available in the FASTA3 program package, and how can they be applied to multiple sequence alignment. (CO3, K3)

14. (a) Describe in detail on force fields methods. (CO4, K3)

Or

(b) Explain why backbone construction and side chain addition are important in protein modelling. (CO4, K4)

15. (a) Explain in detail the protein function prediction and its importance. (CO5, K5)

Or

(b) How does the virtual library support researchers in accessing scientific literature and resources? Explain with an example. (CO5, K6)

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Part C $(5 \times 8 = 40)$

Answer **all** the questions not more than 1000 words each.

16. (a) List out the importance of Bioinformatics in biology and medicine.   (CO1, K1)

Or

   (b) Explain in detail about the nucleic acid databases.   (CO1, K2)

17. (a) Define motif and discuss the importance of motif discovery in sequence analysis.   (CO2, K1)

Or

   (b) Explain in detail about the pairwise alignment techniques.   (CO2, K2)

18. (a) What is multiple sequence alignment? Discuss its significance in bioinformatics. Describe at least two widely used algorithms for performing multiple sequence alignment.   (CO3, K3)

Or

   (b) Explain in detail about the methods of phylogenetic analysis.   (CO3, K2)

19. (a) Explain the features, algorithms used, and applications of any protein modelling software.   (CO4, K3)

Or

   (b) Explain in detail about protein modelling and its significance in bioinformatics.   (CO4, K4)

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20. (a) Discuss in detail about the importance of predicting and analyzing protein secondary structures, and describe the tools or servers frequently employed for this task. (CO5, K5)

Or

(b) Explain the following protein structure prediction methods in detail: (i) Homology modelling, (ii) Threading. (CO5, K4)

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R1006	Sub. Code
	501204

M.Sc. DEGREE EXAMINATION, APRIL – 2024

Second Semester

Biotechnology

GENOMICS AND PROTEOMICS

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1.   Histone protein that binds to DNA is   (CO1, K1)

   (a)   H3   (b)   H2B

   (c)   H2A   (d)   HI

2.   Most of the chloroplast proteins are encoded by (CO1, K1)

   (a)   Nuclear genome   (b)   Mitochondrial genome

   (c)   Plastid genome   (d)   Nucleoid

3.   Which of the following is NOT a physical mapping technique?   (CO2, K1)

   (a)   Chromosome walking

   (b)   Linkage mapping

   (c)   Fluorescence in situ hybridization (FISH)

   (d)   Restriction mapping

4. Radiation hybrids are generated by fragmenting the (CO2, K1)

   (a) introns   (b) chromosomes

   (c) ribosomes   (d) nucleus

5. The first model plant for which the entire genome was sequenced is (CO3, K1)

   (a) *Zea mays*   (b) *Mangifera indica*

   (c) *Oryza saliva*   (d) *Arabidopsis thaliana*

6. The preferred and efficient method for identification of bacterial species is (CO4, K1)

   (a) Gram staining

   (b) 18s rRNA sequencing

   (c) 16s rRNA sequencing

   (d) trnH-psbA sequencing

7. Which of the following statement is CORRECT? (CO5, K1)

   (a) A zwitterion does not possess functional group

   (b) The net charge of a zwitterion is one

   (c) A zwitterion is electrically neutral

   (d) A zwitterion can be negatively charged or positively charged

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8. Protein-DNA interactions can be studied by (CO5, K1)

   (a) Yeast Two Hybrid screening

   (b) Western blotting

   (c) Northern blotting

   (d) ELISA

9. A gene is studied and altered to result a change in phenotype. This is an example of (CO6, K1)

   (a) genomics (b) reverse genetics

   (c) forward genetics (d) epigenetics

10. Overlapping DNA segments that form a consensus region of DNA are called (CO6, K1)

    (a) Translatomes (b) transcripts

    (c) contigs (d) digests

Part B (5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Differentiate prokaryote and eukaryote genomes. (CO1, K1)

    Or

    (b) Briefly explain the salient features of bacterial plasmids. (CO1, K1)

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12. (a) Write the steps involved in RFLP analysis.
    (CO2, K3)

    Or

    (b) Define radiation hybrids (RH). How is an RH mapping performed? (CO2, K3)

13. (a) What are the highlights of human genome project? (CO3, K2)

    Or

    (b) What are SNPs? Give their application as molecular markers (CO4, K5)

14. (a) What are proteome databases? How can you retrieve proteome information? (CO5, K3)

    Or

    (b) List the applications of MALDI-TOF in protein identification. (CO5, K3)

15. (a) Define chromosome walking and brief the technique to characterize chromosomes. (CO6, K4)

    Or

    (b) Mention the significance and list the applications of lipidomics? (CO6, K4)

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Part C (5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Detail the organization of eukaryotic genome. (CO1, K1)

Or

(b) What are organellar genomes in eukaryotes? Explain in detail? (CO1, K1)

17. (a) What are the steps involved in FISH technique to map a DNA or chromosome? (CO2, K3)

Or

(b) Explain the techniques involved in physical and genetic mapping. (CO2, K3)

18. (a) State the features of *Arabidopsis* genome. Explain the outcomes of Arabidopsis Genome Project. (CO3, K2)

Or

(b) Detail the steps involved in 16s rRNA sequencing of bacteria. Give its importance in identification of organisms. (CO4, K5)

19. (a) Illustrate and explain the working principle of 2D-PAGE. (CO5, K3)

Or

(b) How can protein-DNA interactions be studied? With a neat diagram explain the technique. (CO5, K3)

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20. (a) How are contigs are generated? Elucidate the contig assembly processes. (CO6, K4)

Or

(b) Give the workflow of metabolome profiling with examples. (CO6, K4)

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R1007

M.Sc. DEGREE EXAMINATION, APRIL – 2024

Second Semester

Biotechnology

MOLECULAR DIAGNOSTICS

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1.   Which DNA polymorphism technique relies on the use of allele-specific primers and DNA amplification to detect single nucleotide variations?   (CO1, K2)

     (a)   RFLP   (b)   SSR

     (c)   ARMS-PCR   (d)   AFLP

2.   The reciprocal translocation involving chromosomes 9 and 22 leads to the formation of which abnormality associated with chronic myeloid leukemia (CML)?   (CO4, K2)

     (a)   Turner Syndrome

     (b)   Down Syndrome

     (c)   Philadelphia Chromosome

     (d)   Cri du Chat Syndrome

3. Which repair mechanism is responsible for correcting DNA damage caused by exposure to ultraviolet (UV) light? (CO5, K1)

   (a) Base Excision Repair (BER)

   (b) Nucleotide Excision Repair (NER)

   (c) Mismatch Repair (MMR)

   (d) Homologous Recombination (HR)

4. The drug imatinib a tyrosine kinase inhibitor is commonly used for the treatment of cancers associated with the abnormal activation of which of the following pathways? (CO5, K1)

   (a) EGFR

   (b) MAPK

   (c) JAK-STAT

   (d) BCR-ABL

5. Huntington's disease is caused by an expansion of trinucleotide repeats in which gene? (CO4, K2)

   (a) HTT   (b) BRCA1

   (c) TP53   (d) APC

6. Which analytical technique is commonly used for metabolite profiling by separating and quantifying metabolites based on their mass-to-charge ratio?

   (CO2, K2)

   (a) GC-MS

   (b) NMR

   (c) HPLC

   (d) MALDI-TOF

7. ESTs are short DNA sequences derived from —————— cellular process. (CO2, K2)

   (a) Transcription

   (b) Translation

   (c) DNA Replication

   (d) Reverse Transcription

8. Identify the genetic variation that is detected using DHPLC technique. (CO2, K2)

   (a) Single Nucleotide Polymorphisms (SNPs)

   (b) Insertions

   (c) Deletions

   (d) Copy Number Variations (CNVs)

9. In DNA polymorphism analysis, what is the term for a sequence of DNA that exhibits variation in length among individuals? (CO1, K2)

   (a) SNPs

   (b) VNTRs

   (c) STRs

   (d) RFLPs

10. What is the advantage of using denaturing conditions in DHPLC analysis? (CO2, K2)

    (a) Increased specificity

    (b) Enhanced resolution

    (c) Improved sensitivity

    (d) Facilitates direct sequencing

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Part B   (5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Write a short note on DNA polymorphism. (CO1, K2)

                        Or

    (b) Give a brief account on genetic disorders associated with chromosome mutations.   (CO1, K2)

12. (a) What is Metabolic profiling? Explain its applications.   (CO2, K2)

                        Or

    (b) Write a short note on EST.   (CO2, K2)

13. (a) Elaborate on the genotypic markers associated with microbial resistance.   (CO3, K3)

                        Or

    (b) Define antibiotics and elucidate their role in the context of microbiology and medicine.   (CO3, K3)

14. (a) Write a short note on Fragile X syndrome. (CO4, K2)

                        Or

    (b) Give a detailed account on Familial cancer syndromes.   (CO4, K2)

15. (a) Discuss the role of targeted therapy in cancer.
                                          (CO5, K1)

                        Or

    (b) Write a short note on predictive biomarkers for Chronic myeloid leukemia and Melanoma. (CO5, K1)

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Part C (5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Give a detailed account on types of DNA polymorphisms. (CO1, K2)

Or

(b) Discuss the role of DNA, histones and other associated proteins in forming the chromatin structure. (CO1, K2)

17. (a) Explain the principles and applications of SELDI-TOF-MS. (CO2, K2)

Or

(b) Write in detail about Next generation sequencing technologies and their applications in diagnostics. (CO2, K2)

18. (a) Outline and discuss the diverse methods utilized for the detection and identification of slow-growing pathogens. (CO3, K3)

Or

(b) Discuss the mechanisms by which antibiotics exert their effects on microorganisms? (CO3, K3)

19. (a) List out and explain the molecular techniques and methodologies employed for accurate diagnosis of diseases, including genetic testing and molecular markers. (CO4, K2)

Or

(b) Elaborate the types of mutations that can lead to inherited disorders, and provide examples of specific disorders associated with genetic mutations. (CO4, K2)

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20. (a) Explain how specific biomarkers are identified and utilized to predict treatment response and guide personalized therapeutic interventions. (CO5, K1)

Or

(b) Give a detailed account on specific predictive biomarkers associated with various types of cancer and discuss their significance in determining treatment efficacy, prognosis and resistance patterns. (CO5, K1)

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R1008

M.Sc. DEGREE EXAMINATION, APRIL – 2024

Second Semester

Biotechnology

RESEARCH METHODOLOGY AND SCIENTIFIC COMMUNICATION SKILLS

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. What is the primary goal of empirical science?   (CO2, K1)

    (a) Establishing philosophical principles

    (b) Gaining theoretical knowledge

    (c) Understanding the natural world through observation and experimentation

    (d) Speculating about supernatural phenomena

2. In the scientific method, what is the first step investigating a phenomenon?   (CO1, K1)

    (a) Formulating a hypothesis

    (b) Conducting experiments

    (c) Making observations

    (d) Drawing conclusions

3. Which of the following is a key characteristic of descriptive science? (CO2, K1)

   (a) Formulating hypotheses

   (b) Manipulating variables

   (c) Gathering and analyzing data

   (d) Testing predictions

4. What is the primary purpose of having a mentor? (CO1, K1)

   (a) To delegate tasks

   (b) To provide guidance and support

   (c) To criticize your work

   (d) To compete with

5. What is a key quality of a good mentor? (CO4, K1)

   (a) Arrogance   (b) Empathy

   (c) Indifference   (d) Authoritarianism

6. Why is it important to record the date and time of each entry in a laboratory notebook? (CO1, K4)

   (a) To track the researchers schedule

   (b) For organizational purposes

   (c) To comply with legal requirements

   (d) Decorating the laboratory space

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R1008

7. Which communication channel is synchronous in nature? (CO2, K4)

    (a) Email   (b) Telephone

    (c) Letter   (d) Text message

8. Which of the following is an example of non-verbal communication? (CO1, K2)

    (a) Speaking   (b) Writing

    (c) Gestures   (d) Emailing

9. What is the primary purpose of a scientific poster presentation? (CO1, K1)

    (a) To entertain the audience

    (b) To showcase experimental equipment

    (c) To communicate research findings

    (d) To sell products

10. Which of the following is a key element of an effective poster title? (CO1, K1)

    (a) A catchy slogan

    (b) A list of references

    (c) A concise and informative title

    (d) An abstract of the research

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Part B $(5 \times 5 = 25)$

Answer **all** questions not more than 500 words each.

11. (a) What are the underlying assumptions of the scientific method?   (CO2, K1)

    Or

    (b) Why are manipulative experiments crucial in scientific inquiry?   (CO3, K1)

12. (a) What is the role of premises and conclusions in deductive reasoning?   (CO2, K3)

    Or

    (b) How closely does the mentors research align with your own interests and goals?   (CO2, K2)

13. (a) What role does clarity play in formulating a research question?   (CO2, K1)

    Or

    (b) What is the relationship between a research question and the formulation of a hypothesis?
                                                    (CO2, K4)

14. (a) Explain the key components involved in the communication process.   (CO1, K4)

    Or

    (b) How important is understanding your audience when preparing a presentation?   (CO2, K3)

15. (a) How does technical writing contribute to effective communication in various industries?   (CO2, K3)

    Or

    (b) What ethical concerns are associated with plagiarism?   (CO2, K2)

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R1008

Answer **all** questions not more than 1000 words each.

16. (a) How does the choice of research design impact the validity of empirical findings? (CO2, K2)

Or

   (b) Discuss the challenges and opportunities in conducting manipulative experiments in field settings. (CO3, K4)

17. (a) Discuss the distinction between prediction and inference in the context of inductive reasoning. (CO2, K2)

Or

   (b) What are the mentors expectations for your involvement in the research project? (CO2, K3)

18. (a) Discuss the balance between providing guidance and allowing the mentee to make their own decisions. How can a mentor strike this balance effectively? (CO3, K2)

Or

   (b) What is the relationship between a research question and the formulation of a hypothesis? (CO2, K2)

19. (a) Compare and contrast verbal and nonverbal communication. Provide examples of each. (CO2, K4)

Or

   (b) What are the key components of a well-structured presentation? (CO1, K1)

5

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20. (a) Explain the importance of clarity and conciseness in technical writing. (CO2, K5)

Or

(b) How does one critically analyze and synthesize information from different sources in a literature review? (CO2, K5)

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M.Sc. DEGREE EXAMINATION, APRIL – 2024

Second Semester

Biotechnology

Lab IV — MOLECULAR BIOLOGY AND GENETIC ENGINEERING

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1.   In a bacterial lac operon system, which of the following gene has regulatory function?   (CO1, K1)

(a)   *lacZ*   (b)   *lacy*

(c)   *lacI*   (d)   *lacA*

2.   In phage display, the use of a helper phage can be eliminated by using   (CO1, K1)

(a)   bacterial packaging cell line technology

(b)   phagemid vector

(c)   none of the above

(d)   using both methods

3. In the schematic diagram, which of the following environmental conditions influence the transcription of the operon. (CO1, K3)

    (a) Glucose present, lactose absent

    (b) Glucose present, lactose present

    (c) Glucose absent, lactose present

    (d) Glucose absent, lactose absent
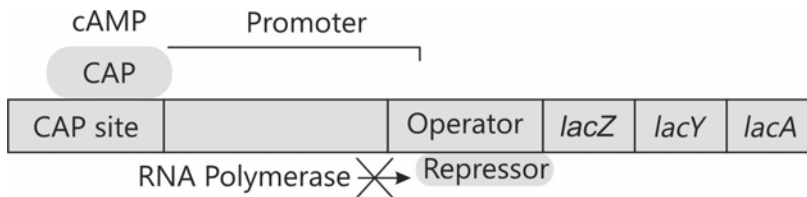
4. In negative selection of recombination clones, generation of the toxic fluorodeoxyuridine product from enzymatic conversion leads to killing of cells having functional gene product of (CO2, K2)

    (a) Ura3   (b) Trp1

    (c) Leu2   (d) GEA2

5. The theory behind the diauxic growth curve stems from the research works of (CO1, K1)

    (a) Joshua Lederberg

    (b) Jacques Monod

    (c) Melvin Cohn

    (d) None of the researcher mentioned

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6. What is the possible reason for poor protein purity in Nickel IMAC Resin for 6X His Tagged Protein Purification? (CO3, K4)

    (a) aggregate formation

    (b) Too little lysis/homogenization buffer used

    (c) Contaminants bind target protein through disulfide bounds

    (d) Strong non-specific interactions of target protein on resin

7. In IMAC, contaminants bind target protein through electrostatic interactions. Which of the following is added excess to reduce non-specific protein binding through ionic interactions? (CO3, K2)

    (a) Urea

    (b) NaCl

    (c) B-mercaptoethanol

    (d) None of the above

8. Biopanning is an affinity selection technique which selects for peptides that bind to a given target. Identify the correct sequence based on the steps involved in the process. (CO3, K4)

    (a) Capture-Washing-Elution-Phage display library generation

    (b) Phage display library generation-Capture-Washing-Elution

    (c) Capture-Phage display library generation-Washing-Elution

    (d) Phage display library generation-Washing-Capture-Elution

R1009

9. If you transform 2 μl (100 pg) of the vector pUC19 DNA into 50 μl of cells, outgrow by adding 250 μl of SOC and dilute 10 μl up to 1 ml in SOC before plating 30 μl. If you count 150 colories on the plate, the Transformation efficiency is : (CO2, K3)

   (a) 0.5×10^9 cfu/μg   (b) 1.5×10^{11} cfu/μg

   (c) 1.5×10^8 cfu/μg   (d) 1.5×10^9 cfu/μg

10. Which of the following statement does not true to pull-down assay? (CO3, K4)

    (a) used for the isolation of low μg amounts of complexes

    (b) common variation of immunoprecipitation and immunoelectrophoresis

    (c) detection of proteins from complexes might not be a problem despite their weak interaction or rapid dissociation during electrophoresis

    (d) None of the above

Part B $(5 \times 5 = 25)$

Answer **all** questions not more than 500 words each.

11. (a) Explain the mechanism of UV mutagenesis. (CO1, K2)

    Or

    (b) Describe the direct facile screening of recombinant DNA vector constructs by using reporter gene assay. (CO1, K4)

12. (a) Compare and Contrast Boiling lysis and Alkaline lysis methods of plasmid isolation. (CO2, K5)

    Or

    (b) Which PCR is used for screening of transformed colonies? Describe in detail. (CO1, K3)

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R1009

13. (a) Explain the principle of Southern hybridization and its applications. (CO3, K2)

Or

(b) Discuss the challenges associated with recombinant protein expression in *E.coli*. (CO3, K4)

14. (a) Differentiate between auxotrophs and prototrophs. How are auxotrophs utilised for strain improvement? (CO1, K3)

Or

(b) Explain the following methods of competent cell preparation in brief. (CO2, K2)

   (i) Calcium chloride method

   (ii) Electroporation

15. (a) What are inclusion bodies? Determine the factors influence the formation of inclusion bodies in e.coli. (CO3, K5)

Or

(b) What is glucose repression? Describe its effects on bacterial growth. (CO1, K3)

Part C $(5 \times 8 = 40)$

Answer **all** questions not more than 1000 words each.

16. (a) Briefly describe the following types of bacterial growth processes observe in *E.coli* and list out their significance. (CO1, K2)

   (i) Diauxic growth

   (ii) Synchronous growth

   (iii) Continuous growth

Or

(b) Discuss briefly on the isolation of auxotrophic mutants of diploid industrial yeast strains after UV Mutagenesis. (CO1, K3)

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17. (a) What are plasmids and how do you perform plasmid isolation using boiling lysis and alkaline lysis method and its quantification with a detailed workflow? (CO2, K6)

Or

(b) Discuss the factors involved in primer designing and optimum reaction conditions for standard PCR technique. (CO2, K3)

18. (a) Explain the detailed methodology on SDS profiling. Justify the principle behind separating and stacking gel setup in SDS analysis. (CO3, K6)

Or

(b) Justify the detailed use of mild solubilization methods in recovering bioactive proteins from inclusion bodies. (CO3, K3)

19. (a) Assess and interpret the application of gene mapping methods. (CO1, K3)

(i) in the detection of recombination within genes

(ii) for constructing genetic maps for intraspecies comparison

(iii) in developing PCR-based markers

Or

(b) Explain the following methods for screening of recombinant transformants : (CO2, K5)

(i) Blue- White screening

(ii) Insertional inactivation

(iii) Antibiotic sensitivity

(iv) Auxotrophic yeast strain

R1009

20. (a) Discuss how the determination of M13 phage titre is crucial for applications of phage display and recombinant DNA technology. (CO1, K4)

Or

(b) Explain the basics of His-tags, their principle methods of tagging, applications and detection in brief. (CO3, K2)

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M.Sc. DEGREE EXAMINATION, APRIL – 2024

Second Semester

Biotechnology

Laboratory – V – IMMUNOLOGY

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1. Which among the following can be diagnosed using an Antigen test?   (CO1, K3)

    (a) Down's syndrome (b) Type I Diabetes

    (c) Hepatitis B   (d) NAFLD

2. The antibodies present in the person with O blood group is —————.   (CO1, K3)

    (a) Anti-O   (b) Anti-A1 and A2

    (c) Anti-A and B   (d) Nil

3. ————— is powerful independent activators of T/B lymphocytes of microbial origin with potentials to be used in immunization.   (CO1, K3)

    (a) Adujuvant   (b) Superantigen

    (c) A hapten   (d) Antiserum

4. Which of the following is not a blocking agent in an antigen-antibody hybridization reaction?   (CO2, K4)

    (a) BSA   (b) Skimmed Milk

    (c) Serum   (d) Saccharose

5. Which of the interpretations on the nature of antibodies (in the blanked antibody well) shown in the following double diffusion result is CORRECT?   (CO2, K4)
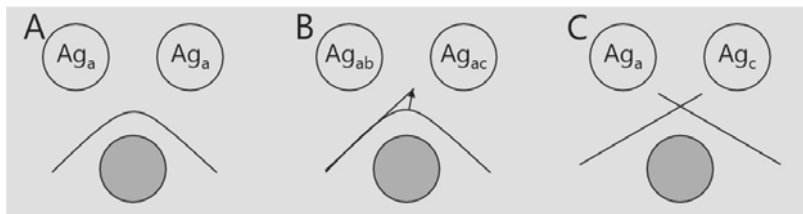
    (a) A shows non-identity to both antigens

    (b) B shows partial identity to one of the antigens

    (c) A and B show identity to the antigens

    (d) C shows partial identity to the antigens

6. Dot blotting is better over Western blotting in ———————.   (CO2, K3)

    (a) Sample numbers

    (b) Signal normalization

    (c) Background reduction

    (d) Target specificity

7. In radial diffusion precipitin rings with larger diameter are formed with: (CO2, K4)

    (a) Increase in concentration

    (b) Decrease in concentration

    (c) Degree of heterogeneity of antigen

    (d) Higher the volume of antibody

R1010

8. A weak acid in SDS-PAGE running buffer that exist either as an uncharged zwitterion, or a charged glycinate anion: (CO2, K3)

   (a) EDTA   (b) Tris HCL

   (c) Acetic acid   (d) Glycine

9. A phagocytic cell derived from monocytes: (CO3, K2)

   (a) Neutrophils   (b) Mast cells

   (c) NK cells   (d) Macrophages

10. A common method to measure IFN-y is (CO3, K2)

    (a) ELISPOT

    (b) FACS

    (c) Cayman's Phagocytosis assay

    (d) SDS-PAGE

Part B $(5 \times 5 = 25)$

Answer **all** the questions not more than 500 words each.

11. (a) Write a note on the following issues of antigen-antibody reaction. (CO1, K3)

    (i) cross-reactivity

    (ii) false positives.

Or

(b) What are the properties of antibodies that make them useful for research and clinical diagnosis? Add a note on the most common class of antibody used for diagnosis of acute infection. (CO1, K4)

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R1010

12. (a) Compare the method of development, use, and characteristics of monoclonal and polyclonal antibodies. (CO1, K4)

Or

(b) Write note on Precipitin Reactions with suitable examples. (CO2, K3)

13. (a) What is agglutination reaction? Compare direct and indirect agglutination assays. (CO2, K3)

Or

(b) Give a note on sandwich ELISA in detecting infectious diseases. (CO2, K3)

14. (a) Narrate the principle of Radial Immunodiffusion and add a note on the factors that affect the size of precipitin rings. (CO2, K3)

Or

(b) Describe Phagocytosis and elaborate on the various Phagocytic cells. Narrate on how opsonines affect phagocytes? (CO3, K2)

15. (a) Elaborate the following methods (CO3, K2)

(i) Immunoblots

(ii) Immunostaining.

Or

(b) Write a note on Immuno chromatographic assay. What are their applications? (CO3, K2)

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Answer **all** the questions not more than 1000 words each.

16. (a) Diagrammatically describe the structure of immunoglobulin and write the features of different types of Immunoglobulins. (CO1, K3)

Or

(b) Define antigen-antibody reaction. List various serological methods to demonstrate antigen-antibody reaction along with their principle. (CO1, K4)

17. (a) Discuss briefly on immunization by different types of vaccines add note on their mode of action. (CO1, K4)

Or

(b) Write the method, principle and advantages of Ficoll-Hypaque method of mononuclear cell preparation and add a note on their application and storage. (CO2, K3)

18. (a) List out and discuss the principle and methodology of the various immunoelectrophoresis techniques used in diagnosis. (CO2, K3)

Or

(b) Compare and contrast Western blotting and dot blot analysis. What are the applications of protein blotting in immunodiagnostics? (CO2, K3)

R1010

19. (a) Define complement and explain in brief about alternative pathways. Elaborate a method to detect the presence of either specific antibody or specific antigen in a patient's serum, based on complement fixation. (CO3, K2)

Or

(b) Write in detail the principle and the procedure employed in ELISPOT technique and what their advantages over ELISA in clinical diagnostics. (CO3, K2)

20. (a) Describe the theory of antibody production. Define "IgY technology" add a note on the separation methods used for isolating IgY from chicken egg. (CO3, K2)

Or

(b) Write down the protocol for separation of the cells from peripheral blood by FACS. (CO3, K2)

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R1010

Sub. Code
501504

M.Sc. DEGREE EXAMINATION, APRIL – 2024

Second Semester

Biotechnology

Elective – ENVIRONMENTAL BIOTECHNOLOGY

(CBCS – 2022 onwards)

Time : Three Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. The main component of air pollution that can lead to respiratory problems is (CO1, K2)

    (a) Carbon dioxide (b) Sulfur dioxide

    (c) Nitrogen oxide (d) Particulate matter

2. Which of the following is an example of chemolithotrophic microorganism? (CO1, K1)

    (a) E.coli (b) Methanogenic archaea

    (c) Nitrosomonas (d) Saccharomyces cerevisiae

3. The purpose of bioaugmentation in wastewater treatment is (CO2, K2)

    (a) Accelerating the formation of sludge

    (b) Reducing microbial diversity

    (c) Enhancing the degradation of pollutants

    (d) Increasing the concentration of harmful substances

4. ———— radionuclide is commonly used in medical imaging. (CO2, K1)

   (a) Uranium-235

   (b) Technetium-99m

   (c) Plutonium-239

   (d) Cesium-137

5. The main advantage of specialized degrading bacteria in certain environments is (CO2, K2)

   (a) High resistance to environmental stress

   (b) Ability to form mycorrhizal associations.

   (c) Faster growth rate compared to fungi.

   (d) Production of ligninolytic enzymes

6. In pytodegradation, plants used ———— to break down pollutants. (CO3, K3)

   (a) Anaerobic respiration

   (b) Photosynthetic

   (c) Transpiration

   (d) Metabolism and enzymes

7. Which factor contributes to the environmental safety of baculovirues as biopesticides? (CO3, K2)

   (a) Persistence in the soil

   (b) Broad host range

   (c) Ability to infect vertebrates

   (d) Lack of impact on non-target organism

R1011

8. Using mycorrhizal fungi as biofertilizers enrich (CO4, K3)

   (a) Fixation of atmospheric nitrogen

   (b) Increased availability of phosphorus and other nutrients

   (c) Production of plant growth hormones

   (d) Soil sterilization

9. Which country is a major producer and consumer of bioethanol derived from sugarcane? (CO5, K1)

   (a) United States   (b) Brazil

   (c) China   (d) India

10. ———— mechanism is employed by microorganisms in MEOR to displace oil from reservoir rocks (CO5, K2)

   (a) Mechanical pumping

   (b) Chemical dissolution

   (c) Microbial bioflim formation

   (d) Biopolymer production.

Part B (5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Discuss the concept of pollution and outline the strategies for its control (CO1, K2)

   Or

   (b) Explain the concept of the lag phase in microbial growth kinetics. How does it differ from other growth phases? (CO1, K4)

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R1011

12. (a) Distinguish between biostimulation and bioaugmentation in the context of environmental remediation. (CO2, K3)

Or

(b) Explore the technical aspects of in site and ex situ bioremediation and techniques for the effective application in environmental remediation. (CO2, K3)

13. (a) Give brief account on White rot fungi and its advantage (CO3, K1)

Or

(b) Write a note on phyto accumulation. (CO3, K3)

14. (a) Describe the symbiotic relationship between plants and microbes in the context of biofertilizers. (CO4, K4)

Or

(b) Write a short note on Baculoviruses and its genetic modifications (CO4, K3)

15. (a) Explain the concept of MEOR and discuss its key mechanisms for improving oil recovery from reservoirs and its advantages. (CO5, K4)

Or

(b) Discuss the potential applications of biosurfactants in various industries (CO5, K3)

R1011

Part C (5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Describe in detail on various ways of management of different kinds of wastes. (CO1, K4)

Or

(b) Discuss two major anthropogenic threats to global biodiversity arid elaborate on their ecological consequences. (CO1, K4)

17. (a) Explain the bioremediation of Organic pollutants such as PAHs PCBs Pesticides and TNT. (CO2, K1)

Or

(b) Explore the characteristics. sources and environmental impact of specific radionuclides, focusing on U and Te. (CO2, K5)

18. (a) Enumerate the differences between Phytovolatilization and Phytostabilization. (CO3, K6)

Or

(b) Describe the applications of Bacteria and Fungi in Bioremediation. (CO3, K3)

19. (a) Explain the significance of Bacillus thuringiensis (Bt) in agriculture, and highlight its mode of action associated with the use of Bt in crop protection. (CO4, K4)

Or

(b) Express the abbreviation of PGPR and enumerate the limitations in application. (CO4, K3)

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20. (a) Elaborate the mechanism of production, applications, Upperhand and alternatives of Biodiesel. (CO5, K2)

Or

(b) Describe the conventional paper production procedure and the role of Xylanases and White Rot Fungi in paper production. (CO5, K5)

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R1011