

**ST JOSEPH’S UNIVERSITY, BENGALURU -27**

**B.Sc. Biochemistry- VI SEMESTER**

**SEMESTER EXAMINATION: APRIL 2023**

**(Examination conducted in May 2023)**

**BCH6222: Recent developments in the field of Biochemistry**

**Time: 2 1/2 Hours                                                                                         Max Marks: 70**

**This paper contains TWO printed pages and FOUR parts**

**Part A: Answer *ANY 16*of the following questions: 16 X 1 mark = 16 marks**

1. What is an exon?
2. Define an operon.
3. Name any one of the transgenic crops cultivated in India.
4. Name the cells that secrete insulin in the human body.
5. In the context of a vector, what does MCS stand for?
6. What is the main objective of SSCP?
7. Name the insect pest/s against which resistance has been engineered in the most widely cultivated transgenic crop in India.
8. Define artificial gene synthesis.
9. Name a commonly used promoter in bacterial expression vectors.
10. What is TTGE?
11. What are the basic elements/features of an expression vector?
12. State any two common applications for synthesised oligonucleotides in molecular biology.
13. What is CRISPR an acronym for?
14. Name the scientists who won the Nobel Prize for Chemistry in 2020.
15. Define the term ‘Metabolome’.
16. Define mass to charge ratio.
17. What is the basic principle behind FISH?
18. To study global gene expression patterns, which of the following is the nucleotide that is typically bound on a microarray: DNA, mRNA, siRNA or cDNA?

**Part B: Answer *ANY 10*of the following questions: 10 X 2 mark = 20 marks**

1. What is a UTR in the context of the structure of a gene?
2. What is a promoter? Name the promoter element highly conserved across eukaryotic genomes.
3. Briefly describe at least two broad traits that are incorporated into various transgenic crops worldwide.
4. Draw a diagram of the lac operon. List the gene names and the enzymes coded by the lac operon.
5. What are ESTs? How are they useful?
6. State any two advantages of HRM analysis.
7. Write a note on 16S rRNA and its use in bacterial species identification.
8. What are SNPs?
9. What is spacer acquisition in the context of CRISPR mediated immunity in bacteria?
10. Mention any two roles that genomics based approaches played in our fight against Covid-19.
11. State any two of applications of protein microarrays.
12. Name any two fluorophores used in biochemical research.

**Part C: Answer *ANY 8* of the following questions: 8 X 3 marks = 24 marks**

1. What are the basic steps of a PCR reaction?
2. Briefly describe the various steps in production of Insulin using rDNA technology.
3. What are the differences between a genomic DNA library and cDNA library? What are the specific advantages of either over the other?
4. Write a note on site-directed mutagenesis.
5. Draw the diagram and accurately label all parts of the Agrobacterium Ti plasmid.
6. Using an illustration, describe how heteroduplexes are formed between mutant and WT alleles, and how this can be used to detect point mutations.
7. Describe how Denaturing Gradient Gel Electrophoresis (DGGE) can be used for detecting mutations.
8. Write a brief note about the Human Genome Project.
9. Using a flowchart, describe the key stages of a typical metabolomics study.
10. Write a note on carbohydrate microarrays. What are the advantages of carbohydrate microarrays over traditional methods for studying carbohydrate-protein interactions, such as glycan-binding assays or ELISA?

**Part D:Answer *ANY 2*of the following questions: 2 X 5 marks = 10 marks**

1. How is transcription of the lac operon affected in the following situations? Use appropriate illustrations and justify your answers.
2. There is a loss of function mutation in the lac repressor gene on the lac operon; lactose present in the medium, glucose absent.
3. There is a silent mutation in the CAP binding site on the promoter; low levels glucose and high levels of lactose are present in the medium.
4. CRISPR-Cas is a powerful tool for gene editing that has revolutionized the field of molecular biology. What are the basic steps involved in using CRISPR-Cas for gene editing?
5. BRCA1 (BReastCAncer gene 1) and BRCA2 (BReastCAncer gene 2) are genes that produce proteins that help repair damaged DNA. People who inherit harmful variants in one of these genes have increased risks of several cancers-most notably breast and ovarian cancer. Studies show that 55%–72% of women who inherit a harmful BRCA1 variant and 45%–69% of women who inherit a harmful BRCA2 variant will develop breast cancer by 70–80 years of age. Therefore early screening and detection of harmful BRCA variant is especially useful if a person has a family history of breast and ovarian cancer. Based on all the omics-based techniques that you studied in this course, how might you perform genetic testing to identify BRCA mutants?