(PART-B : Descriptive)

Time : 2 hrs. 40 min. **Marks : 50**

[Answer question no.1 & any four (4) from the rest]

1. Discuss the salient features of mitochondrial genome in eukaryotes. Discuss the genome organization of Plastid DNA in plants. 5+5=10

2. Write short notes on *any two*: 2×5=10
   a) Ames test
   b) Sanger Sequencing
   c) Mutagenic Agents

3. Explain frameshift mutation and tandem duplication. Give examples for each of the genetic situations with explanation: Autosomal dominance, X-linked Recessive, & Y-linked genetic diseases. 4+6=10

4. Explain the various advantages of Chloroplast transformation of plants. Explain complex inheritance in mammalian system with proper example. 6+4=10

5. Explain how the science "Epigenetics" changes the structure of eukaryotic & mammalian genomes to affect the transcription event. 10

6. What are the implications for Human Genome Project? Explain the Hardy Weinberg equilibrium. 6+4=10

7. What are the differences between micro RNA (miRNA) and small interfering RNA (siRNA)? Explain "Pedigrees" in Genetics. 5+5=10

8. Define the term "Next Generation Sequencing". Explain just one next generation sequencing principle. Explain "quantitative PCR" with a proper system. 3+3+4=10

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M.Sc. BIOTECHNOLOGY
FOURTH SEMESTER
GENETICS & GENOMICS
MBT-401

(Use separate answer scripts for Objective & Descriptive)

Duration : 3 hrs. **Full Marks : 70**

(PART-A : Objective)

Time : 20 min. **Marks : 20**

Choose the correct answer from the following: ***1x20=20***

1. Which one of the following types of mutation is most likely to lead to premature termination of translation?
   a. Single base change in a promoter
   b. Exon skip
   c. Insertion of a single base into DNA
   d. Deletion of three bases from DNA

2. Which of the following is most likely to be a conservative mutation?
   a. CGA to TGA
   b. ATC to GTC
   c. ATA to AAA
   d. CAA to TAA

3. A cDNA library contains clones representing which of the following?
   a. miRNA
   b. Genomic DNA
   c. rRNA
   d. mRNA

4. The CAG repeat in the Huntington disease gene encodes:
   a. A Polyglutamine repeat
   b. A signal to methylate the promoter
   c. An RNA–protein binding segment
   d. A signal to alter patterns of splicing

5. Which of the following statements regarding single-nucleotide polymorphisms is true?
   a. They occur in blocks that are in linkage disequilibrium.
   b. Individual alleles are randomly distributed along the chromosomes.
   c. They are subject to a high rate of new mutation.
   d. They are never associated with phenotypic changes.

6. What, approximately, is the fraction of genetic variation in the nuclear genome that is expected to have a harmful effect on gene function?
   a. 50%
   b. 25%
   c. 10%
   d. 1%

7. The crossing of F1 to homozygous recessive parents is called:
   a. Back cross
   b. Test cross
   c. F1 cross
   d. All of these

8. Which of the following statements is true regarding the law of independent assortment?
   a. Factors assort independent of each other when more than one pair of characters is present together.
   b. Independent assortment leads to variation.
   c. Independent assortments lead to formation of new combination of characters.
   d. All of the above.

9. In a family, father is having a disease but mother is normal. The disease is inherited to daughters only, but not to sons. What type of disease is this?
   a. Autosomal dominant
   b. Sex-lined recessive
   c. Sex-linked dominant
   d. Autosomal recessive

10. A woman with one gene for haemophilia and one gene for color blindness in one of the X-Chromosome. She marries a normal man. How will the progeny be?
   a. Haemophilic and color blind daughters.
   b. 50% haemophilic color blind sons and 50% normal sons.
   c. All sons and daughters are haemophilic and color blind.
   d. 50% haemophilic color blind sons and 50% color blind daughters.

11. Which of the following statements regarding epigenetics is FALSE?
   a. There is no change in the underlying DNA sequence of the organism.
   b. Genetic factors cause the organism's genes to behave (or express themselves) differently.
   c. May last for multiple generations and is therefore inheritable.
   d. These changes may remain through cell divisions for the remainder of the cell's life.

12. The mechanism of silencing genes through epigenetics occurs:
   a. specifically on amino acids on histone tails.
   b. specifically at cytosine (C) in DNA located in CpG islands.
   c. specifically at (C) in RNA located in CpG islands.
   d. specifically at cytosine (C) in DNA located in areas where strings of C are located.

13. A pattern of transmission where all offspring have the same phenotype as their mother is consistent with which type of non-Mendelian inheritance?
   a. Dosage compensation
   b. Genomic imprinting
   c. Extranuclear inheritance
   d. Maternal effect

14. Mitochondrial mutations in humans tend to affect some tissues more than others. Which is the most likely explanation?
   a. Some human tissues can synthesize large amounts of ATP in the absence of mitochondrial function.
   b. Some human tissues have higher energy demands than others.
   c. Some human tissues do not have mitochondria.
   d. Heteroplasmy and subsequent segregation often leads to a variegated phenotype.

15. In addition of histone protein, chromatin contains an approximately equal mass of a wide variety of:
   a. non-histone protein
   b. unknown protein
   c. positive charge protein
   d. RNA

16. Those mutations that arise in the absence of known mutagen are known:
   a. spontaneous mutations
   b. none of the above
   c. fused mutations
   d. induced mutations

17. Which of the following descriptions of chromosomes is not correctly matched?
   a. Acrocentric – chromosome arms are identical in size.
   b. Submetacentric – chromosome arms are slightly different in size.
   c. Metacentric – chromosome arms are almost equal in size.
   d. Telocentric – there is only one chromosome arm.

18. Which of the following is correct with regard to aneuploidy?
   a. 2n + 1
   b. All aneuploid individuals die before birth
   c. 3n+1
   d. 4n

19. Both husband and wife have normal vision though their fathers were colour blind. The probability of their daughter becoming colour blind is:
   a. 100%
   b. 0%
   c. 50%
   d. 25%

20. Haemophilia is more common in males because it is a:
   a. dominant trait carried by X-chromosome.
   b. dominant character carried by Y-chromosome.
   c. recessive trait carried by X-chromosome.
   d. recessive character carried by Y-chromosome.

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