RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FIFTH SEMESTER EXAMINATION, DECEMBER 2019

THIRD YEAR [BATCH 2017-20]

Date : 16/12/2019 **MICROBIOLOGY [Honours]**

Time : 11 am – 1 pm **Paper : V [Gr-A]** Full Marks : 50

Answer <u>any three</u> questions from <u>Question Nos. 1 to 6</u> : [3×10]

1. a) A cross $a^+a^+b^+b^+ \times aabb$ results in an F_1 phenotype a+b+. After self-fertilization/interbreeding of the F_1 progeny organisms the following results are obtained in the F_2 generation.

   $a^+b^+ = 110$

   $a+b = 16$

   $ab^+ = 19$

   $ab = 15$

   Are genes at the a and b loci linked or independent? What F_2 phenotypic ratio would otherwise be expected? [3]

   b) Using any eukaryotic microorganism how can you prove that genes may be located outside the chromosomal DNA? [3]

   c) How can you prove that the donor or F^+ bacteria transfer a copy of F factor to the recipient cell in an $F^+ \times F^-$ mating? [2]

   d) What is meant by sexduction? [2]

2. a) The mating between the human males and females with "AB" blood groups in each should show the phenotypic ratio of the blood-groups as, A:AB:B = 1:2:1. Under which condition the ratio would be changed to A:AB:B:O = 3:6:3:4? [4]

   b) Histones must fall off from DNA during replication and transcription and subsequently reassemble. Explain what type of modifications enable there protein molecules to do so. [3]

   c) How did Benzer prove that rll locus of bacteriophage T4 contains two genes? [3]

3. a) A cross between rice plants with purple and green-colored leaves respectively yielded all the F_1 dihybrids with green-colored leaf. But the progeny plants of the F_2 generation exhibited a phenotypic ratio, green : purple = 13:3. How can you interpret the results? [4]

   b) You have been given the genome of an unknown organism. Using re-association kinetics, how can you understand the nature of genome of the organism - eukaryotic or prokaryotic? [3]

   c) In specialized transduction either the *gal* or *bio* marker is transduced but not the both together. Why? [3]

4. a) What is non-disjunction? How was this phenomenon used to prove that eye-color of *Drosophila* is located on X-chromosome? [1+3]

   b) In spite of having double the number of genes in the X- chromosome of human females, the corresponding protein is expressed almost in same levels as that of their male counterparts. How is this achieved? [3]

   c) When and how the competence pheromones exercise their effects to make the bacterial cells competent for transformation? [3]

5. a) Mammalian sex determination is of XX-XY type in which one of the two 'X'-chromosomes in the somatic cells of females is heterochromatized. Present a biochemical evidence that this heterochromatization is a random phenomenon. [3]

b) If a single F plasmid is added to a culture of growing F^- *E.coli* cells, a large fraction of the F^- cells acquire a copy of F and is converted to F^+ cells following cell growth for 15 to 20 generation. But in case of R plasmids only about 0.02% of a population of cells containing most R plasmids are competent donor. Why? [3]

c) How did Seymour Benzer determine the minimum distance for two mutant sites in the rII gene of phageT4 which corresponds to about 2.3 nucleotide pairs in DNA? [4]

6. a) Col plasmids do not have *tra* genes. How can these plasmids be mobilizable? [2]

b) Polydactyly (extra fingers and / or toes) in humans is a dominat trait and so the heterozygous individuals should show polydactyly traits. But some heterozygous individuals do not show this trait. How can you explain these? [3]

c) Pairs of closely related plasmids usually cannot be stably maintained in a single cell. What would be the probable cause of this phenomenon? [2]

d) If $F^+ \times F^-$ crosses, the F^- recipient is converted to a donor with very high frequency. However, it is rate for a recipient to become a donor in Hfr×F^- crosses. Explain. [2]

e) State two similarities among bacterial and mitochondrial genomes. [1]

Answer <u>any two</u> questions from <u>Question Nos. 7 to 10</u> : [2×10]

7. a) What is an EST database? State its use. [1+1]

b) How BLAST is useful for identifying a bacterial species? [4]

c) Differentiate between pair wise and multiple sequence alignment. [3]

d) What is gap penalty? [1]

8. a) What are auxotrophic mutants? How does it useful for L lysine production? [1+3]

b) State and explain any two preservation techniques used for industrially useful microorganism. [2+2]

c) What are idiolites? [2]

9. a) What are the raw materials required for alcohol fermentation? [2]

b) Describe in flowchart about mixed process of alcoholic fermentation. [4]

c) Write short notes on (i) Air lift bio-reactor. (ii) HET strain. [2+2]

10. a) Explain briefly whether the statement is true or false — [2×2]

(i) Secondary screening help in the selection of improved strain.

(ii) Regulation of pH & temperature maintain capacity is the only criteria to be a good fermentor.

b) What is sparger? State its application. [1+1]

c) Describe the design & application of Bubble column **<u>or</u>** Stirred tank bioreactor. [4]

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