



WEST BENGAL STATE UNIVERSITY

B.Sc. Honours Part-III Examination, 2019

MICROBIOLOGY

PAPER-MCBA-V-(A+B)

Time Allotted: 4 Hours

Full Marks: 100

*The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.*

Use separate answer books for each Group.

GROUP-A

Answer Question No. 1 and any *four* from the rest

1. Answer any ***five*** questions from the following: 2×5 = 10
 - (a) What do you mean by mutation rate?
 - (b) What is relative frequency?
 - (c) The mode of a series is 26.1 and its average is 24.6. Find the median of the series.
 - (d) What is null hypothesis?
 - (e) The G+C content of phage T₃ is 53%. What would be the G+C content of the T₃ mRNA?
 - (f) What are LINEs and SINEs?
 - (g) Can hydroxylamine treatment reverse non-sense mutation? Justify your answer.
 - (h) Classify 'variables' in relation to biostatistics with suitable example.
2.
 - (a) When F⁺ cell is mixed with F⁻ cell, all F⁺ cells are generated, but when Hfr cell is mixed with F⁻ cell, the later remains F⁻ cell. Justify your answer. 2
 - (b) Design an experiment to determine the origin of replication of F plasmid. 4
 - (c) Draw and explain 'Time of entry curve' of interrupted mating technique. 4
3.
 - (a) Describe the composition of nucleosome. 4
 - (b) The linear chromosome of phage T₂ is 50 μm long. The chromosome consists of double stranded DNA with 0.34 nm between each base pair. How many base pairs does a chromosome of phage T₂ contain? 3
 - (c) If a virus particle contains 2,00,000 bp of double stranded DNA, how many complete 360° turns occur in its genome? 3

4. (a) Name any two physical and any two chemical mutagens? What are transition and transversion? 2+2
- (b) What do you mean by 2
- (i) silent mutation
- (ii) non-sense mutation?
- (c) Explain the Ames Test for mutagenesis. 4
5. (a) Explain the methyl-directed mismatch repair. 3
- (b) Why is SOS repair is called error-prone repair? 2
- (c) What do you mean by 2.5+2.5
- (i) Recombinational repair
- (ii) Excision repair?
6. (a) Comment on the genophore of prokaryote. 3
- (b) What is 'Centromere'? Describe its functional role. 1+2
- (c) What are 'Pseudogenes'? 2
- (d) State the role of Mu phage in transposon. 2
7. (a) Explain the term 'Statistical error' with example. 2
- (b) Calculate the standard error of mean using the data of the number of bacterial colonies observed by 60 students: 4
- | | | | | | |
|-----------------|---------|---------|---------|---------|---------|
| No. of colony : | 156-160 | 161-165 | 166-170 | 171-175 | 176-180 |
| Frequency : | 4 | 14 | 25 | 11 | 6 |
- (c) Crossing a grey bodied scarlet eyed *Drosophila* with a black bodied red eyed one produced all grey bodied red eyed flies in the F_1 generation. On crossing the F_1 flies, the F_2 generation gave the following phenotypes: 4
- Grey bodied red eyed = 360
- Black bodied red eyed = 130
- Grey bodied scarlet eyed = 120
- Black bodied scarlet eyed = 40.
- Do the data fit with the Mendelain 9: 3: 3: 1 distribution?
- [Critical χ^2 value : $\chi^2_{(0.05,3)} = 7.82$]
8. (a) Design an experiment to prove that single-stranded DNA enters during transformation. 3
- (b) Differentiate between homologous recombination and site-specific recombination. 2
- (c) What are autosomes? 1

- (d) In a transformation experiment, the donor strain was $A^+ B^- C^+$ and the recipient was $A^- B^+ C^-$. During plating experiments, following numbers of transformation were obtained:

$$A^+ B^- C^+ = 12, A^+ B^- C^- = 3, A^+ B^+ C^+ = 100;$$

$$A^+ B^+ C^- = 135, A^- B^- C^+ = 13, A^- B^+ C^+ = 142.$$

Deduce the gene order.

4

GROUP-B

Answer Question No. 9 and any *four* from the rest.

9. Answer any *five* questions from the following: 2×5 = 10
- Which technique is mostly followed for improving of strain in the industries and why?
 - What are expression vectors?
 - What is the specific function of Terminal Deoxynucleotidyl Transferase?
 - Define Idiophase.
 - Which microbial cells can be preserved by Lyophilization?
 - What is a soy meal?
 - What is Episome?
 - What is a binary vector?
 - Why lambda replacement vector is called so?
- 10.(a) How is genomic library created? What should be the average DNA fragment length for genomic library preparation? Why? 3+1+3
- (b) Compare the use of Phage Lambda and Cosmids for construction of gene libraries. 3
11. “Amino acids are often produced in large scale in the industries”. Discuss the microbial strains, media used, biosynthesis, downstreaming, and uses of any one amino acid production studied by you. 2+2+2+2+2
- 12.(a) Mention the specific temperatures for ‘annealing’ and ‘extension of primers’ during PCR with reasons. 2+2
- (b) List down the basic requirements for amplification of a DNA segment using PCR technique. 2
- (c) How can PCR act as an important tool in forensic investigations? 2
- (d) What is the disadvantage of using Taq polymerase for PCR? 2

- 13.(a) What is Feature mapping? 2
(b) What is a non-autonomous MITES? 2
(c) Why single locus probes are useful in DNA finger printing over multiple locus probes? 3
(d) What are Helitrons? State their uses. 3
- 14.(a) Why agitation and aeration is a problem in amylase production? $2 \times 5 = 10$
(b) What is SPC? Give example.
(c) Name the organism used for industrial production of Vit B₂ and Lysine.
(d) Why sulfur dioxide is used in vinegar production?
(e) Why charcoal treatment is applied in penicillin production?
15. Write short notes on any *four* of the following: $2.5 \times 4 = 10$
(a) Fed batch mode of fermentation
(b) Chemostat
(c) Preservation by Liquid Nitrogen
(d) AFLP
(e) Sanger's sequencing
(f) RACE
- 16.(a) What are the advantages of the carrier binding mode of immobilization? What properties are essential for an ideal carrier? 1+2
(b) Explain the role of genetic engineering in clinical application with at least one specific example. 3
(c) What are biopesticides? How is *Bacillus thuringiensis* useful as a biopesticide? 1+2+1
Name two biopesticide other than *B. thuringiensis*.

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