WEST BENGAL STATE UNIVERSITY

B.Sc. Honours PART-III Examinations, 2018

MICROBIOLOGY-HONOURS

PAPER- MCBA-V

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.

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) Define mobilizable plasmid.

   (b) What is Zygotic induction?

   (c) List two biochemical activities of RecA protein.

   (d) What are mutator genes? Give one example.

   (e) What do you mean by co-dominance?

   (f) Define the term 'variable' in biostatistics.

   (g) Recombination frequencies between 3 genes are- $a - b \neq 2.6\%$, $b - d = 1.4\%$ and $a - d = 1.2\%$.

   (h) What is the gene order?

2. (a) What do you mean by homologous recombination? 2+4+2+2

   (b) Describe the mechanism of RecBCD complex action in homologous recombination in *E.coli* . Give the necessary diagram.

   (c) What is meant by 'chi intermediate'?

   (d) Mention the role of RecA protein in bacterial recombination.

3. (a) Differentiate between test cross and back cross. 2+2+(3+3)

   (b) Write two salient features of mitochondrial DNA.

   (c) How does nuclear material of a bacterium organized in cell? How does this arrangement differ from an animal cell?

4. (a) What is plasmid in compatibility? 2

(b) Explain the regulation of replication of Col EI - derived plasmids. 4

(c) Why do self-transmissible plasmids usually encode their own primase function? 2

(d) What is plasmid partitioning? 2

5. (a) What are episomes? Give one example. 2

(b) What is meant by extrachromosomal inheritance? 2

(c) How eukaryotic chromatin gets compacted? 4

(d) What are alleles? 1

(e) What is a nucleoid? 1

6. (a) What are the two characteristic components of transposable elements? 2

(b) What is a composite transposon? 2

(c) What are the differences between a phage that produces only specialized transducing particles and the one that produces only generalized transducing particle and the one than can produce both? 3

(d) In what mechanism does *B. Subtilis* attain competence? 3

7. (a) State the significance of the term dispersion in biostatistics. 2

(b) State various ways to measure the dispersion. 2

(c) Concentration of an unknown enzyme protein was determined by 60 students, using Bradford method. Find out the statistical error from the mean. 4

Protein conc.: (μg/ml)	11-15	16-20	21-25	26-30	31-35
Frequencies:	9	17	22	8	4

(d) Write down the significance of t-test. 2

8. (a) What are relative frequency and frequency density? 2

(b) To test the efficacy of a new drug, a controlled experiment was conducted wherein 300 patients were administered the new drug and 200 other patients were not given the drug. The results obtained were as follows: 4

	Cured	Condition worsened	No effect	Total
Given the drug	200	40	60	300
Not given the drug	120	30	50	200

Use χ^2-test for finding the effect of the drug. [given $\chi^2_{0.05,2} = 5.99$]

(c) In a study on the growth of children, one group of 70 children had a mean height of 65 cm and standard deviation of 2.5 cm. While another group of 80 children had a mean height of 68 cm and standard deviation of 3 cm. Is the difference between the two sample means statistically significant? 4

Tabulated Z at 5% α is 1.96.

Group-B

Answer Question Number 9 and any *four* from the rest

9. Answer any ***five*** questions from the following: 2×5 = 10

(a) Why are antifoams used in bioreactors?

(b) What is curing of plasmids?

(c) Define BACs.

(d) What is corn steep liquor?

(e) What is meant by scale up?

(f) State the possible cause of loss of efficiency of mother culture.

(g) Why Ti plasmid is called so?

10. Write short notes on:

(a) Enzymes immobilization 2.5

(b) Packed Bed Bioreactor 2.5

(c) Secondary metabolite 2.5

(d) Fed-batch fermentation. 2.5

11. What are the suitable carbon sources for the large scale production of the following products by microbial fermentation? Name the microorganisms to be used for these fermentations.

(a) Ethyl alcohol to be used as fuel. 2

(b) Vinegar by submerged process. 2

(c) Sodium Benzyl Penicillin. 2

(d) Butanol. 2

(e) Vitamin B_{12}. 2

12. Write short notes on (any ***four***): 2.5×4 = 10

(a) Nested PCR

(b) Agitator system for industrial bioreactors

(c) Cryopreservation

(d) Air sterilization for use in industrial bioreactors

(e) Taq DNA polymerase

(f) YCps.

13.(a) Molecular biological techniques are available that allow forensic scientists to make DNA fingerprints from materials like blood left at the crime scene and can help in identifying the offender. How is it possible? 3

(b) Discuss the mechanism for selecting lambda replacement vectors. What are the benefits of cosmid over lambda replacement vectors? 3+2

(c) What is a shuttle vector? 2

14.(a) What do you mean by directional cloning? 3

(b) What is insertional inactivation of plasmid gene? 2

(c) What is the advantage of using a plasmid with two antibiotic resistance genes as a cloning vehicle? 2

(d) State the uses of RAPD. 3

15.(a) Explain the difference between a microsatellite repeat and a minisatellite repeat. 3+3

Which of the two is more useful in DNA fingerprinting? Why?

(b) Why Real time PCR is called so? What are the benefits of real time PCR over end PCR? 2+2

16.(a) State the harmful aspects of aflatoxin. 3

(b) Why is *Spirulina* important? 2

(c) What are the advantages of a mycelial fungi over yeast in alcohol fermentation? 2

(d) State the advantages of fermented soya food. 3

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Group – A

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

1. Answer any ***five*** questions from the following: 2×5 = 10
   (a) Name the causative agents of HIV mediated Tuberculosis and tetanus.
   (b) Distinguish between endotoxin and exotoxin.
   (c) What is cytopathic effect?
   (d) Define terminal redundancy. State an example.
   (e) What are opportunistic pathogens?
   (f) What are Koch's postulates?
   (g) Name the different classes of interferon you have studied.

2. (a) Diagrammatically represent the process of integration of λDNA with *E.coli* chromosome during lysogeny. Mention the names of the enzymes required for the integration and excision of prophage. 4+2
   (b) State the molecular mechanism involved in the process of induction of prophage. 3
   (c) Define 'immunity to super infection'. 1

3. (a) Depict the major morphological types of symmetry of viral capsids. Briefly state the formation of these capsid structures with one example of each type. 2+4
   (b) Temperate phages generally choose lysogeny when MOI is high – Explain. 2
   (c) Schematically represent the process of prion replication. 2

4. (a) Normal microflora of human body prevents the establishment of pathogen – Explain. 2

   (b) Write a note on skin microflora of human body. 3

   (c) Differentiate endotoxin from exotoxin of bacteria. 2

   (d) Why diphtheria considered as a toxemia? State its mode of action. 1+2

5. (a) What is M.O.I.? 2

   (b) At which M.O.I. the one step growth experiment of *E. coli* and T_4 phage is performed and why? 1+2

   (c) What is intracellular growth curve experiment? 2

   (d) Describe an experimental procedure of isolation of cholera phage from natural source. 3

6. (a) What is the function of N protein in lambda phage life cycle? 2

   (b) How cerebral malaria is caused? State its symptoms. 3

   (c) If CI^- mutant *E. coli* strain is mixed with wild type CI *E. coli* strain and then allowed to grow and plated, which type of plaques will be generated. Explain. 3

   (d) How CI protein establishes the lysogeny? 2

7. (a) What are the genomic property of TMV? 2

   (b) What is the function of reverse transcriptase of HIV? 2

   (c) What is WAART? State its advantage. 1+2

   (d) How it can be proved that T_4 phage use E.coli RNA polymerase during its transcription? 3

8. (a) State the essential features of ICTV. 3

   (b) Why is Bovine Spongyform encephalopathy caused? What are its symptoms? 1+2

   (c) MDT and DOT are important tools for the treatment of which disease and why? 2+2

Group-B

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

9. Answer any ***five*** questions from the following: 2×5 = 10

   (a) Why are antibodies called biological adaptor molecules?

   (b) Why RBCs of an individual are not normally destroyed as a result of innocent bystander lysis by complements?

(c) Define endogenous and exogenous antigens.

(d) Write down two reasons of the development of autoimmunity. Give example.

(e) State the advantage of monoclonal antibody.

(f) What are the advantages of DNA vaccines over the traditional vaccines?

(g) Name the interleukine first produced by the Thelper cells and does it act?

10.(a) How important is positive and negative selection in Thymus for T cell development? 2+2

(b) CDRs play the most important role in antigen recognition – Explain. 2

(c) State the structural and functional differences among different IgG subtypes. 4

11.(a) Somatic hypermutation is very important in generation of antibody diversity – Explain. 4

(b) Explain why a V_H segment cannot join directly with a J_H segment in heavy chain gene rearrangement. 4

(c) Name the causative agents of inflammation. 2

12.(a) 95% of the T cells express αβTCR and only 5% of T cells express the γδTCR. What are their functions? 4

(b) How CD4 differs from CD8? 3

(c) Why do lymph nodes swell in an infection? 3

13.(a) How monoclonal antibodies are produced in laboratories? 5

(b) Neutrophils are the first cells to reach the site of an infection – how do neutrophils enter to the tissue from blood? 5

14.(a) What is role of chaperones during antigen presentation by the help of MHC class I molecules? 3

(b) Complement reactions are effective against gram-ve bacteria – Explain. 2

(c) Define the term– Self-MHC restriction. 2

(d) Define epitope. What are immunodominant epitopes? 1.5+1.5

15.(a) Mention the properties of an immunogen that contribute to its immunogenicity. 2

(b) Distinguish between serum IgA and secretory IgA. 3

(c) What is hematopoiesis? 1

(d) Name two secondary lymphoid organs of the human body. 0.5+0.5

(e) Explain the antiviral role of IFNα, β in human body. 3

16.(a) What is passive agglutination? 2

(b) What are agglutinins? 1

(c) How does agglutination inhibition act as a sensitive assay method for small amounts of antigen? 3

(d) Which types of interactions are responsible for the formation of antigen-antibody complexes? 2

(e) What is immunofluorescence? 2