

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. FIFTH SEMESTER EXAMINATION, DECEMBER 2014

THIRD YEAR

MICROBIOLOGY (Honours)

Paper : V (Gr. A)

Date : 20/12/2014

Time : 11 am – 1 pm

Full Marks : 50

1. Answer the following : [8×1]
- Name a bacterium which contains linear chromosome.
 - Name the raw materials used in the industrial production of ethanol.
 - What do you mean by melting temperature (T_m) of DNA?
 - What do you mean by conditional lethal mutation?
 - Why are antibiotics called secondary metabolites?
 - What is a transformosome?
 - Name the microorganisms employed for industrial production of vitamin B₁₂ and acetic acid.
 - What is an episome?

Answer **any four** questions from **Q.No. 2-9** : [4×7]

2. a) What was the finding of Meselson Stahl experiment? What would have been the results of that experiment if DNA replication were dispersive? [3]
b) What is the biological significance of DNA to be double stranded? [2]
c) How is sedimentation rate of underwound closed circular duplex DNA related to increased concentration of ethidium bromide? [2]
3. a) How can it be possible for an *E. coli* cell of 1μm – 2μm long to accommodate a DNA of approximately 1000μm long as its genome? [2]
b) How can you prove that F⁺ cell of *E. coli* sends a copy of its F factor to the recipient in a F⁺ × F⁻ cross? [3]
c) What is a mobilizable plasmid? Cite an example. [1+1]
4. a) A Lac⁻ bacterial strain has a dna (T_s) mutation, which prevents colony formation at 42°C. An F'^{lac} plasmid is introduced into the strain by conjugation. The culture is grown for many generations at 30°C, and then 10⁶ cells are plated at 42°C. Colonies arise, and those are capable of growth at both 30°C and 42°C.
• Are these colonies Lac⁺ or Lac⁻
• Do the cells still carry the dna A (T_s) mutation?
• What feature of the cells has changed that enables them to grow at 42°C? [3]
b) A hybrid plasmid P^{SC134} was constructed that consists of a complete copy of two plasmids, Col E1 and P^{SC101} with copy numbers 16 and 6 respectively. What will happen if a P^{SC101} is moved into a bacterium containing 16 copies of P^{SC134} by CaCl₂ transformation? Explain with reasons. [2]
c) Why is *Agrobacterium tumefaciens* used to develop transgenic plants? [2]
5. a) An F'(T_s)lac⁺ plasmid has a temperature sensitive mutation in its replicating system. An F'(T_s)lac⁺ / lac⁻gal⁺ strain is grown for many generations and then plated at 42°C. Some Lac⁺ colonies form at 42°C. How have these formed? [2]
b) What are the differences between *E. coli* topoisomerases I & II? [3]
c) Which kind of DNA of human genome is chosen for DNA finger-printing and why? [1+1]
6. a) What do you mean by plasmid curing and plasmid incompatibility? [1+1]
b) How can you conclude that the eukaryotic genome consists of different kinds of DNA from C₀t curve analysis? [2]
c) DNA polymerase fails to replicate DNA in telomeric region. Why?
What measure is taken by the cell to replicate telomeric DNA? [2+1]

7. a) Some yeast DNA fragments of yeast genome when circularized are able to transform defective yeast cells very efficiently and fragments can survive there in an unintegrated state. Which component of the fragment confers its stability in the transformed cell? [2]
- b) There are two strains in *Chlamydomonas*, mt^+ and mt^- . The MUD2 mutants of this organism are resistant to myxothiazol whereas the wild type (mud 2) is sensitive to this antibiotic. A crossing experiment was done and the following results were obtained.
- MUD 2(mt^+) resistant \times mud 2 (mt^-) sensitive
 \downarrow
mud 2 (sensitive)
 - mud 2 (mt^+) sensitive \times MUD2 (mt^-) resistant
 \downarrow
MUD2 (resistant)
- Why is this difference? Explain. [2]
- c) Distinguish between generalized and specialized transduction. [3]
8. a) How can you prove that the state of DNA is altered during transformation? [3]
- b) How did complementation analysis helped Benzer to conclude that rII locus of bacteriophage T₂ consists of two cistrons? [2]
- c) Write down the roles of sensory and response regulatory proteins to make bacterial cells competent. [2]
9. a) Cavalli – Sforza isolated a new strain of donor from a nitrogen mustard induced population of F⁺ strain of *E. coli* in which recombination frequency increased by 1000 times than normal F⁺ strains when crossed with an F⁻ recipient. How can you explain the result? [2]
- b) What is zygotic induction? [2]
- c) A bacterium with genotype A⁺B⁻C⁻ was transduced by a particle carrying the linked genes A⁻B⁺C⁺. A⁺B⁺C⁺ recombinants were selected. The reciprocal cross was also performed. The number of A⁺B⁺C⁺ recombinants was the same in both the first cross and reciprocal cross. What information does this give you about the order of the three genes? [3]

Answer **any two** questions from **Q.No. 10-13** :

[2×7]

10. a) Why is screening necessary for the industrially important strains of microorganisms? [2]
- b) "Agitator is mandatory in aerobic fermentation" —Explain. [2]
- c) What type of materials are typically used in the construction of a bioreactor? Mention the factors, affecting a bioreactor's performance. [1½+1½]
11. a) "Batch fermentations are less effective compared to feed batch and continuous fermentation for the production of biomass and growth associated products" —Justify. [2]
- b) What are the important features of stirred tank fermentor? [2]
- c) Write down the differences between lyophilization and cryopreservation with respect to various parameters. [2]
- d) What is antifoam agent? [1]
12. a) Describe the design and application of an air-lift bioreactor. [2½]
- b) "Immobilized enzyme can be used for unlimited number of times without loss of activity". Is this statement true or false. Justify your answer. [½+1]
- c) What are the basic differences between Fring's generator process and acetator process for vinegar production? [3]
13. a) What is the chemical composition of the beads of Ca-alginate? [1]
- b) How is vitamin B₁₂ separated and purified at the end of the fermentation? [1½+1½]
- c) "Submerged fermentation is more advantageous than surface fermentation" —Why? [2]
- d) What is corn steep liquor? [1]