RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.SC. FIFTH SEMESTER EXAMINATION, DECEMBER 2012

THIRD YEAR

MICROBIOLOGY (Honours)

Date : 17/12/2012

Time : 11 am – 1 pm

Paper : V (Gr. A)

Full Marks : 50

Group-A

Genome organization, Genetics, Industrial Microbiology

1. Attempt **all questions** from the following:
   a) Differentiate between generalized and specialized transduction. 2
   b) What will happen if the gyrase gene of a pathogenic bacteria is mutated. 2
   c) "Batch fermentations are less effective compared to fed batch and continuous fermentation for the production of biomass and growth associated products"- Justify. 2
   d) What do you mean by secondary metabolite in microorganisms? 2
2. Answer **any four** questions from the following:
   a) i) Consider a long linear DNA molecule, one and of which is rotated four times with respect to other end, in the unwinding direction. The two ends are them joined. –If the molecule is to remain in the underwound state, how many base pairs will be broken? 2
   -If the molecule is allowed to form a supercoil how many nodes (writhes) will be formed?
   ii) Design an experiment to prove that only viral nucleic acid enters the bacterial cell whereas the protein coat remains outside during infection. 3
   iii) How can you prove that RNA is the genetic material? 2
   b) i) The sedimentation velocity properties of a supercoild DNA molecule are being studied as a function of the concentration of added ethidium bromid. It is found that sedimenation coefficients decreases, reaches a minimum, and then increases. Explain. 3
   ii) What is the basis of the observation made by Meselson and & Stahl experiment. 3
   iii) What are episomes? 1
   c) i) A lac^- bacterial strain has a dnaA(Ts) which prevents colony formation at 42^0C. An $F^/$ lac^+ plasmid is introduced into the strain by conjugation. The culture is grown for many generation at 30^0C, and then 10^6 cells are plated at 42^0C. A few colonies arise and these are capable of growth at both 30^0C and 42^0C. 3
   a) Are these colonies Lac^+ or Lac^-?
   b) Do the cells still carry the mutation?
   c) What feature of the cells has changed that enables them to grow at 42^0C?
   ii) Define cotransduction frequency. 2
   iii) Define and cite example of conjugative and mobilizable plasmids. 2
   d) i) What happens when Hfr cells are mated with F^- cells? 3
   ii) What is complementation analysis? 2
   iii) The DNA of the bacterial virus T_4produces $Cot_{½}$ of about 0.5 and contains 10^5 nucleotide pairs in its genome. How many nucleotide pairs are present in the genome of virus MS2 and bacterium *E.coli*, whose respective DNAs produce $Cot_{½}$ values of 0.001 and 10.0? 2
   e) i) A culture of Gal^- *E.coli* cells is infected with a lysate resulting from induction of Gal^+ culture lysogenic for λ and these infected cells are subsequently plated on galactose plate. How many types of Gal^+ colony would you obtain? Write the fate of the cells in each colony. 4
   ii) Why are λ d gal phages called defective? 3
   f) i) What are LINEs and SINEs? 3
   ii) What do you mean by maternal inheritance? Cite an example to prove the phenomenon. 2+2

g) i) In *E.coli*, four Hfr strains donate the following markers, shown in the order donated:

strain1: M Z X W C
strain2: L A N C W
strain3: A L B R U
strain4: Z M U R B

All the Hfr strains are derived from the same F^+ strain. What is the order of these markers on the circular chromosome of the original F^+? 3

ii) Define competence development. 1

iii) Define copy number of a plasmid. How can it be amplified. 1+2

h) i) What will happen if the DNA polymerase remains engaged in the replication of telomeric DNA generation after generation. 2

ii) What is meant by superhelical density? 2

iii) In prokaryotes, closely related genes are often organized in operons which is absent in eukaryotes. However many related eukaryotic genes can be grouped together in the genome. Can you cite any example of such group? 2

iv) What is nucleosome core particle? 1

3. Answer **any two** questions out of 4 questions:

a) i) Write the advantages of immobilized enzymes citing examples.

ii) What makes solid state fermentation a better process than submerged fermentation? 2

iii) Name the vinegar producing microorganism. 1

b) i) What are the general methods of preservation of industrially important culture strains. Give a brief description. 3

ii) How are Packed Bed Bioreactors used for some specific fermentation processes? 4

c) i) What are the basic differences between Fring's generator process and acetator process in vinegar production. 3

ii) Comment on the various methods opted for microbiological strain improvement. 3

iii) What is alcograph. 1

d) i) How do you screen an enzyme producing microbe from a bulk of soil isolates? 4

ii) Define microfilm and mention its advantages. 1+2