

# RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FIFTH SEMESTER EXAMINATION, DECEMBER 2015

THIRD YEAR [BATCH 2013-16]

MICROBIOLOGY [Hons]

Date : 15/12/2015

Time : 11 am – 1 pm

Paper : V

Full Marks : 50

## Group – A

### Unit - I

(Answer any three questions)

1. a) What is the difference between complementation and recombination? [2]  
b) A complementation data is shown in the following table. The numbers refer to particular mutations. The symbols “+” and “-” indicate that the two mutations do and do not complement respectively. How many genes are represented? Assign the mutations to the genes. [3]

Mutants							
	1	2	3	4	5	6	7
1	-	+	+	+	+	+	-
2		-	+	-	+	+	+
3			-	+	+	-	+
4				-	+	+	+
5					-	+	+
6						-	+
7							-

- c) What is the importance of sexduction in bacterial reproduction? [2]  
d) i) What is the importance of pseudogenes in evolution?  
ii) Distinguish between LINES and SINES with examples. [1.5+1.5]
2. a) How can you prove that only one copy of the donor plasmid is transferred from  $F^+$  to  $F^-$  cells during conjugation? [3]  
b) In a cross between  $F^+ \text{lac}^+ \text{str}^s$  and  $F^- \text{lac}^- \text{str}^r$  cells of *E. coli*, each donor cell transfer a copy of the F plasmid within 20 minutes, but in  $\text{Hfr} \times F^-$  crosses, the plateau values for each markers ranged from 20 to 50 per 100 Hfr cells, which does not reflect the efficiency of transfer. How can you measure the efficiency of transfer in a  $\text{Hfr} \times F^-$  cross? [3]  
c) A cross was done between  $\text{Hfr } a^+ b^+ c^+ \text{str}^s \times F^- a^- b^- c^- \text{str}^r$  cells. The results obtained are tabulated below.

Supplement added to the minimal medium	Time of interruption			
	5 mins	10 mins	15 mins	20 mins
Nutrients A & B	0	0	4	21
Nutrients B & C	0	5	23	40
Nutrients A & C	4	25	60	82

What is the order of the genes? [2]

- d) Why can generalized transduction transfer any gene but specialized transfection is restricted only to a small set? [2]

3. a) There are two mating types in *Chlamydomonas*  $mt^+$  and  $mt^-$ . MUD2 mutations of each mating types confer resistance to the antibiotic myxothiazol. Reciprocal crossing experiments were done and the following results were obtained

i)	MUD2 $mt^+$ (mutant, resistant)	×	mud 2 $mt^-$ (wild type, sensitive)	— P
		↓		
	mud 2 sensitive progeny			— F <sub>1</sub>
ii)	mud 2 $mt^+$ (wild type, sensitive)	×	MUD2 $mt^-$ (mutant, resistant)	— P
		↓		
	MUD2 resistant progeny			— F <sub>1</sub>

What are the reason for these differential results?

[2]

- b) What do you understand by complexity of the eukaryotic genome? How can you relate complexity of the genome with the Cot curve? [1+2]
- c) In a generalized transduction system using P1 phage, the donor is  $pur^+ nad^+ pdx^+$  and the recipient is  $pur^- nad^- pdx^-$ . The donor allele  $pur^+$  is initially selected after transduction and 50  $pur^+$  transductants are then scored for the other alleles present. The results are

Selected marker	Genotype	Number of Colonies
$pur^+$	$nad^+ pdx^+$	3
	$nad^+ pdx^-$	10
	$nad^- pdx^+$	24
	$nad^- pdx^-$	13
		<u>Total = 50</u>

- i) What are the cotransduction frequencies for  $pur$  and  $nad$ , and  $pur$  and  $pdx$ ?
- ii) Which of the unselected loci is closest to  $pur$ ?
- iii) Are  $nad$  and  $pdx$  on the same side or opposite side of  $pur$ ? Explain [3]
- d) Mention the names and roles of sensory and response regulator proteins to develop competence in Gram positive bacteria. [2]
4. a)  $\Delta Tw + \Delta Wr = 0$ , Explain this relationship with suitable mathematical expression. [3]
- b) What are degradative and cryptic plasmids? Cite one example for each. [2]
- c) An  $F' lac^+ / str^s$  strain was mated with a  $lac^- dna$  (Ts)  $str^r$  and  $lac^+ str^r$  cells were selected by plating at 42°C on a minimal lactose plate containing streptomycin. Give an explanation for the formation of  $lac^+$  cells. [3]
- d) What is meant by plasmid amplification? When is it required? [2]
5. a) Briefly mention the steps of enzymatic digestion to obtain nucleosomal core particles. [3]
- b) How can you prove the presence of different kinds of DNA species in eukaryotic genome without performing DNA sequence analysis? [2]
- c) Mention the structural peculiarities of telomere DNA and give the importance of the telomere region. [1.5+1.5]
- d) What are ARS? Mention their importance. [2]
6. a) What is meant by plasmid copy number? With the help of examples cite any two methods by which copy member can be controlled. [1+3]
- b) What is aborting transduction? State the reason behind this phenomenon. [3]
- c) How can you prove genetically that the state of DNA is altered during DNA uptake by a recipient cell? [3]

## Unit - II

(Answer any two questions)

7. a) What is the basic difference in approach between immobilizing a cell and an enzyme? [2]
- b) 'Submerged fermentation is more advantageous than surface fermentation' —Why? [2]

- c) How are the cultures preserved with the help of mineral oil? Mention two advantages of this preservation technique. [2+1]
- d) What is a bioreactor? What is the basic principle for carrying out aerobic fermentation? [2]
- e) What is fusel oil? [1]
- 8. a) Distinguish between primary and secondary metabolites with examples. [2]
- b) Why is Corn-Steep liquor preferred substrate for penicillin fermentation? [2]
- c) What features of strain of yeast make it suitable to be used for alcohol fermentation? [2]
- d) Write two importance of secondary screening in industrial microbiology. [2]
- e) Vinegar can be made both by oxidative fermentation and anaerobic fermentation — Justify. [2]
- 9. a) Why pH and temperature are critical for the success of a fermentation process? [2·5]
- b) Which fermentation method is adapted for large scale production of penicillin? How is it recovered from the broth? [1+1·5]
- c) 'Mutant strains allow over production of L-lysine than wild type strain' —Give reasons. [2·5]
- d) What are the basic requirements for large scale production of vit-B<sub>12</sub>? [2·5]

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