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PG CBCS
M.Sc. Semester-I Examination, 2023
ZOOLOGY
PAPER: ZOO 104
(CELL BIOLOGY AND CYTOGENETICS)

Full Marks: 40 **Time: 2 Hours**

The figures in the right-hand margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Write the answer for each unit in separate sheet

UNIT: ZOO 104.1
CELL BIOLOGY

GROUP-A

1. Answer any TWO from the following questions: **2×2=4**

a) What do you mean by GAGS?
b) State the function of integrin.
c) What is the principle function of DAG?
d) State the significance of cholesterol molecule in biomembrane.

GROUP-B

2. Answer any TWO from the following questions: **2×4=8**

a) Why is fluidity important in membrane structure? Write a short note on fluid mosaic model of Plasma membrane. 1+3
b) What are microtubules? Describe the dynamics of microtubule assembly. 1+3
c) The Rb protein has been called the "master brake" of the cell cycle. Describe how the Rb protein acts as a cell cycle brake.
d) What is second messenger? Describe the mechanism of Ras-triggered MAP-Kinase pathway. 1+3

GROUP-C

3. Answer any ONE from the following questions: **1×8=8**

a) a) What is active transport? What type of protein is involved in active transport? Describe the functions of the sodium-potassium pump. What is the electrochemical gradient? 1+2+3+2
b) What is G protein? What is the function of G protein coupled receptors? How does GCPR activate G protein? 1+2+5

(P.T.O.)

UNIT: ZOO 104.2
CYTOGENETICS

GROUP-A

4. Answer any TWO from the following questions: 2×2=4

a) What are the frequencies of heterozygote in a population of 293 individuals in which Gm^{a+} (77) is dominant over Gm^{a-} 65?

b) Co-transduction of genes leu+ and trp+ to recipient leu trp cells produce the following transductants:

leu+ trp+ 369
leu- trp+ 31
leu+ trp- 46

What is the map distance between leu and trp?

c) Write the name of two tumor suppressor gene.

d) What role does Ras-GTP play in intracellular signaling that makes it a proto-oncogene?

GROUP-B

5. Answer any TWO from the following questions: 2×4=8

a) The amber mutants of phage T4 are conditional lethal mutants. That grows on *E. coli* strain CR_{63}, but are lethal on *E. coli* strain B. An amber mutant almost never exhibits intragenic complementation with any other amber mutant; for this problem, assume that no intragenic complementation occur between any of the mutants involved. The following results were obtained when eight amber mutants were analyzed for complementation by infecting the restrictive host (*E. coli* strain with each possible pair of mutants. The results of mixed infections by pairs of mutants are shown as 0 if no progeny are produced, and as + if progeny phage resulted from the infection with that particular pair of mutants.

Mutants	1	2	3	4	5	6	7	8
8	+	+	+	+	+	+	0	0
7	+	+	+	+	+	+	0	
6	+	+	+	+	+	0		
5	0	+	0	+	0			
4	+	+	+	0				
3	0	+	0					
2	+	0						
1	0							

i. Indicates that the eight amber mutations are located in how many different genes?

ii. Which mutations are located in the same gene or genes?

b) Albinism is the phenotypic expression of a homozygous recessive genotype. One source estimates the frequency of albino as 1 in 18000. What percentage of population is heterozygous for this gene?

c) In *E. coli* four Hfr strains donate the following genetic markers shown in the order donated:

Strain 1: Q W D M T
Strain 2: A X P T M
Strain 3: B N C A X
Strain 4: B Q W D M

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

d) Discuss the role of a tumor suppressor gene (p53) in cell cycle regulation.

GROUP-C

6. Answer any ONE from the following questions: 1×8=8

a) One hundred fruit flies (*Drosophila melanogaster*) from Calcutta were tested for their genotype at the alcohol dehydrogenase locus using starch gel electrophoresis. Two alleles were present, S and F, for slow and fast migration respectively. The following results were obtained:

SS- 66; SF- 20; FF-14.

i. What is the allelic and genotypic frequency in this population?

ii. Is this population in Hardy- Weinberg equilibrium? 3+3+2=8

b) In a transduction experiment the donor was $c^+d^+e^+$ and recipient was $c^-d^-e^-$. Selection was for e^+. The four classes of transductants are shown-

Class	Genetic composition	No. of individuals
1	$c^+d^+e^+$	57
2	c^+d^+e	76
3	$c^+d\,e$	365
4	$c^+d\,e^+$	2

i) Determine the cotransduction frequency of c^+d^+ and c^+e^+.

ii) Calculate actual distance between three.

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