

Zoology (P.G.)

[CBCS]

M.Sc. First Semester End Examination-2023

(Regular & Supplementary Paper)

PAPER-104

Full Marks: 40

Time: 02 Hrs

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Group 104.1

Full Marks 20

[Cell Biology]

1. Answer any two questions of the following: 2x2= 4
 - a. What do you mean by GPI anchored protein?
 - b. What are the structural differences between three types of lipid molecules found in biomembrane?
 - c. Microtubule has polarity. What is the basis for this polarity?
 - d. Draw a schematic diagram induced cell cycle arrest at different phases of cell cycle.

2. Answer any two questions of the following: 2x4= 8
 - a. Explain how CDK activity is controlled or modulated by the following proteins:-
 - i) Cyclin
 - ii) CAK
 - iii) Weel
 - iv) APC4

(2)

- b. Briefly discuss how GTP hydrolysis by Ran in the cytosol provides directionality to nuclear transport?
- c. What is lipid rafts? State the difference between voltage-gated ion channels and ligand-gated ion channels.
- d. Mention any two name of chemical inhibitors of action filament? What is filament nucleation?

3. Answer any one question of the following: 1x8=8

- a. i) The Rb protein has been called the master brake of the cell cycle. Describe how, the Rb protein acts as a cell cycle brake released in mid to late G1 to allow the cell to S-phase?
ii) What is securin? Write its function. (3+3)+2
- b. i) Explain how GPCR increases cytosolic Ca^{2+} and activate protein Kinase C?
ii) What is GPCR desensitization? 6+2

Group 104.2
Full Marks 20
[Cytogenetics]

4. Answer any two questions of the following: 2x2= 4

a. Calculate the allele frequency from the following population:

Phenotype	Genotype	Number
MM	$L^M L^M$	182
MN	$L^M L^N$	172
NN	$L^N L^N$	44

(3)

- b. Differentiate cin heterozygote and trans heterozygote.
- c. The frequency of the allele for red-green colour blindness is 0.08; find out the ratio between men and women.
- d. Which protein is the major player in activating a DNA damage checkpoint?

5. Answer any two questions of the following: 2x4= 8

a. In a transduction experiment, the donor is $a^+b^+c^+$ and the recipient is abc. Selection is a^+ . Four classes of transductants from this experiment are shown in the following table:-

Genetic Composition	No of individuals
$a^+b^+c^+$	55
a^+b^+c	72
$a^+b c$	300
$a^+b c^+$	3

- i) Determine the contransduction frequency for a^+ and b^+
- ii) Determine the cotransduction frequency for a^+ and c^+
- iii) Which co-transduction frequency shows the smaller actual distance between genes?
- b. The ability to taste PTC is due to a single dominant allele "T". You sampled 215 individuals in biology and determined that 150 could defect bitter taste of PTC and 65 could not . Calculate all of the potential frequencies.
- c. Mention the role of Ras protein in a signaling cascade with proper diagram.

(4)

- d. A DNA fragment obtained from a bacteria whose genotype is $pur^+ pro^- his^-$. Cuts are made at random. A mixture of these fragment are added to a culture of recipient bacterium having genotype $pur^- pro^+ his^+$ and pur^+ is selected. From the data given below predict the gene order.

<u>Genotype</u>	<u>Number of Colonies</u>
$pro^+ his^+$	103
$Pro^- his^+$	24
$pro^+ his^-$	158
$Pro^- his^-$	1

6. Answer any one question of the following: 1x8=8

- a. Six different rII deletion strain of phage T4 listed for recombination by pair wise crossing in E.Coli. Following table is the result. Form the deletion map.

<u>Deletion mutation</u>	M_1	M_2	M_3	M_4	M_5	M_6
Dfp	0	0	+	0	0	0
Dfq	0	+	0	+	0	0
Dfr	0	+	+	0	0	+
Dfs	0	0	0	0	0	0
Dft	0	+	0	+	+	0

(5)

- b. The gene for coat color in rabbit can exist in four alleles formed C (full coat color), C^{ch} (chinchilla), C^h (Himalayan) and C (albino). ($C > C^{ch} > C^h > C$). In a population of rabbit in Hardy-weinberg equilibrium the allele frequencies are –

$$C=0.05, C=0.34, C^{ch}=0.17, C^h=0.44$$

- i) What is the frequency of albino rabbit?
- ii) Among 1000 rabbit, how many would you expect to have a Himalayan coat color
- iii) Among 1000 rabbit, how many would be hetero-zygous with a chinchilla coat color.