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PG CBCS

M.Sc. Semester-I Examination, 2021

ZOOLOGY

PAPER: ZOO 104

(CELL BIOLOGY & CYTOGENETICS)

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

Write the answer for each unit in separate sheet

UNIT- ZOO 104.1

Cell Biology

Answer any TWO questions of the following: **2X10=20**

1. Why polar substances are impermeable through the plasma membrane? What do you mean by primary and secondary active transport? Describe the active co-transport of Na^+ and K^+ by Na^+ K^+ ATPase. 2+2+6
2. What is second messenger? Describe the mechanism of Ras-triggered MAP –Kinase pathway. Discuss about the different types of cell surface receptors. 2+5+3
3. What are microtubules? Describe the dynamics of microtubule assembly. Discuss the role of kinesin and dyneins in intracellular transport. 2+4+4
4. The Rb protein has been called the "master brake" of the cell cycle. Describe how the Rb protein acts as a cell cycle brake. How is the brake released in mid- to late G1 to allow the cell to proceed to S phase? 5+5
5. Describe the role of IP3 in causing a rise in cytosolic Ca2+ concentration. How do cells restore resting levels of cytosolic Ca2+? What is the principal function of DAG? 5+3+2

UNIT- ZOO 104.2

Cytogenetics

Answer any TWO questions from the following: **2X10=20**

1. A researcher is interested in delineating the pathway for the production of blue color colony in Yeast. She finds that it is possible to mate two mutant strains of Yeast with gray colonies and produce diploid yeast cells that produce blue colonies. She then proceeds to mate nine different yeast mutants (A to I) with gray colonies in all possible pairwise combinations and inspects the diploid progeny for colony color. The results of her complementation analysis are presented in the following table, where a "+" = blue colonies and a "-"= grey colonies.

a. Place the mutations in the nine strains into complementation group.

b. What is the minimum number of genes for the production of blue color in yeast?

c. Can you estimate the maximum number of genes necessary for this trait, and if so, what is the maximum number? 5+2+3

2. Propose a genetic map that is consistent with the complementation data provided below, where m1-m7 are different point mutations and Dfa- Dfe are deletions. '+' indicates complementation occurs whereas '0' indicates no complementation.

	m 1	m 2	m 3	m 4	m 5	m 6	m 7
Dfa	0	0	0	+	0	0	0
Dfb	0	+	+	0	+	0	0
Dfc	0	+	+	+	0	0	+
Dfd	0	0	+	0	0	0	0
Dfe	0	+	+	0	+	+	0

10

3. How do proto-oncogenes become oncogenes? Distinguish between V src and C src. Write the role of E_2F and Rb in cell cycle regulation. 2+2+6

4. The A–B–O blood types of 1000 people from an isolated village were determined to obtain the following data:

Blood Type	Number of People
A	42
B	672
AB	36
O	250

Estimate the frequencies of the I^A, I^B, and *i* alleles of the A–B–O blood group gene from these data. 10

5. In a transduction experiment, the donor was c+ d+ e+ and the recipient was c d e. Selection was for c+. The four classes for transductants from this experiment are shown in the following table;

Class	Genetic composition	number of individuals
1	c+d+e+	57
2	c+d+e	76
3	c+de	365
4	c+de+	2
	Total	500

i) Determine the cotransduction frequency of c+d+?

ii) Determine the cotransduction frequency of c+e+?

iii) Which of the cotransduction frequencies calculated in a and b represents the greater actual distance between genes? 10

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