Name : .....

Roll No. : .....

Invigilator's Signature : .....

2012
GENETICS & CELL BIOLOGY

Time Allotted : 3 Hours *Full Marks* : 70

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

GROUP – A
(Genetics)

(FULL MARKS : 35)
Question No. 1 is compulsory

1. Answer any *five* of the following : 5 × 1 = 5

   i) What is meiosis ?

   ii) Name two agents used for cell hybridization.

   iii) What is the consequence of nondisjunction of chromosome 21 ?

   iv) What is the function of *Sry* gene ?

   v) What is linkage ?

   vi) What is the function of antisense RNA ?

   vii) What is oncogene ?

MODULE – I

Answer any *one* of the following questions. 1 × 9

2. a) What is recombination ?

b) Singed bristles (*sn*), crossveinless wings (*cv*), and vermilion eye colour (*v*) are due to recessive mutant alleles of three X-linked genes in *Drosophila melanogaster*. When a female heterozygous for each of the three genes was testcrossed with a singed, crossveinless, vermillion male, the following progeny were obtained :

Class	Phenotype	Number
1	singed, crossveinless, vermilion	3
2	crossveinless, vermilion	392
3	vermilion	34
4	crossveinless	61
5	singed, crossveinless	32
6	singed, vermilion	65
7	singed	410
8	wild type	3

What is the correct order of these three genes on the *X* chromosome ? What are the genetic map distances between *sn* and *cv*, *sn* and *v*, *cv* and *v* ? What is the coefficient of coincidence ? 1 + 8

3. Explain the mechanism of liposome mediated gene delivery. Compare the viral and nonviral based gene delivery system. 5 + 4

4. Depict the molecular mechanism of sex determination in *Drosophila.* 9

MODULE – II

Answer any *three* of the following questions. 3 × 7= 21

5. a) Explain Hardy-Weinberg Principle ?

   b) The following data for the A-B blood types were obtained from Salt Lake & New Town.

Group	**Sample Size**	**A**	**AB**	**B**
Salt Lake	86	53	29	4
New Town	278	78	61	139

Calculate the frequencies of the L^A and L^B alleles for the two groups. 2 + 5

6. State the strategy, applications and implications of Human genome project. 4 + 2 + 1

7. What is somatic cell hybridization ? How are hybrid cells selected in HAT medium ? 2 + 5

8. Define genetic counseling. What are the steps in genetic counseling ? What is the cause of fragile *X* syndrome ? 2 + 2 + 3

GROUP – B
(Cell Biology)

(FULL MARKS : 35)

1. Answer any *five* questions : 5 × 2 = 10

Fill in the blanks :

a) Cephalins contain the amino alcohols ..... or ..... .

b) Binding of GABA at certain synapses in the central nervous system admits ..... ions into the cell and ..... the creation of a nerve impulse.

c) Binding immunoglobulin protein (BiP) are also known as ..... kDa..... regulated protein.

d) Rabs are anchored via .....groups on two..... in the C-terminus.

Answer in brief :

e) "Most of the fatty acids in the membrane are unsaturated" – Why ?

f) Name four types of "gated" ion channels.

g) Which ionic channels are defective in patients with cystic fibrosis ?

h) What are Porosomes ?

2. Answer any *three* of the following questions : $3 \times 5 = 15$

a) Name three P-type ion transporters. Describe in brief, role of any one of these three pumps to mediate active transport. Who discovered Patch Clamp technique ?

$$\left(3 \times \frac{1}{2}\right) + 2\frac{1}{2} + 1$$

b) Name two categories of SNAREs. Where are they located ? Draw a diagram to explain postulated role of SNAREs in guiding vesicular transport. 1 + 1 + 3

c) Define a Symporter. Give an example and explain its involvement to move specific cargo molecules through plasma membrane. What is Liddle's syndrome ?

$1 + 2 + 2$

d) Define Chaperone, Co-chaperone and Pharmacological chaperone. Draw a diagram to show the difference between normal and mutant LDL receptor. $3 + 2$

e) Describe diagrammatically a low density lipoprotein particle. Name four functional regions of cisternae stack present in Golgi apparatus. Define Prenylation.

$2 + 4 \times \frac{1}{2} + 1$

3. Answer any *one* question of the following : $1 \times 10 = 10$

a) Write a short note on Centrosome. "Tight junction is one kind of intracellular bridge which perform two vital functions" – Explain. What is the difference between Integrins and Cadherins ? Describe four types of signal through which animal cells can signal to one another.

$2 + 2 + 4 \times 1\frac{1}{2}$

b) What is Cytokinesis ? How does it differ in plant and animal cells ? Name and describe individual roll of three proteins which control cell cycle. Define Endoreplication. 2 + 1 + (3 × 2) + 1