Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH(BT)(PHMB)(PHMC)/SEM-2/MBT-PHMB-PHMC-204/2010

2010

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)

Total marks (5 + 9 + 21) = 35

Q. No. 1 Compulsory

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

   i) What is microsatellite marker ?

   ii) What is translocation ?

   iii) What is the function of Sxl gene ?

   iv) What is the difference between paracentric and pericentric inversion ?

   v) What is nucleosome ?

   vi) What is the difference between monosomy & trisomy ?

Module I

Answer any *one*.

2. What is genetic map ?

   Singed bristles(sn), crossveinless wings(cv) and vermilion eye color(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 test crossed with a singed, crossveinless, vermilion 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* and *cv* and *v* ? What is the coefficient of coincidence ? 1 + 8

3. Explain the molecular mechanism of sex determination in *Drosophila.* 9

Module II

Answer any *three* questions.

4. What is Hardy-Weinberg Principle ?

   a) The incidence of recessive albinism is 0.0004 in a human population. If mating of this trait is random in the population, what is the frequency of the recessive allele ?

   b) The frequeny of an allele in a large randomly mating population is 0.2. What is the frequency of heterozygous carriers ? 1 + 3 + 3

5. State the strategy, applications and implications of human genome project. 7

6. What is mutation ? Demonstrate with a suitable experiment that *X*-rays are mutagenic. 7

7. What is somatic cell hybridization ? Explain the mechanism of selection of hybrid cells. 1 + 6

GROUP B

(Cell Biology)

Total marks (5 + 30) = 35

1. Choose the correct alternatives for any *five* of the following : 5 × 1 = 5

   i) A cell undergoing apoptotic death initially
      a) swells b) shrinkgs.

   ii) A cell undergoing necrotic death initially
      a) swells b) shrinkgs.

   iii) Which is more condensed ?
      a) Euchromatin b) Heterochromatin.

   iv) Match Photoreceptor types with putative function(s) : Rods for
      a) B/W b) Color vision.

   v) Match Photoreceptor types with putative function(s) : Cones for
      a) B/W b) Color vision.

   vi) Does Brefeldin *A* treatment affect ?
      a) Anterograde b) Retrograde vesicles.

   vii) An SH2 domain binds
      a) phospho-Tyrosine
      b) poly proline sequences.

Answer any *three* of the following : 3 × 10

2. a) What exactly is the Nuclear Localization Signal (NLS) ? How was it discovered ? 3

   b) Illustrate how the Ran GTPase cycle imposes directionality on nuclear entry / exit. 4

   c) Mention the exact sub cellular location of N-linked glycosylation as well as that of O-linked glycosylation of proteins. 3

3. a) What is congenital night blindness (CNB) ? What is the molecular defect associated with CNB ? Explain briefly the mechanism of the consequence of this molecular defect. 6

   b) Illustrate briefly the function(s) of motor proteins (i) Myosin and (ii) Kinesin. 4

4. a) Cite two instances where apoptotic death of specific cells during mammalian development is essential. 4

   b) Mention four specific morphological hallmarks of cells undergoing apoptotic death. 4

   c) How does and how much Ca^{2+} impact cadherin function ? 2

5. a) Illustrate with figure(s) the role of Selectins in leukocyte extravasation. 3

   b) Which are the four major components associated with cell-matrix adhesion ? 4

   c) Draw the structure of a monomeric unit of hyaluron (D-Glucoronic acid and N-Acetyl D-Glucosamine). 3