



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**

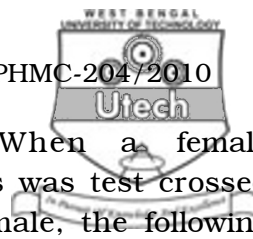
Answer any *one*.

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

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[ Turn over



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 :

<b>Class</b>	<b>Phenotype</b>	<b>Number</b>
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*.

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## Module II

Answer any *three* questions.

4. What is Hardy-Weinberg Principle ?

- 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 ?
- The frequency 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 :

$5 \times 1 = 5$

- 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-Glucuronic acid and N-Acetyl D-Glucosamine ). 3