Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B. Tech (BT)/SEM-5/BT-504/2011-12

2011
GENETICS AND BIOSTATISTICS

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
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$10 \times 1 = 10$

   i)   The medium of the items listed below

      52, 13, 20, 5, 17, 10, 8, 2, 40, 34

      is

      a)   10   b)   15

      c)   20   d)   None of these.

   ii)   A bag contains 6 white balls, 9 black balls. What is the probability of drawing a black ball ?

      a)   3/5   b)   2/5

      c)   2/3   d)   1/9.

   iii)   The gene which exhibits multiple effects is known to be

      a)   complimentary   b)   pleiotropic

      c)   pseudogenes   d)   none of these.

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iv) The primer of the lagging strand during DNA replication is removed by

a) 3' to 5' exonuclease activity of DNA polymerase III,

b) DNA primase

c) 5' to 3' exonuclease activity of DNA polymerase I

d) 3' to 5' exonuclease activity of DNA polymerase I.

v) A nonsense mutation in the gene encoding protein X leading to the synthesis of a truncated protein results in a slow growing stain. Mutagenesis of this strain towards the isolation of extragenic suppressors led to the isolation of a strain which grew normally and synthesized the full-length protein X. The extragenic suppressor is likely to be a gene coding for

a) rRNA   b) tRNA

c) RNA polymerase   d) Ribosomal protein.

vi) An HFR bacterium is one that contains

a) many unusual plasmids

b) chromosomal material acquired from a recipient cell

c) the ability to undergo transduction

d) plasmid integrated into its chromosome.

vii) Photo reactivation is the process where damage caused by .... can be removed.

a) ions   b) radiation

c) UV   d) temperature.

viii) In RNA splicing the removal of .... takes place.

a) introns   b) exon

c) poly AA site   d) initiation codon.

ix) In Hershey-Chase experiment the bacteriophage was taken as experimental material is

a) T4   b) T2

c) lamda   d) M13.

x) Interrupted matting experiments were based upon

a) Medium   b) Time

c) Light   d) Organism.

xi) In 'goodness of fit' for Chi square value of .... is most dependable.

a) 50 %   b) 20 %

c) 05 %   d) 01 %.

xii) Test cross in determining percentage of linkage requires crossing of 'F1 hybrid with'

a) both of 'male' and 'female' parents

b) only 'male' parent

c) only 'female' parent

d) none of them.

GROUP – B

(Short Answer Type Questions)

Write short notes on any *three* of the following.

$3 \times 5 = 15$

2. Describe any *one* of the following with diagram only

   a) Transfer of F plasmid from donor cells to a F^- receipient cells by conjugation.

   b) Mechanism of bacteria transformation.

3. What are the proteins and other factors involved in initiation of DNA replication in *E.coli* origin of replication ? (use diagram and table).

4. How will you differentiate between intact DNA and denatured DNA using light ? What is 'phospho-di-ester bond' ?   2 + 3

5. Define 'variance'. Mention it's different components, comment on 'what they signify'.   2 + 3

6. From the data given below calculate the mean, mean deviation and standard deviation :

Height (cm)	10-20	20-30	30-40	40-50	50-60
Frequency	6	8	10	14	9

7. An HFR strain carrying the phototrophic markers a^+, b^+, c^+ and d^+ is mixed with an F^- strain carrying the auxotrophic alleles a, b, c and d. Conjugation was interupted at every 5 min intervals and plated on medium that revealed the presence of recombinants.

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Time (min)	Recombinants detected
5	ab^+cd
10	$^{a+}b^+cd$
15	$a+b+cd+$
20	$^{a+}b^+c^+d^+$

What is the order of the markers in the HFR strain ? Explain the order and draw a genetic map of the four markers in time units.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

8. a) Singed bristle (sn), crossveinless wings (cv) and vermilion (v) eye colour are due to recessive mutant alleles of the 3 sex-linked genes in Drosophila melanogaster. When a female heterozygous for each of the 3 genes was test-crossed with a singed, crossveinless, vermilion male, the following progeny were obtained :

signed, crossveinless, vermilion – 3, crossveinless, vermilion – 392, vermilion – 34, crossveinless – 61, singed, crossveinless – 32, singed, vermilion – 65, singed – 410, wild type – 3.

What is the correct order of the 3 genes on the chromosome ? What are the genetic map distances between the 3 genes ? Calculate the coefficient of coincidence.

b) In a Hardy-Weinberg population, the following blood group frequencies were observed : $A = 0.53$, $B = 0.13$, $O = 0.26$. Determine the allele frequencies of the blood groups in the population.

c) Cystic fibrosis is a recessive trait disorder with a frequency of 1 in 2500. Calculate the frequency of heterozygotes.

d) Define : Pseudodiploidy, Haplodiploidy

$$(2 + 2 + 1) + 5 + 3 + (1 + 1)$$

9. a) Mention the Binomial Distribution law.

b) Assuming that half the population are consumers of rice so that the chance of an individual being a rice consumer is $1/2$ and assuming that 100 investigations each take 10 individuals to see whether they are rice consumers. How many investigations would you expect to report that three people or less were consumers ?

c) The probability that a student passes a Physics test is $(2/3)$ and the probabilty that a student passes a both Physics and English is $(14/45)$. The probability that he passes at least one test is $(4/5)$. Mention the result where the student passes the English test. $3 + 6 + 6$
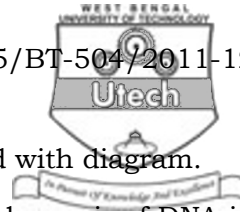
10. a) Describe the genetic map of *F* plasmid with diagram.

b) Describe the methyl directed mismatch repair of DNA in *E.coli* with diagram.

c) What is SOS repair ? Describe the mechanism of SOS repair of DNA damage in *E.coli* with diagram ?   3 + 5 + 7

11. a) A cross involving *X*-linked genes was made between yellow, bar, vermilion females Drosophila and wild males, and the F_1 females were crossed with $y\ B^+ v$ males. The following phenotype were obtained when 1000 progeny was examined :

$y\ B\ v$ and $+ + +$ = 546

$y + +$ and $+ B\ v$ = 244

$y + v$ and $+ B +$ = 160

$y\ B +$ and $+ + v$ = 50

i) What is the order of the three genes ? Construct a linkage map showing the genes in the correct order and the map distances.

ii) Calculate the percentage interference of double crossed over.

iii) Write down the parental genotypes.

b) Explain the factors which effect the rate of recombination.

c) Explain continuous variation.   8 + 4 + 3

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12. What is 'Allopolyploidy' and how does it contrast with 'Autopolyploidy' ? Citing one classical example. Illustrate how this has contributed in Origin of Species. 1 + 4 + 10

13. a) An article manufactured by a company consists of two parts A and B. In the process of manufacture of part A, 9 out of 100 are likely to be defective. Similarly, 5 out of 100 are likely to be defective in the manufacture of part B. Calculate the probability that the assembled article will not be defective.

    b) For a group of 50 boys the mean score and the standard deviation of scores on a test are 59·5 and 8·38. For a group of 40 girls the same results are 54·0 and 8·23. Find the mean and S.D. of the combined group of 90 children. 7 + 8