Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M. Tech (BT)/SEM-2/MBT-215-E/2013

2013
GENETICS

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) Repulsion in linkage denotes

a) dominant alleles for all the linked genes are presented in the same single chromosome

b) dominant allele for one gene and recessive allele for other gene(s) remaining is same chromosome

c) recessive alleles are represented for all genes in same chromosome

d) all of the three stated at 'a' to 'c'.

ii) Micro-RNA play key role in translation process by

a) breaking mRNA into smaller RNA pieces.

b) by assembly of several micro RNAs and forming a large mRNA like polymer

c) by competitively blocking the mRNA and tRNA interaction

d) by modifying the nitrogeneous bases of mRNA by methylation.

iii) Cytoplasmic inheritance is same as

a) maternal inheritance

b) non-genic inheritance

c) quantitative inheritance

d) non-DNA inheritance.

iv) Genetic recombination in yeast taken place

a) in haploid members through somatic crossing over

b) in diploid members through meiosis (reduction division)

c) in conjugation process

d) in none of the above processes.

v) The number and morphology of human chromosome was first described by

a) Painter (1923)

b) Tjio and Levan (1956)

c) Boveri (1898)

d) Flemming (1882).

vi) Barr body found in human individuals with chromosomal complements

a) *xo* b) *xyy*

c) *xx* d) *xy*.

vii) Cri-du-chat syndrome is due to

a) deletion of chromosome 5

b) chromosome 6

c) chromosome *X*

d) none of these.

viii) Amniocentesis is a technique to

a) remove amniotic fluid from Yolk sac

b) removal fluid from placenta

c) removal of fluid from amniotic sac

d) removal and culture of fluid from amniotic sac.

ix) Philadelphia chromosome is referred to

a) deleted chromosome member 21

b) A deletion in chromosome 22

c) deletion and translocation in chromosome 21

d) none of these.

x) Positive Eugenics is applied in human to create

a) super man

b) super race

c) super pedigree

d) more genetically adjustable human races artificially.

xi) Humulin is

a) genetically engineering artificial gene

b) artificial gene product

c) artificial insulin

d) insulin like animal metabolic product.

xii) 80% of a population consists of taster and 20% of non-tasters. The frequency of heterozygous tasters in the population would be

a) 40% b) 10%

c) 90% d) none of these.

xiii) Genetic drift causes

a) change in genotype frequency of ancestral population

b) charge in gene frequency of ancestral population

c) change in gene frequency in founder population

d) change in genotype frequency in founder population.

xiv) Tranduction is a process found only in

a) bacteria

b) bacteria and viruses

c) some special forms of bacteria

d) some special forms of viruses.

xv) Recombination frequency between tow genes is calculated by

a) NF = NPP + 1/2TT/Total no. of Tetrad

b) NF = TT' – NPP/Total of Tetrad

c) NF = NPP-TT/Total no. of tetrad

d) NF = NPP × TT – 1/2/1/2 of total tetrad.

GROUP – B

(Short Answer Type Questions)

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

$3 \times 5 = 15$

2. Amniocentesis
3. Turner syndrome
4. AIS
5. F-factor
6. Insertion sequence (IS)
7. Balanced polymorphism
8. Selection in founder species
9. Ethical basis of Genetic counseling
10 Heterozygous advantage
11. Definition of nucleosomes and its chemical and organizational characteristics.
12. List of the sources of genetic variation and a comment on their evolutionary significance.
13. RNA interference.

GROUP – C

(Long Answer Type Questions)

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

14. a) What is conjugation ? Describe bacterial conjugation with suitable diagram.

    b) In a bacteria the order of genes is A, B, C, D, E , F, G, H, I, J, K and L. If such order has 4 sites representing four chromosomes, draw the order of genes in 4 chromosomes (Each chromosome can be loaded with 10 genes). 2 + 6 + 2 + 5

15. An Hfr strain of *E.coli* transfers its genetic material during conjugation. Given the time of entry of markers in $F^{/}$ recipients, construct a genetic map and label the time distance between adjacent gene pairs :

    Marker : Phe-his-bio-azi-Thr

    Time in min : 6 " 33 48 49 8 + 7

16. Classify human genetic diseases with example. Comment on the diseases caused by damaged chromosomes. 9 + 6

17. What do you mean by recessive traits ? Give example of one such trait in man stating disease symptoms, chromosomal complement and relative frequency. Comment on its genetic therapy and inheritance patterns. 2 + 3 + 3 + 3 + 2 + 2

18. What is optic fibrosis ? Comment on the symptoms of such disease in man and its relative frequency in different population. What is the molecular background of such disease? State with suitable diagram and illustrations.

2 + 3 + 3 + 4 + 3

19. What is genetic counselling ? What are the objectives of such programme ? Explain the different steps of genetic in reference to haemoglobinopathy ? 2 + 4 + 9

20. What is Hardy-Weinberg principle ? How will you prove that genotype frequency and gene frequency remain constant through generation ? State the factors that affect gene frequencies in a population. 3 + 4 + 5 + 3

21. What is the significance of Biston betularia in the study of population genetics ?

22. a) Phenylketonuria is a metabolic disorder due to an autosomal recessive gene. If the frequency of affected individuals in the population is 1/10,000, what is the probability that the unrelated, normal parents will produce a phenylketonuric child ?

    b) What is the frequency of heterozygotes *Tt* in a randomly mating population if the frequency of recessive phenotype (tt) is 0·04 ? 8 + 7

23. Define and discuss the DNA composition changes possible to happen in bacteria and other organisms through processes other than sexual reproduction. Which of these are better tools to ensure higher number of generating recombined offspring ? 3 + 12

24. What are forward and reverse genetics ? State how knowledge about these help in understanding inheritance controls. 3 + 12

25. What is understood by Hardy-Weinberg equilibrium ? Explain the phenomenon with illustrated discussion. Comment on the role of such equilibrium in the process of spread of a new mutation appearing in a naturally inbreeding population. 3 + 9 + 3

26. A yellow, cut, vermilion ♀ is crossed to a normal ♂ and the *F*1 females crossed *y ct v* malrs (the test cross). The offspring of the test cross are as follows :

a)	Gray, noncut, red (+++)	3562
b)	Yellow, cut, vermilion (*y ct v)*	3425
c)	Gray, cut, vermilion (+ *ct v*)	941
d)	Yellow, noncut, red (*y* + +)	884
e)	Gray, noncut, vermilion (+ + *v*)	592
f)	Yellow, cut, red (*y ct* +)	529
g)	Gray, cut, red (+ *ct* +)	107
h)	Yellow, noncut, vermilion (*y* + *v*)	96

State which of the above classes contain crossover between *y* and *ct* and which between *ct* and *v*. Give then the total number of crossovers in each region, and figure the per cent

these totals are of the total offspring. Give then the distance between *y* and *ct* and between *ct* and *v*, as shown by the experiment. Construct a chromosome map giving the locations of these three genes.