Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M. Sc(GE)/SEM-1/MSGEN-101/2012-13

2012

MENDELIAN & CLASSICAL 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) A 1 : 1 F2 Phenotypic ratio is a

a) monohybrid ratio b) dihybrid ratio

c) test cross ratio d) back cross ratio.

ii) Mendelian recombinations are due to

a) linkage

b) modification

c) independent assortment of characters

d) mutations.

iii) Lack of independent assortment of two genes *A* and *B* in fruit fly *Drosophila* is due to

a) repulsion b) recombination

c) linkage d) crossing over.

iv) A mother of blood group O has a group O child. The father could be

a) A or B or O b) O only

c) A or B d) AB only.

v) A mating that is expected to produce 50% homozygous and 50 % heterozygous is

a) BB X Bb

b) Bb X Bb

c) bb X Bb

d) mating a, b and c of above

vi) How many linkage groups are present in *Drosophila* ?

a) 8 b) 4

c) 6 d) none of these.

vii) Males are hemizygous, because they have

a) only one *X* chromosome

b) *Y* chromosome

c) no inactive *x* chromosome

d) none of these.

viii) the first sex-linked trait reported was

a) white eye colour in *Drosophila*

b) haeomophilia in human

c) colour blindness in human

d) narrow leaves in Melandrium album.

ix) In *Drosophila* 'XXY' denotes

a) normal female b) normal male

c) sterile male d) barely visible female.

x) Absence of recombinant classes means

a) incomplete linkage

b) deletion of genes

c) complete linkage

d) independent assortment.

xi) The best example of X-linked trait in man is

a) Albinism b) Down syndrome

c) Haemophilia d) Epistasis.

xii) I^A allele produces a glycosyltransferase that adds the following sugar to the end of a polysaccharide to produce A antigen on RBC.

a) N-acetylgactosamine b) N-acetylglucosamine

c) galactose d) glucose.

xiii) Andalusian *x* Andalusian crosses in chicken produces following phenotypic ratio

a) Black : Andulusian blue : Whilte (1 : 1 : 1)

b) Black : Andalusian blue : White (1 : 2 : 1)

c) Black : Andalusian blue : White (1 : 3 : 1)

d) All are andalusian blue.

xiv) When true breeding rose and pea-combed chickens are crossed, the F1 effsprings are

a) mainly rose-combed

b) mainly pea-combed

c) rose and pea in 1 : 1 ratio

d) all are walnut combed.

xv) What is the main feature of the disease osteogenesis imperfect

a) blueness of sclera b) fragility of bones

c) deafness d) all of these.

xvi) Which of the following proteins has accumulated maximum mutations during the course of evolution

a) Hemoglobin b) Cytochrome C

c) Fibrinopeptide d) Insulin.

GROUP – B

(Short Answer Type Questions)

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

2. A man belongs to AB blood group while his wife is B blood group. Predict the probable genotypes and phenotypes of their offsprings.
3. State briefly the role of recombination in genetic mapping.
4. 'Dominance works at interallelic but intragenic level, epistasis works at intergenic level'- define it.

5. Red-green colour blindness in humans is recessive and sex linked. If a woman heterozygous for colour blindness marries a colour blind man, what is the probability that their first child will be a colourblind daughter ?
6. Discuss the phenomenon of incomplete dominance with reference to plumage color in chickens.
7. Show an example where an environmental factor influences the expression of a gene.
8. How you can determine variance and standard deviation of a population data.

GROUP – C

(Long Answer Type Questions)

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

9. Female *Drosophila* heterozygous for ebony (e^+/e), scarlet (st^+/st) and spineless (ss^+/ss)were test crossed and the following progeny were obtained :

Progeny phenotypes	**Number**
wild type	67
ebony	8
ebony scarlet	68
ebony spineless	347
ebony scarlet spineless	78
scarlet	308
scarlet spineless	10
spineless	54

a) Write the genotypes of the flies involved in the parental cross and test cross.

b) Construct the genetic map of the three loci involved indicating the map distance and correct sequence of the gene.

c) Calculate the coefficient of coincidence. 2 + 2 + 6 + 2 + 3

10. What do you mean by an essential gene and a lethal allele ? What are the type of lethal alleles ? Discuss with a suitable cross the inheritance of a lethal allele and the molecular mechanism of the lethal effect. 2 + 1 + 7 + 5

11. Defferentiate continuous and discontinous traits with examples. Discuss how the phenotypes of discontinuous traits are controlled. Explain the mode of inheritance of discontinuous traits taking wheat karnel color as an example. 2 + 3 + 10

12. What are multiple alleles ? Discuss the genetic basis of ABO blood group system. What are the molecular mechanisms of antigenicity of RBCs in this system. 1 + 9 + 5

13. What do you mean by 'pedigree analysis' ? How human pedigree can be constructed ? What are the limitations of a pedigree to draw conclusion about the mode of inheritance ? Describe a pedigree of 'sex-linked dominant' inheritance with suitable diagram. 2 + 3 + 3 + 7

14. Write short notes of any three of the following : 3×5
    a) Dominant epistatic interaction.
    b) Autosomal recessive inheritance with example.
    c) Evolutionary relationship in basic cell types.
    d) Cytoplasmic inheritance.
15. a) Discuss Mendel's laws of inheritance.
    b) Describing the advantages Mendel get by selecting *Pisum sativum* for his experiments.
    c) Explain the reasons for Mendel's success.
    d) Compare the chromosome theory with the Mendelian theory.
    e) State essential features of inheritance. 5 + 3 + 2 + 2 + 3
16. What is a modifier gene and what is epistasis ? Discuss with a suitable cross how does a modifier gene can act. What is pleiotropic effect ? 2 + 8 + 5