[This question paper contains 6 printed pages.]

1301 *Your Roll No.* .....

B.Sc. (Hons.)/II **A**

BOTANY – Paper VI

(Genetics and Biotechnology)

(Admissions of 2004 and onwards)

Time : 3 Hours *Maximum Marks : 38*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt **Five** *questions in all, including Question No.* **1** *which is compulsory.*
All *parts of a question should be answered together.*

1. Attempt any **ten** :

(i) If the coding region of a gene is estimated to consist of 450 nucleotide base pairs (bp). How many amino acids would the corresponding polypeptide chain contain ?

(ii) Why did Mendel fail to discover linkage ?

(iii) Give an example each of a base analogue and an alkylating agent.

P.T.O.

(iv) Write the chromosomal constitution of an individuals with Turner and Klinefelter Syndrome.

(v) Name the regions within an eukaryotic primary transcript that are removed during the processing of mRNA.

(vi) Explain why lethal genes are much more common in Diploid than in Haploid organisms.

(vii) Name the bacterial enzymes that break phosphodiester bonds in DNA at specific base sequences.

(viii) Expression of Hemophilia gene generally skips one generation. Comment.

(ix) How many linkage groups are there in Man and *Allium cepa*.

(x) Why is *Neurospora* used as a model system in genetics.

(xi) If individuals of genotypes AaBbCc are intercrossed. How many different genotypes can appear in their progeny.

(xii) What are hot spots ? (1×10=10)

2. Write short notes on any **four** :

(i) Cis-trans complementation test

(ii) Plasmids – as vectors in cloning

(iii) Hybridoma Technique

(iv) 'Petites' in Yeast

(v) PCR

(vi) Bruce Ames Test $(1^3/_4 \times 4 = 7)$

3. (a) Differentiate between any **two** :

(i) Genomic and cDNA Library

(ii) Sex linked and Sex influenced characters

(iii) Maternal Inheritance and Maternal Effect

$(2 \times 2 = 4)$

(b) In humans a series of alleles (I^A, I^B, I^o) has been associated with the ABO blood type. What phenotypes and their ratios might be expected from the following matings :

(i) $I^A I^A \times I^B I^B$

(ii) $I^A I^o \times I^B I^o$ (3)

4. (a) (i) What bases on the mRNA transcript would represent the following DNA sequence :

5′ – G T G A G A C G A – 3′

P.T.O.

(ii) If the codon in mRNA is UUA, what is the tRNA anticodon that will bind to this codon ? (1+1=2)

(b) Tabulate the differences between the prokaryotic and eukaryotic transcription. (3)

(c) Diagramatically represent the process of photoreactivation. (2)

5. (a) Describe the post transcriptional modifications of h_nRNA in eukaryotes. (4)

(b) Define Cancer. How do cancer cells differ from normal cells. (3)

6. (a) In lac operon of *E. coli* what is the function of each of the following genes ?

(i) Regulator (ii) Structural gene Z

(iii) Promoter (iv) Operator

(v) Structural gene Y (½×5=2½)

(b) Diagramatically explain inducible and repressible operon. (3)

(c) Write a short note on gene therapy. (1½)

7. (a) Give full forms of the following :

(i) RFLP (ii) HUGO

(iii) RAPD (iv) YAC

(v) ICGEB (vi) IBPGR (½×6=3)

(b) What are transgenics ? (1)

(c) Briefly explain the salient features of the genetic code. (2)

(d) When a plasmid DNA from an organism is digested with a restriction enzyme having two restriction sites, how many fragments of DNA will be generated ? (1)

8. Maize plants homozygous for recessive genes "variable sterile" (va) exhibit irregular distribution of chromosomes during meiosis. Yellowish green seedlings are the result of another recessive gene called "virescent" (v). A third recessive called "glossy" (gl) produces shiny leaves. All three of these gene are linked. A cross between a homozygous dominant and a recessive parent produced all normal F_1 progeny. When the F_1 was test crossed, progeny phenotypes appeared as follows :

Virescent – 60

Virescent, glossy – 48

glossy – 07

Variable sterile, virescent, glossy – 270

Variable sterile, virescent – 04

Variable sterile – 40

Variable sterile, glossy – 62

Wild type – 235

(a) What were the genotypes and phenotypes of the original parents and the test cross parents ? (2)

(b) Calculate the percentage of recombination between different pairs of genes. (2)

(c) Construct the linkage map showing the correct order of these genes. (1)

(d) Calculate the coefficient of coincidence and interference. (2)