2023

BOTANY

Paper : BOTHC3076

(Genetics)

Full Marks : 60
Pass Marks : 24

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct answer from the following (any *five*) : 1×5=5

(a) Homozygosity and heterozygosity of an individual can be determined by

(i) testcross

(ii) backcross

(iii) self-fertilization

(iv) All of the above

(b) A genetic phenomenon where in the genes are inherited from both parents but offspring's phenotype is determined not by its own but by genotype of its mother, this is known as

(i) genetic maternal effect

(ii) cytoplasmic inheritance

(iii) genomic imprinting

(iv) anticipation

(c) The alternate form of a gene is

(i) recessive character

(ii) alternate type

(iii) allele

(iv) dominant character

(d) In Barbara McClintock's famous experiment revealing the existence of transposable genes, she primarily used which of the following as her experimental organism?

(i) Drosophila

(ii) *E. coli*

(iii) Lambda phage

(iv) Corn plants

(Continued)

(e) What kind of aneuploid gametes will be generated if meiotic non-disjunction occurs at first division (n represents haploid no. of chromosomes)?

(i) Only $n+1$ and n

(ii) Only $n-1$ and n

(iii) Both $2n+1$ and $2n-1$

(iv) Both $n+1$ and $n-1$

(f) Natural mutation in plants and animals was first observed by

(i) Stadler

(ii) Hugo de Vries

(iii) Bateson

(iv) Muller

(g) The action of ultraviolet radiation on DNA to induce mutation is the

(i) formation of thymine dimers

(ii) methylation of base pairs

(iii) deletion of base pairs

(iv) addition of base pairs

(Turn Over)

(h) Genetic drift is changed in the allele frequency of a population due to

(i) random chance

(ii) natural selection

(iii) non-random mating

(iv) artificial selection

(i) DNA glycosylase is an enzyme involved in base excision repair. The function is

(i) addition of correct base

(ii) addition of correct nucleotide

(iii) removal of incorrect base

(iv) removal of phosphodiester bond

(j) 12 : 3 : 1 ratio in F_2-generation represents

(i) incomplete dominance

(ii) epistasis

(iii) co-dominance

(iv) All of the above

(Continued)

2. Answer the following questions (any *five*) : 2×5=10

(a) Describe the difference between penetrance and expressivity.

(b) Define karyotype. Write the karyotype of Klinefelter syndrome.

(c) What is linkage? Write the significance of crossing-over.

(d) What is chromosomal mutation? Write different types of chromosomal mutation observed in plants.

(e) What is complementary gene interaction? Give their genotypic and phenotypic ratio.

(f) Write the assumption of Hardy-Weinberg equilibrium.

(g) Define 'holandric genes' in sex-linked inheritance.

3. Answer the following questions (any *five*) : 5×5=25

(a) What do you mean by gene interaction? Explain lethal factor in plants. 1+4

(b) Describe the maternal effect in relation to dextral and sinistral coiling of snail.

(Turn Over)

(c) What are the different types of mutagens? Describe the role of different kinds of chemical mutagens. 1+4

(d) What is T_4 bacteriophage? Write the structural features of T_4 bacteriophage with diagram. 1+4

(e) Mention the full form of LINE. Explain the different types of transposons in transposable element. 1+4

(f) Write a short note on DNA repair mechanism.

(g) Describe the characteristics of polygenic inheritance.

(h) Define Aneuploids. Write about its production and uses of Aneuploids. 1+4

(i) What do you understand by the term chromosomal aberration? Briefly explain the different types of chromosomal aberrations. 1+4

4. Answer the following questions (any *two*) : 10×2=20

(a) Write the difference between allele and genotype frequencies. Explain the role of natural selection, mutation and genetic drift in detail.

(b) What is cytoplasmic inheritance? Distinguish between cytoplasmic and nuclear inheritence. Describe the plastid inheritance pattern in four o'clock plant. 1+2+7

(c) What do you mean by 'three-point cross'? Construct a genetic map considering three sex-linked genes of Drosophila. 2+8

(d) Define polyploidy. Describe the importance of polyploidy, particularly in relation to evolution and origin of new species. 2+8

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