

FACULTY OF SCIENCE
B.Sc. (CBCS) II YEAR (PRACTICAL) EXAMINATION
SUBJECT: BOTANY
Semester – IV - PAPER – IV
(Cell Biology, Genetics and Plant Physiology)
QUESTION BANK

Time: 3 Hrs

Max. Marks: 50

- I. Carry out the cytological preparation and staining of the given material (A) and report any TWO stages of cell division to the examiners. 12 X 1 = 12 M
(Procedure - 5, Slide preparation - 4, Figures - 2, Inference - 1)
1. Onion root tip squash (Mitosis)
 2. Onion flower buds (Meiosis)
- II. Solve the Two given genetic problems (B) (Dihybrid cross/incomplete dominance – 1) (Working out - 2, Inference - 1); (interaction of genes/linkage map/two and three point test cross - 1) (Working out - 6, Inference - 1); 3 + 7 = 10 M
3. What will be the result of selfing F1 generation in a cross when round and yellow seeded pea plants (YYRR) are crossed with green and wrinkled (yyrr) seeded pea plants?
 4. When round and yellow seeded pea plants (YYRR) are crossed with green wrinkled (yyrr) seeded plants F1 are yellow and round seeded plants (YyRr). What will be the result when this F1 is crossed with round and yellow seeded plants?
 5. In garden peas tall plant habit 'T' is dominant over dwarf 't' green pods 'G' over yellow 'g'. Bring out a cross between tall yellow with dwarf green and obtain F1 and F2 give the percentage of tall green homozygous among F2. Give the F2 genotypic ratio.
 6. In snapdragon red flower 'R' is incompletely dominant over white 'r' the heterozygous being pink. The normal broad leaves 'B' are incompletely dominant over narrow leaves 'b' the heterozygous being intermediate leaf breadth. Find out the phenotype of the following crosses.
 - a. Red flowered broad leaved plant crossed with white flowered narrow leaved plant what will be F1 and F2.
 7. In four O'clock plant, red flower colour 'R' is incompletely dominant over white 'r' to heterozygous plant being pink flowered. When a cross is made between a red flowered 4'0 clock plant with a white flowered one, Find out the phenotypic progeny in F1 and F2 generations?
 8. In pea plant the allele 'T' for tallness is dominant over the allele 't' for dwarfness and the allele 'R' for round seeds is dominant over allele 'r' for wrinkled seeds. Give the phenotypes of the progeny of the following crosses.
TtRr X ttrr
TTRR X ttrr
TtRr X TtRr
 9. In a plant cross between red flowered and white flowered plant yields plants of both the colours in equal proportion but a cross between two white flowered plants yields only white flowered plants. What could be the genotype of the parents and which phenotype is recessive?
 10. In pea a tall plant with round seeds is crossed with a dwarf plant having wrinkled seeds. The progeny obtained is in the ratio of
 - 1 tall plant with round seeds
 - 1 tall plant with wrinkled seeds
 - 1 dwarf plant with round seeds
 - 1 dwarf plant with wrinkled seeds

11. Two white flowered strains of the sweet pea (*Lathyrus odoratus*) were crossed, producing an F₁ with only purple flowers. Random crossing among the F₁ producing 96 progeny plants, 53 exhibiting purple flowers & 43 with white flowers.

- What phenotypic ratio is approximated by the F₂?
- What type of interaction is involved?
- What were the probable genotypes of the parental strains?

12. A plant of the genus *Capsella* commonly called as shepherd purse produces a seed capsule.

The shape of which is controlled by two independently assorting genes, represented by symbols A and B. When dihybrid plants were interpollinated, 6% of the progeny were found to possess ovoid shaped seed capsule. The other 94% of the progeny had triangular shaped seed capsule.

- What two factors epistatic ratio is approximated by the progeny?
- What type of interaction is operative?

13. A fully heterozygous grey bodied (B⁺) normal winged (vg⁺) female F₁ of fruit fly was crossed with black bodied (b), vestigial (vg) male gave the following results

Grey Normal - 126

Grey Vestigial - 24

Black normal - 26

Black vestigial - 124

- Does this indicate linkage?
- If so what is the percentage of crossing over?
- Diagram the cross showing the arrangement of the genetic markers on the chromosome?

14. The recessive gene 'sh' produced shrunken corn kernels and its dominant allele 'sh⁺' produces full plump kernels. The recessive gene 'c' produce coloured endosperm and its dominant allele (c⁺) produces coloured endosperm. A pure plum kernels and coloured endosperm is crossed with shrunken kernels and coloured endosperm. The F₁ is crossed with recessive parent and produced the following progeny.

Shrunken coloured - 149

Shrunken colourless - 4035

Plump colourless - 152

Plump coloured - 4032

- Does this indicate linkage?
- What is the percentage of crossing over?
- Construct the genetic map?

15. In corn a dominant gene 'C' produces coloured aleurone its recessive allele produces colourless aleurone. Another dominant gene 'SH' produces full, plump kernels, its recessive alleles 'sh' produces shrunken kernels, due to collapsing of endosperm. A third dominant 'Wx' produces normal starchy endosperm and its recessive allele 'wx' produces waxy starch. A homozygous plant from a seed with colourless, plump and waxy endosperm is crossed a homozygous plant from a seed with coloured shrunken and starchy endosperm.

The F₁ is test crossed to a colourless, shrunken, waxy stain. The progeny seed exhibit the following phenotypes.

1. Colourless, shrunken, starchy - 113

2. Coloured, plump, waxy - 116

3. Coloured, shrunken, waxy - 601

4. Colourless, full, starchy - 626

5. Colourless, plump, waxy - 2708

6. Coloured, shrunken, starchy - 2538

7. Colourless, shrunken, waxy - 2

8. Coloured, plump, starchy - 4

- Construct a genetic map of this region of chromosome.
- Calculate the coefficient of coincidence.

16. A kidney bean shaped eye is produced 'b' a recessive gene 'k' on the third chromosome of drosophila. Orange eye colour called, 'cardinal' is produced by the recessive gene 'cl' on the same chromosome. Between those two loci is a third locus with recessive allele 'e' producing ebony body colour homozygous kidney, cardinal females are mated to homozygous ebony male.

The tri-hybrid F1 females are then test crossed to produce the F2. Among 4000 F2 progeny are of the following.

1761 Kidney, cardinal	97 Kidney
1773 Ebony	89 Kidney, cardinal
128 Kidney, ebony	6 Kidney, ebony, cardinal
138 Cardinal	8 Wild type

- Determine the linkage relationship in the parents and F1 tri-hybrid.
- Estimate the map distance.

III. Conduct the experiment allotted to you. Write procedure, give results and inference (Procedure: 2 M + Experimentation: 6 M + Observations or recordings of results: 2 M + Inference: 2 M) 12 M

17. Determination of osmotic potential of vacuolar sap by plasmolytic method using leaves of *Rheo / Tradescantia*.

18. Determination of stomatal frequency using leaf epidermal peelings/impressions.

19. Determination of catalase activity using potato tubers by titration method.

20. Separation of chloroplast pigments using paper chromatography technique.

21. Estimation of protein by Biuret method.

IV. Critical notes on (D, E) spotters (photograph) (Identification - 1, Notes - 1)

2 x 3 = 6 M

D. Deficiency symptoms

- Micronutrients
- Macronutrients

E. Cell organelles/ Chromosomes

- Cell wall
- Cell Membrane
- Nucleus
- Mitochondria
- Lampbrush chromosome
- Polytene chromosome
- B chromosome

V. Record 5 M

VI. Viva 5 M