PLANT BIOTECHNOLOGY
(BIOT 3221)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) The ability of single cells to divide and produce all differentiated cells in the entity
(a) Totipotency (b) Multipotent (c) Pluripotent (d) Unipotent.

(ii) Recovery of healthy plant from disease plant is possible by
(a) Meristem culture (b) Somatic hybridization
(c) Protoplast fusion (d) Callus culture.

(iii) To obtain a virus-free plant, which can be the explant for micropropagation?
(a) Apical meristem (b) Axillary meristem
(c) Seed (d) Whole plant.

(iv) Carotenoids and anthocyanin pigments are examples of
(a) Primary metabolite (b) Secondary metabolite
(c) Protein (d) Sugar.

(v) Genetically modified GM brinjal in India has been developed for
(a) insect resistance (b) enhancing shelf life
(c) enhancing mineral content (d) drought resistance.

(vi) Repeated sequence in genome is present in
(a) only non-coding region (b) only coding region
(c) both coding and noncoding region (d) all of these.

(vii) Inducible genes have
(a) TATA-containing promoter (b) TATA-less promoter
(c) CAAT-containing promoter (d) CAAT-less promoter.

(viii) Pathogenesis Resistant proteins are expressed
(a) when a plant is exposed to biotic stress
(b) at the site of infection
(c) only in plants resistant to pathogen
(d) none of these.

(ix) Plant satellite DNA contains
(a) Tandem repeat sequence
(b) Dispersed repeat sequence
(c) Both Tandem and dispersed repeat sequence
(d) None.

(x) Maize Mu element is a type of
(a) Ac/Ds element (b) Retrotransposon
(c) Transposable element (d) Insertion sequence.

Fill in the blanks with the correct word

(xi) One synthetic cytokinin is _____.

(xii) *Euglena gracilis* contains 3-5 _____repeat sequences in their chloroplast genome.

(xiii) Spermidine has a role in DNA _____.

(xiv) *Agrobacterium tumefaciens* is a Gram _____ bacteria.

(xv) One example of bZIP class of transcription factor is _____.

Group - B

2. (a) Cytokinin is needed for the sustenance of plant life-justify the statement in view of its application. (mention any three). *[(CO1)(Justify/IOCQ)]*
(b) Mention the name of any two synthetic cytokinins. *[(CO1)(Remember/LOCQ)]*
(c) Mention the mechanism of action of cytokinin with suitable diagram with respect to *Arabidopsis.* *[(CO1)(Apply/IOCQ)]*

3 + 2 + (5 + 2) = 12

3. (a) Briefly describe the steps of micropropagation along with a diagram. *[(CO1)(Analyse/HOCQ)]*
(b) Mention the benefits of this process over the conventional process of plant growing method. *[(CO1)(Remember/LOCQ)]*
(c) Mention the limitations of this method. *[(CO1)(Apply/IOCQ)]*

6 + 3 + 3 = 12

Group - C

4. (a) Mention the importance of alkaloids in plant. Mention the precursor, end product and plant examples of the following class of alkaloids:
(i) Quinoline
(ii) Indole
(iii) Piperidine. *[(CO2)(Analyse/IOCQ)]*
(b) Name the plant secondary metabolite compound with hypotensive property found in *Catharanthus roseus*. Write its chemical name, nature and biosynthetic pathway. *[(CO2)(Apply/LOCQ)]*

2 + (2 × 3) + 4 = 12

5. (a) Describe briefly citing an example following one step bioconversion by freely suspended cells a plant secondary metabolite product can be developed. *[(CO3)(Analyse/HOCQ)]*

(b) Describe briefly giving two examples citing the fungi name and plant names along with the product developed in elicitor based approach in secondary metabolite production. *[(CO4)(Remember/LOCQ)]*

(c) Mention the precursor, reaction type and product for the preparation of the following enzyme- digitoxin12-hydrolyase enzyme in one-step bioconversion method. *[(CO2)(Apply/IOCQ)]*

3 + (3 × 2) + 3 = 12

Group - D

6. (a) Discuss how chromatin conformation of *Arabidopsis* influence its gene expression. *[(CO3)(Analyse/HOCQ)]*

(b) Describe the molecular mechanism of DNA binding by the following plant transcription factors:
(i) bZIP class
(ii) Zn-finger. *[(CO3)(Remember/LOCQ)]*

(c) What is the importance of the following cis-element in plant gene expression?
5'-NNACGTNN-3'
What is the importance of the sequence flanking to ACGT? *[(CO2)(Apply/HOCQ)]*

4 + (2 + 2) + (2 + 2) = 12

7. (a) How protein turnover is controlled in plant cells? Discuss the molecular mechanisms. *[(CO3)(Apply/HOCQ)]*

(b) Discuss the regulation of following genes in plant:
(i) Rubisco activase (ii) AdoMetDC. *[(CO3)(Remember/IOCQ)]*

6 + (3 + 3) = 12

Group – E

8. (a) Compare the following techniques for gene delivery to plant cells:
Protoplast fusion, LASER-mediated *[(CO4)(Remember/LOCQ)]*

(b) Mention the role of following components in plant expression vectors:
Kanamycin resistant gene, GFP, 35S CaMV promoter *[(CO4)(Understand/IOCQ)]*

(3 + 3) + (2 + 2 + 2) = 12

9. (a) What is herbicide? *[(CO5,6)(Analyse/HOCQ)]*

(b) Mention two examples gene based herbicide resistance in plants. *[(CO5,6)(Remember/LOCQ)]*

(c) Mention briefly any two strategies followed for engineering herbicide resistant plants citing suitable examples. *[(CO5,6)(Apply/IOCQ)]*

2 + 4 + (3 × 2) = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	30.20	43.75	26.04

Course Outcome (CO):

After the completion of the course students will be able to:

1. Explain the basic concepts of plant tissue culture and its application of numerous techniques.
2. Interpret how various plant biochemical metabolic pathways work in the plant system and relate them with medicinally important bioactive compounds.
3. Understand basic molecular biological aspects of plant by studying the structure and organization of plant genome
4. Describe the molecular biological techniques of gene transfer to plants.
5. Understand concept of raising transgenic plants
6. Impart knowledge on all recent biotechnological developments related to GMO through quality improvement of crops.

**LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*