MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END EXAMINATION
B.Sc. (Hons.) ABM

Semester: I (Old)	Academic Year: 2019-2020
Course No: BOT-111	Title: Principles of Plant Biotechnology
Credits: 1+1=2	Total Marks: 40
Day & Date:	Time:

Note: 1.Solve any **EIGHT** questions from **SECTION"A".**
2. All questions from **SECTION "B"** are compulsory.
3. All questions carry equal marks.
4. Draw neat diagrams wherever necessary.

MODEL ANSWER PAPER

SECTION: "A"

Q.1 Explain the method of synthetic seed production and importance of it.

Ans Several steps are followed for making synthetic seeds [2M]

i)Establishment of callus culture

ii) Induction of somatic embryogenesis in callus culture

iii) Maturation of somatic embryos

iv) Encapsulation of somatic embryos

Importance: [2M]

i) Seeds are produced within short span of time

ii) These are produced across the time and season barrier

iii) Dormancy period can be reduced

iv) Applicable for large scale monoculture

v) It holds and delivers beneficial adjuvant

vi) It helps to study the role of endosperm and seed coat formation.

Q.2 Define Biotechnology. Enlist different branches of Biotechnology and write down its importance.

Ans:-Definition: The application of biological organisms, system or processes to manufacturing and service industries. [1M]

Importance: [3M]

1) Meristem tip culture- obtaining virus free plants.

2) Micropropagation-for rapid propagation

3) Pollen and anther culture- Haploid and diploid production

4) Somaclonal varation- High yield variant in rice and tobacco

5) Somatic hybridization- Through protoplast fusion in Pomato

6) Development of cotton hybrids by *bt* gene against bollworms

7) Male sterility.

Q.3 Why all the cells in culture are not totipotent? Give the importance of totipotency.

Ans:- Genetic and epigenetic variation are main reasons behind limited expression of totipotency. [1M]

Importance: [3M]

i) Totipotentiality of somatic cells are exploited in vegetative propagation of many economical, medicinal and agriculturally important plant species.

ii) Studies of genetic modification of plants, production of homozygous diploid plants, mutation, etc. depends on expression of totipotency.

iii) Totipotency can be utilized for germplasm conservation.

Q.4 What is *in vitro* culture? Give the importance of anther, pollen and ovule culture.

Ans:- It is the culture of cells and tissues removed from the intact organism and placed in an artificial condition for experimentation. [2M]

Anther and pollen culture: Cytogenetic studies, identification of recessive phenotypic characters, study of genetic recombination, cell division, etc. [1M]

Ovule culture: Production of haploid callus, induction of polyembryo, etc. [1M]

Q.5 Define somaclonal variation. Enlist the causes of somaclonal variation.

Ans: It is the genetic variability which is regenerated during tissue culture. [1M]

Causes of somaclonal variation: i) Chromosomal aberrations [3M]

ii) DNA amplification

iii) Transposable elements

iv) Culture environment

Q.6 Explain Southern blotting in detail.

Ans:- **Introduction:** Southern blotting is routinely used method for detection of a specific DNA sequencing in sample. The method is named after the British biologist Edwin Southern, who first published it in 1975. [1M]

Method: [3M]

1. Restriction endonucleases are used to cut high-molecular-weight DNA strands into smaller fragments.
2. The DNA fragments are then electrophoresed on an agarose gel to separate them by size.
3. . A sheet of nitrocellulose (or, alternatively, nylon) membrane is placed on top of (or below, depending on the direction of the transfer) the gel.
4. Pressure is applied evenly to the gel (either using suction, or by placing a stack of paper towels and a weight on top of the membrane and gel), to ensure good and even contact between gel and membrane.
5. The membrane is then baked in a vacuum or regular oven at 80 °C for 2 hours
6. The membrane is then exposed to a hybridization probe.
7. The probe DNA is labelled so that it can be detected, usually by incorporating radioactivity or tagging the molecule with a fluorescent or chromogenic dye
8. After hybridization, excess probe is washed from the membrane and the pattern of hybridization is visualized on X-ray film by autoradiography.

Q.7 Explain the nutritional requirement for *in vitro* culture.

Ans- Nutritional requirement-

a) Inorganic nutrients

b) Vitamins [2M]

c) Carbon source

d) Growth regulators

Functions of the above-

[2M]

Q.8 Define Plant tissue culture. Explain its importance in crop improvement.

Ans: It is *in vitro* culture of plant cells, tissues by aseptic techniques on artificial growth medium under controlled environmental conditions. [1M]

Importance in crop improvement: [3M]

i) Production of genetically variable plants

ii) Application in plant breeding

iii) Production of useful biochemicals

iv) Transgenic development

v) Eradication of virus.

Q.9 What is Micropropagation? Explain its different stages of it.

Ans: Clonal propagation of small or minute part of plant cell, tissue or organ through tissue culture is known as micropropagation. The term was initiated by G.Morel (1960) for orchid propagation. [2M]

Stages: [2M]

Stage 0: Selection and maintenance of stock plant for culture initiation.

Stage I: Initiation and establishment of aseptic culture.

Stage II: Multiplication of shoots using a defined culture medium.

Stage III: Rooting of regenerated shoots *in vitro*.

Stage IV: Transfer of plantlets to sterilized soil for hardening under greenhouse environment.

Q.10 Enlist the direct methods of gene transfer and explain any one in detail. [4M]

Ans:The methods are: 1. Particle Bombardment 2. Electroporation 3. Microinjection 4. Pollen Transformation-5. Liposome Mediated Transfer 7. Macro-Injection 9. Poly Ethylene Glycol (PEG) Mediated Transformation 10. Ultrasound Mediated Transfer.

Electroporation: It is the application of an electric current to a living surface in order to open pores or channels through which drug or DNA may pass. Electroporation is usually used in molecular biology as a way of introducing some substance into a cell, such as loading it with a molecular probe, a drug that can change a cell's function, or a piece of coding DNA.

In molecular biology, the electroporation process is commonly used cell *transfection/transformation*, the non-viral DNA transfer, of bacteria, yeast, plant protoplasts. Electroporation is also highly effective for the introduction of foreign gene tissue culture cells, especially mammalian cells.

SECTION: "B"

Q.11 Spell out the abbreviations.

1) **RFLP**: Restriction Fragment Length *[1M]*

2) **SSR**: Simple Sequence Repeats *[1M]*

3) **QTL**: Quantitative Trait Loci *[1M]*

4) **MAS**: Marker Assisted Selection *[1M]*

Q.12 Fill in the blanks. *[4M]*

1) The fusogen used in protoplast fusion is **Polyethylene glycol** *(PEG)*.

2. **Gotielb Haberlandt** is regarded as father of plant tissue culture.

3) **Anther culture** is used for production of haploid plants.

4) **2,4 D** auxin play important role in callus culture.