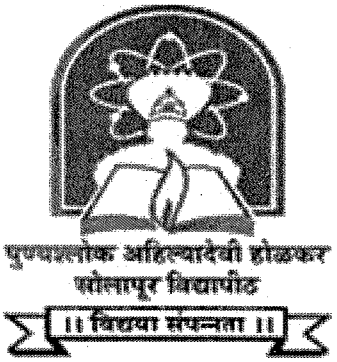
PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

SKILL DEVELOPMENT CENTRE



Course Name: Certificate Course in Plant Tissue Culture

Year- 2023

Dr. Santosh H. Thite (Chairman)
Dr. Tushar S. Rodage (Member)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Certificate Course in Plant Tissue Culture

Syllabus

Theory: Paper-I: Introduction and Techniques of Plant Tissue Culture

Objectives of the Paper:

1. To get the knowledge about introductory history of plant tissue culture
2. To get the knowledge about Laboratory organization in plant tissue culture
3. To get the knowledge about Media preparation in plant tissue culture
4. To get the knowledge about aseptic manipulation in plant tissue culture
5. To get the knowledge about the Cell Culture & Cellular Totipotency

Expected Outcome of the Paper:

1. Student will come to know introductory history of plant tissue culture
2. Student can understand Laboratory organization in plant tissue culture
3. Student can understand Media preparation in plant tissue culture
4. Student will come to know about aseptic manipulation in plant tissue culture
5. Student will come to know about Cell Culture & Cellular Totipotency

Unit 1: Introductory History

1.1 Concept of Cell culture
1.2 Development of tissue culture
1.2.1 Root tip culture
1.2.2 Embryo culture
1.2.3 Stem-tip culture
1.3 Role of Auxin
1.4 Discovery of Cytokinin
1.5 Hormonal control of organ formation
1.6 Improvement of Media
1.7 Preparation and Cloning of Single Cell Cultures
1.8 Regeneration of single cell to whole plant
1.9 Practical applications and recent advances
1.9.1 Morphological aspects
1.9.2 Production of secondary metabolites
1.9.3 Production of pathogen-free plants
1.9.4 Germplasm conservation
1.9.5 Genetic manipulation

Unit 2: Laboratory Organisation

2.1 Washing and storage facilities
2.1.1 Cleaning glassware
2.1.2 Using Plastic Labware
2.2 Media preparation room
2.3 Transfer area
2.4 Culture room
2.5 Data collection area and specialised facilities
2.6 Transplantation area

Dr. Santosh H. Thite (Chairman)
Dr. Tushar S. Rodage (Member)

Unit 3: **Media**

3.1 Media Composition
3.1.1 Inorganic nutrition
3.1.2 Carbon and energy source
3.1.3 Organic supplements
3.1.4 Growth regulators
3.1.5 Solidifying Agents
3.1.6 pH
3.2 Media Preparation
3.3 Selection of New Medium

Unit 4: **Aseptic Manipulation**

4.1 Sterilising the culture vessels and instruments
4.2 Sterilisation of Nutrient Media
4.3 Sterilising Culture rooms and transfer area
4.4 Aseptic Culture technique
4.4.1 Sterilising plant material
4.4.2 Transfer of the explant

Unit 5: **Cell Culture & Cellular Totipotency**

5.1 Isolation of Single Cell
5.2 Culture medium for cell suspensions
5.3 Viability of Cultured Cell
5.4 Vascular Differentiation
5.5 Phloem Differentiation
5.6 Organogenic Differentiation
5.7 Totipotency of Epidermal Cells
5.8 Totipotency of Crown-gall cells

Theory: Paper-II: Applications to Plant Breeding

Objectives of the Paper:

1. To get the knowledge about Haploid Production
2. To get the knowledge about Triploid Production
3. To get the knowledge about *In Vitro* Pollination & Fertilization
4. To get the knowledge about Zygotic Embryo Culture
5. To get the knowledge about the Somatic Hybridization, Cybridisation and Genetic transformation

Expected Outcome of the Paper:

1. Student will come to know Haploid Production
2. Student can understand Triploid Production
3. Student can understand *In Vitro* Pollination & Fertilization
4. Student will come to know about Zygotic Embryo Culture
5. Student will come to know about the Somatic Hybridization, Cybridisation and Genetic transformation

Dr. Santosh H. Thite (Chairman)
Dr. Tushar S. Rodage (Member)

Unit 1: **Haploid Production**

1.1 Techniques of androgenesis
1.2 Factors influencing anther culture
1.3 Differentiation of pollen into gametophytic or Sporophytic cell
1.4 Development of Androgenic Haploids
1.5 Haploids from Isolated microspore or pollen culture
1.6 Induction of haploids from unpollinated overies/ovules
1.7 Diplodisation of haploid plants
1.8 Applications of haploids in plant breeding
1.9 Problems associated with haploid production

Unit 2: **Triploid Production**

2.1 The technique
2.1.1 Explant
2.1.2 Nutrient Media
2.1.3 Development of Shoot Buds and Plantlets
2.1.4 Maintenance of cultures
2.1.5 Biochemical markers in Endosperm culture
2.2 Histology and Cytology of Callus
2.3 Application of triploids in plant improvement

Unit 3: ***In Vitro* Pollination & Fertilization**

3.1 Methodology
3.1.1 Materials
3.1.2 Disinfection of material
3.1.3 Culture of Ovules and Ovary
3.2 Factors affecting seed set after *in vitro* pollination
3.3 Applications of *in vitro* pollination
3.4 *In vitro* fertilization using isolated single gametes

Unit 4: **Zygotic Embryo Culture**

4.1 Types of embryo culture
4.2 Technique
4.3 Nutritional requirement
4.4 Role of suspensor in embryo culture
4.5 Precocious germination
4.6 Morphogenesis in the cultures of seeds with partially differentiated embryos
4.7 Organogenic Potential of Embryo Callus
4.8 Practical Applications

Unit 5: **Somatic Hybridization, Cybridisation and Genetic transformation**

5.1 Isolation of protoplasts
5.2 Culture of protoplasts
5.3 Protoplasts regeneration
5.4 Protoplast fusion
5.5 Selection of somatic hybrids and cybrids
5.6 Assessments of somatic hybrid and cybrid nature of plants
5.7 Practical applications of somatic hybridisation and cybridisation
5.8 Uptake of DNA by pollen; transformation of protoplasts; integration

Dr. Santosh H. Thite (Chairman)
Dr. Tushar S. Rodage (Member)

and expression of foreign DNA in plant cells
5.9 Use of selectable markers and reporter genes

Practical: Paper-III: General Applications of Plant Tissue Culture

Objectives of the Paper:

1. To get the knowledge about General Applications of Plant tissue culture through various practicals

Expected Outcome of the Paper:

1. Student will come to know General Applications of Plant tissue culture through various practicals in the laboratory

1. Sterilization and Preparation of media
2. Isolation of explants, establishments, and maintenance of culture
3. Subculture of Callus, organogenesis, and transfer of plants to soil
4. Micropropagation by proliferation of axillary bud
5. Micropropagation by adventitious shoot proliferation
6. Initiation and establishment of cell suspension cultures
7. Microspore/anther culture for haploid production
8. Protoplast isolation and culture
9. Embryogenesis and embryo culture, synthetic seeds
10. Density gradient centrifugation for isolation of chloroplast and mitochondria
11. Isolation of total RNA from plant
12. Isolation of total DNA from chloroplast
13. Demonstration of southern hybridization to check the plant transformation
14. Isolation of total DNA from plant

Practical: Paper-IV: Project on Plant Tissue Culture

Objectives of the Paper:

1. To get the knowledge about Plant tissue culture through laboratory/industry

Expected Outcome of the Paper:

1. Student will get hands on training through field work-based project in laboratory/industry.

Field Work and Project based on field work	**3 Credits (100 Marks)**
Student should complete the field work of 45 hrs from Plant Tissue Culture based laboratory/industry and submit the project based on same. The Project should clearly mention Title of the Project, Material Methodology implemented in the project, Review of Literature, Result and Discussion.	

Dr. Santosh H. Thite (Chairman)
Dr. Tushar S. Rodage (Member)

Reference Books:

1. Plant Tissue Culture by **K.K. Dey**
2. Methods in Plant tissue culture by **Razdan**
3. Plant tissue culture by **Jha & Ghosh**
4. Trends in plant tissue culture by **Pareek**
5. Plant Cell, Organ & tissue culture by **Norasa**
6. Plant Cell & Tissue Culture by **S. Narayaswami**

Scheme of Examination:

Scheme of the examination: The examination will be carried out as guidelines given by the P.A.H. Solapur University, Solapur

The Proposed scheme is as follows:

Sr. No.	Heads	Total Marks
1.	Theory Paper-I: Introduction and Techniques of Plant Tissue Culture (100 Marks) Paper-II: Applications to Plant Breeding (100 Marks)	200
2	Practical Paper-III: General Applications of Plant Tissue Culture (100 Marks) Paper-IV: Project on Plant Tissue Culture (100 Marks)	200
	Total	400

Nature of Theory Question Paper

University Assessment: **Total Marks 80**

Q.1.	Objectives	20
Q.2.	Short Notes (Any four)	20
Q.3.	Short Answer (Any two)	20
Q.4.	Long Answer (Any one)	10
Q.5.	Long Answer (Any one)	10

College Assessment:

Collect Home Assignment/Open Book Examination **Total 20 Marks**

Nature of Practical Question Paper **Total Marks 100**

Short Experiments	2 (15 marks each)	30 marks
Long Experiments	3 (20 marks each)	60 marks
Practical Record	10 marks	10 marks
Total Marks		**100 marks**

Nature of Project

Submission of Dissertation **100 marks**

Dr. Santosh H. Thite (Chairman)
Dr. Tushar S. Rodage (Member)

19/8
19/8/22

Passing Criteria: As per the guidelines of P.A.H. Solapur University, Solapur
The Proposed passing criteria is as follows:

The candidate obtaining minimum of 40 marks each in theory examination & practical examination will be declared as pass. Certificates will be issued for such candidates.

Dr. Santosh H. Thite (Chairman)
Dr. Tushar S. Rodage (Member)

Faculty of Science

Examination : Certificate course in Plant Tissue Culture

Subject: Certificate Course in Plant Tissue Culture

Title of the Paper: Theory Paper for Certificate Course in Plant Tissue Culture

Time : 3.00 hours Max. Marks: 100

N.B.

1. Figures to the right indicate full marks.
2. Draw a neat, well labeled, complete diagram wherever necessary.
3. Use of calculators, cell phones, or any other electronic gadgets is prohibited.
4. All questions are compulsory.

Q.1 Rewrite the following sentences by using correct alternative. 14 Marks

1) ---------- is a fusagenic agent used for protoplast fusion.

a) polyethylene glycol b) mannitol c) glutamine d) teapot

2) ---------- is an osmotic used in preparation of protoplasts.

a) mannitol b) $HgCl_2$ c) Sodium hypochlorite d) H_2O_2

3) ----------is the culture of embryos excised from immature or mature seeds.

a) embryo culture b) somatic embryogenesis

c) somaclonal variation d) organogenesis

4) Establishment of cultures from an explants after freeing it of contaminants, inane environment free of these microorganisms is called as ----------.

a) cultivation b) aseptic culture c) contamination d) germination

Dr T.S. Rohe 19/8/22

5) ---------- is a vessel for sterilizing with steam under pressure.

a) autoclave b) oven c) laminar d) burner

6) A cell or plant produced by the fusion of protoplasts with nucleus of one parent and cytoplasm of another or both parents is known as ----------

a) soma clone b) cybrid c) protoplast d) hybrid

7) Reversal of organized structures into an undifferentiated state is called as ----------

a) dedifferentiation b) dedifferentiation c) cytogenesis d) embryogenesis

8) Asexual or vegetative propagation of plants in vitro is called as----------

a) embryo culture b) micro propagation c) somaclonal variation d) organogenesis

9) Aseptic culture of organized structures of plant is called as----------

a) cell culture b) micro propagation c) organ culture d) organogenesis

10) Single cells with their walls stripped off are called ----------

a) callus b) organ c) protoplast d) suspension

11) Heritable differences observed among plants propagated through tissue culture of a single mother plant is known as ----------

a) embryo culture b) micro propagation c) somaclonal variation d) organogenesis

12) Potentiality or property of a cell to produce a whole organism is called as ----------

a) plueripotency b) growth c) tot potency d) culture

13)----------is an auxine?

a) 2,4-D b) kinetin c) BAP d) Zeatin

14) ---------- is a vitamin incorporated in PTC media.

a) ascorbic acid b) glutamine c) casein d) peptone

Q.2 Answer the following (any 10) 20 Marks

1. Mention any two surface sterilizing agents used for PTC.

2. What is an explants

3. Enlist any 4 instruments used in PTC laboratory.

4. Enlist any 2 cytokines used for preparation of PTC media.

5. How can Air inside laboratory be sterilized?

6. Define micro propagation.

7. Mention any 2 applications of PTC.

8. Define cryopreservation.

9. Define axenic culture.

10. Write any 2 differences between somatic embryogenesis and somatic hybridization.

11. Enlist the enzymes used for protoplast isolation by enzymatic method.

12. Define plant tissue culture.

Q.3 Answer the following (any 5) 25 Marks

1. Draw a neat, well labeled diagram that explains protoplast isolation method.

2. Embryo culture

3. Explain in brief – somaclonal variation.

4. Sterilization techniques used in PTC laboratory

5. Culture media for PTC

6. Discuss in brief – Growth regulators used in PTC media

Q.4 Answer the following (any 3) 21 Marks

1. Root culture

2. Suspension culture

3. Callus culture

4. Artificial seeds

Q.5 Answer the following (åny 2) 20 Marks

1. Organogenesis

2. General plant Tissue Culture Laboratory design & equipment for PTC

3. Haploid production – Anther and pollen culture

Faculty of Science

Examination : Certificate course in Plant Tissue Culture

Subject: Certificate Course in Plant Tissue Culture

Title of the Paper: Theory Paper for Certificate Course in Plant Tissue Culture

Time : 3.00 hours Max. Marks: 100

Scheme of marking and model answer

Q.1 Rewrite the following sentences by using correct alternative. 14 Marks

Each correct answer carries one full mark.

Q.2 Answer the following (any 10) 20 Marks

Each correct definition, or names, or examples, or meaning, or differences carries two full marks.

Q.3 Answer the following (any 5) 25 Marks

1. A complete, neat well labeled, correct diagram carries 5 full marks.

2. Definition, Principle with diagram – 5 Marks

3.Terminlology, explanation – 3 marks and example of somaclonal variation -2 marks

4. Any 5 Sterilization techniques used in PTC laboratory -5 full marks

5. Description of media preparation, mention components

6. All growth regulators and their roles with examples -5 full marks

Q.4 Answer the following (any 3) 21 Marks

1. Root culture- definition-2 marks, principle (with diagram)-3 marks, application-2 marks

2. Suspension culture- definition- 2 marks, principle (with diagram)-3 marks, applications-2 marks

3. Callus culture- definition- 2 marks, principle (with diagram)-3 marks, applications-2 marks

4. Artificial seeds – concept -2 marks, preparation/principle-3, applications-2 marks

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Q.5 Answer the following (any 2) 20 Marks

1. Organogenesis- introduction, definition-2 marks, principle (with diagram)-6 marks, applications -2 marks

2. Detailed description with diagram -10 full marks

3. Haploid production- Anther and pollen culture – introduction, definition – 2 marks, principle (with diagram) – 5 marks, applications – 3 marks

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Certificate Course in Plant Tissue Culture

Syllabus

Theory: Paper-I: Introduction and Techniques of Plant Tissue Culture

Objectives of the Paper:

1. To get the knowledge about introductory history of plant tissue culture
2. To get the knowledge about Laboratory organization in plant tissue culture
3. To get the knowledge about Media preparation in plant tissue culture
4. To get the knowledge about aseptic manipulation in plant tissue culture
5. To get the knowledge about the Cell Culture & Cellular Totipotency

Expected Outcome of the Paper:

1. Student will come to know introductory history of plant tissue culture
2. Student can understand Laboratory organization in plant tissue culture
3. Student can understand Media preparation in plant tissue culture
4. Student will come to know about aseptic manipulation in plant tissue culture
5. Student will come to know about Cell Culture & Cellular Totipotency

Unit 1: **Introductory History**

1.1 Concept of Cell culture
1.2 Development of tissue culture
1.2.1 Root tip culture
1.2.2 Embryo culture
1.2.3 Stem-tip culture
1.3 Role of Auxin
1.4 Discovery of Cytokinin
1.5 Hormonal control of organ formation
1.6 Improvement of Media
1.7 Preparation and Cloning of Single Cell Cultures
1.8 Regeneration of single cell to whole plant
1.9 Practical applications and recent advances
1.9.1 Morphological aspects
1.9.2 Production of secondary metabolites
1.9.3 Production of pathogen-free plants
1.9.4 Germplasm conservation
1.9.5 Genetic manipulation

Unit 2: **Laboratory Organisation**

2.1 Washing and storage facilities
2.1.1 Cleaning glassware
2.1.2 Using Plastic Labware
2.2 Media preparation room
2.3 Transfer area
2.4 Culture room
2.5 Data collection area and specialised facilities
2.6 Transplantation area

Dr. Santosh H. Thite (Chairman)
Dr. Tushar S. Rodage (Member)

Unit 3: **Media**

3.1 Media Composition
3.1.1 Inorganic nutrition
3.1.2 Carbon and energy source
3.1.3 Organic supplements
3.1.4 Growth regulators
3.1.5 Solidifying Agents
3.1.6 pH
3.2 Media Preparation
3.3 Selection of New Medium

Unit 4: **Aseptic Manipulation**

4.1 Sterilising the culture vessels and instruments
4.2 Sterilisation of Nutrient Media
4.3 Sterilising Culture rooms and transfer area
4.4 Aseptic Culture technique
4.4.1 Sterilising plant material
4.4.2 Transfer of the explant

Unit 5: **Cell Culture & Cellular Totipotency**

5.1 Isolation of Single Cell
5.2 Culture medium for cell suspensions
5.3 Viability of Cultured Cell
5.4 Vascular Differentiation
5.5 Phloem Differentiation
5.6 Organogenic Differentiation
5.7 Totipotency of Epidermal Cells
5.8 Totipotency of Crown-gall cells

Theory: Paper-II: Applications to Plant Breeding

Objectives of the Paper:

1. To get the knowledge about Haploid Production
2. To get the knowledge about Triploid Production
3. To get the knowledge about *In Vitro* Pollination & Fertilization
4. To get the knowledge about Zygotic Embryo Culture
5. To get the knowledge about the Somatic Hybridization, Cybridisation and Genetic transformation

Expected Outcome of the Paper:

1. Student will come to know Haploid Production
2. Student can understand Triploid Production
3. Student can understand *In Vitro* Pollination & Fertilization
4. Student will come to know about Zygotic Embryo Culture
5. Student will come to know about the Somatic Hybridization, Cybridisation and Genetic transformation

Dr. Santosh H. Thite (Chairman)
Dr. Tushar S. Rodage (Member)

Unit 1: **Haploid Production**

1.1 Techniques of androgenesis
1.2 Factors influencing anther culture
1.3 Differentiation of pollen into gametophytic or Sporophytic cell
1.4 Development of Androgenic Haploids
1.5 Haploids from Isolated microspore or pollen culture
1.6 Induction of haploids from unpollinated overies/ovules
1.7 Diplodisation of haploid plants
1.8 Applications of haploids in plant breeding
1.9 Problems associated with haploid production

Unit 2: **Triploid Production**

2.1 The technique
2.1.1 Explant
2.1.2 Nutrient Media
2.1.3 Development of Shoot Buds and Plantlets
2.1.4 Maintenance of cultures
2.1.5 Biochemical markers in Endosperm culture
2.2 Histology and Cytology of Callus
2.3 Application of triploids in plant improvement

Unit 3: ***In Vitro* Pollination & Fertilization**

3.1 Methodology
3.1.1 Materials
3.1.2 Disinfection of material
3.1.3 Culture of Ovules and Ovary
3.2 Factors affecting seed set after *in vitro* pollination
3.3 Applications of *in vitro* pollination
3.4 *In vitro* fertilization using isolated single gametes

Unit 4: **Zygotic Embryo Culture**

4.1 Types of embryo culture
4.2 Technique
4.3 Nutritional requirement
4.4 Role of suspensor in embryo culture
4.5 Precocious germination
4.6 Morphogenesis in the cultures of seeds with partially differentiated embryos
4.7 Organogenic Potential of Embryo Callus
4.8 Practical Applications

Unit 5: **Somatic Hybridization, Cybridisation and Genetic transformation**

5.1 Isolation of protoplasts
5.2 Culture of protoplasts
5.3 Protoplasts regeneration
5.4 Protoplast fusion
5.5 Selection of somatic hybrids and cybrids
5.6 Assessments of somatic hybrid and cybrid nature of plants
5.7 Practical applications of somatic hybridisation and cybridisation
5.8 Uptake of DNA by pollen; transformation of protoplasts; integration

Dr. Santosh H. Thite (Chairman)
Dr. Tushar S. Rodage (Member)

9/8/22

and expression of foreign DNA in plant cells
5.9 Use of selectable markers and reporter genes

Practical: Paper-III: General Applications of Plant Tissue Culture

Objectives of the Paper:

1. To get the knowledge about General Applications of Plant tissue culture through various practicals

Expected Outcome of the Paper:

1. Student will come to know General Applications of Plant tissue culture through various practicals in the laboratory

1. Sterilization and Preparation of media
2. Isolation of explants, establishments, and maintenance of culture
3. Subculture of Callus, organogenesis, and transfer of plants to soil
4. Micropropagation by proliferation of axillary bud
5. Micropropagation by adventitious shoot proliferation
6. Initiation and establishment of cell suspension cultures
7. Microspore/anther culture for haploid production
8. Protoplast isolation and culture
9. Embryogenesis and embryo culture, synthetic seeds
10. Density gradient centrifugation for isolation of chloroplast and mitochondria
11. Isolation of total RNA from plant
12. Isolation of total DNA from chloroplast
13. Demonstration of southern hybridization to check the plant transformation
14. Isolation of total DNA from plant

Practical: Paper-IV: Project on Plant Tissue Culture

Objectives of the Paper:

1. To get the knowledge about Plant tissue culture through laboratory/industry

Expected Outcome of the Paper:

1. Student will get hands on training through field work-based project in laboratory/industry.

Field Work and Project based on field work	**3 Credits (100 Marks)**
Student should complete the field work of 45 hrs from Plant Tissue Culture based laboratory/industry and submit the project based on same. The Project should clearly mention Title of the Project, Material Methodology implemented in the project, Review of Literature, Result and Discussion.	

Dr. Santosh H. Thite (Chairman)
Dr. Tushar S. Rodage (Member)

Reference Books:

1. Plant Tissue Culture by **K.K. Dey**
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3. Plant tissue culture by **Jha & Ghosh**
4. Trends in plant tissue culture by **Pareek**
5. Plant Cell, Organ & tissue culture by **Norasa**
6. Plant Cell & Tissue Culture by **S. Narayaswami**

Scheme of Examination:

Scheme of the examination: The examination will be carried out as guidelines given by the P.A.H. Solapur University, Solapur

The Proposed scheme is as follows:

Sr. No.	Heads	Total Marks
1.	Theory Paper-I: Introduction and Techniques of Plant Tissue Culture (100 Marks) Paper-II: Applications to Plant Breeding (100 Marks)	200
2	Practical Paper-III: General Applications of Plant Tissue Culture (100 Marks) Paper-IV: Project on Plant Tissue Culture (100 Marks)	200
	Total	400

Nature of Theory Question Paper

University Assessment: **Total Marks 80**

Q.1.	Objectives	20
Q.2.	Short Notes (Any four)	20
Q.3.	Short Answer (Any two)	20
Q.4.	Long Answer (Any one)	10
Q.5.	Long Answer (Any one)	10

College Assessment:

Collect Home Assignment/Open Book Examination **Total 20 Marks**

Nature of Practical Question Paper **Total Marks 100**

Short Experiments	2 (15 marks each)	30 marks
Long Experiments	3 (20 marks each)	60 marks
Practical Record	10 marks	10 marks
Total Marks		**100 marks**

Nature of Project

Submission of Dissertation **100 marks**

Dr. Santosh H. Thite (Chairman)
Dr. Tushar S. Rodage (Member)

Passing Criteria: As per the guidelines of P.A.H. Solapur University, Solapur
The Proposed passing criteria is as follows:

The candidate obtaining minimum of 40 marks each in theory examination & practical examination will be declared as pass. Certificates will be issued for such candidates.

Dr. Santosh H. Thite (Chairman)
Dr. Tushar S. Rodage (Member)

Faculty of Science

Examination : Certificate course in Plant Tissue Culture

Subject: Certificate Course in Plant Tissue Culture

Title of the Paper: Theory Paper for Certificate Course in Plant Tissue Culture

Time : 3.00 hours Max. Marks: 100

N.B.

1. Figures to the right indicate full marks.
2. Draw a neat, well labeled, complete diagram wherever necessary.
3. Use of calculators, cell phones, or any other electronic gadgets is prohibited.
4. All questions are compulsory.

Q.1 Rewrite the following sentences by using correct alternative. 14 Marks

1) ---------- is a fusagenic agent used for protoplast fusion.

a) polyethylene glycol b) mannitol c) glutamine d) teapot

2) ---------- is an osmotic used in preparation of protoplasts.

a) mannitol b) HgCl2 c) Sodium hypochlorite d) H2O2

3) ----------is the culture of embryos excised from immature or mature seeds.

a) embryo culture b) somatic embryogenesis

c) somaclonal variation d) organogenesis

4) Establishment of cultures from an explants after freeing it of contaminants, inane environment free of these microorganisms is called as ----------.

a) cultivation b) aseptic culture c) contamination d) germination

5) ---------- is a vessel for sterilizing with steam under pressure.

a) autoclave b) oven c) laminar d) burner

6) A cell or plant produced by the fusion of protoplasts with nucleus of one parent and cytoplasm of another or both parents is known as ----------

a) soma clone b) cybrid c) protoplast d) hybrid

7) Reversal of organized structures into an undifferentiated state is called as ----------

a) dedifferentiation b) dedifferentiation c) cytogenesis d) embryogenesis

8) Asexual or vegetative propagation of plants in vitro is called as----------

a) embryo culture b) micro propagation c) somaclonal variation d) organogenesis

9) Aseptic culture of organized structures of plant is called as----------

a) cell culture b) micro propagation c) organ culture d) organogenesis

10) Single cells with their walls stripped off are called ----------

a) callus b) organ c) protoplast d) suspension

11) Heritable differences observed among plants propagated through tissue culture of a single mother plant is known as ----------

a) embryo culture b) micro propagation c) somaclonal variation d) organogenesis

12) Potentiality or property of a cell to produce a whole organism is called as ----------

a) plueripotency b) growth c) tot potency d) culture

13)----------is an auxine?

a) 2,4-D b) kinetin c) BAP d) Zeatin

14) ---------- is a vitamin incorporated in PTC media.

a) ascorbic acid b) glutamine c) casein d) peptone

Q.2 Answer the following (any 10) 20 Marks

1. Mention any two surface sterilizing agents used for PTC.

2. What is an explants

3. Enlist any 4 instruments used in PTC laboratory.

4. Enlist any 2 cytokines used for preparation of PTC media.

5. How can Air inside laboratory be sterilized?

6. Define micro propagation.

7. Mention any 2 applications of PTC.

8. Define cryopreservation.

9. Define axenic culture.

10. Write any 2 differences between somatic embryogenesis and somatic hybridization.

11. Enlist the enzymes used for protoplast isolation by enzymatic method.

12. Define plant tissue culture.

Q.3 Answer the following (any 5) 25 Marks

1. Draw a neat, well labeled diagram that explains protoplast isolation method.

2. Embryo culture

3. Explain in brief – somaclonal variation.

4. Sterilization techniques used in PTC laboratory

5. Culture media for PTC

6. Discuss in brief – Growth regulators used in PTC media

Q.4 Answer the following (any 3) 21 Marks

1. Root culture

2. Suspension culture

3. Callus culture

4. Artificial seeds

Q.5 Answer the following (ảny 2) 20 Marks

1. Organogenesis

2. General plant Tissue Culture Laboratory design & equipment for PTC

3. Haploid production – Anther and pollen culture

Faculty of Science

Examination : Certificate course in Plant Tissue Culture

Subject: Certificate Course in Plant Tissue Culture

Title of the Paper: Theory Paper for Certificate Course in Plant Tissue Culture

Time : 3.00 hours Max. Marks: 100

Scheme of marking and model answer

Q.1 Rewrite the following sentences by using correct alternative. 14 Marks

Each correct answer carries one full mark.

Q.2 Answer the following (any 10) 20 Marks

Each correct definition, or names, or examples, or meaning, or differences carries two full marks.

Q.3 Answer the following (any 5) 25 Marks

1. A complete, neat well labeled, correct diagram carries 5 full marks.

2. Definition, Principle with diagram – 5 Marks

3.Terminlology, explanation – 3 marks and example of somaclonal variation -2 marks

4. Any 5 Sterilization techniques used in PTC laboratory -5 full marks

5. Description of media preparation, mention components

6. All growth regulators and their roles with examples -5 full marks

Q.4 Answer the following (any 3) 21 Marks

1. Root culture- definition-2 marks, principle (with diagram)-3 marks, application-2 marks

2. Suspension culture- definition- 2 marks, principle (with diagram)-3 marks, applications-2 marks

3. Callus culture- definition- 2 marks, principle (with diagram)-3 marks, applications-2 marks

4. Artificial seeds – concept -2 marks, preparation/principle-3, applications-2 marks

Q.5 Answer the following (any 2) 20 Marks

1. Organogenesis- introduction, definition-2 marks, principle (with diagram)-6 marks, applications -2 marks

2. Detailed description with diagram -10 full marks

3. Haploid production- Anther and pollen culture – introduction, definition – 2 marks, principle (with diagram) – 5 marks, applications – 3 marks