

DIPLOMA IN PLANT TISSUE CULTURE AND NURSERY TECHNOLOGY

(Non-Semester)

(With effect from the academic year 2013-14)

Eligibility for the Course

Candidates for admission to Diploma in Plant Tissue Culture and Nursery Techniques could possess a A pass in Higher Secondary level with Biology/ Botany as one of the subject.

Duration of the Course

One year Diploma in Plant Tissue Culture and Nursery Techniques course non-semester for One Year duration

Examination

All the theory paper are of 3hours duration each for maximum of 100 marks with passing minimum of 35 marks Practical examinations are also for 3 hours duration for a maximum of 100 marks and passing minimum of 35 marks.

Question Paper Pattern

Maximum marks: 100

Time: 3 hours

Part A (5 x 3 = 15)

Five short answer questions (One question from each unit)

Part B (5 x 8 = 40)

Paragraph questions (Total questions 8, out of which answers are to be given for any five questions;

Part C (3x 15 = 45)

Total questions 5, out of which answers are to be given for any Three questions;

S.No	Theory & Practicals	Maximum Marks	Minimum Marks
1.	Fundamentals of plant tissue culture	100	35
2.	Applications of <i>in vitro</i> plant systems and nursery technology	100	35
P1	Hands on practical: Commercial applications of plant tissue culture and nursery technology	100	35

Paper I - Fundamentals of plant tissue culture

Unit-I

Introduction - History, Scope and Concepts of basic techniques in plant tissue culture. Laboratory requirements and organization. Sterilization - filter, heat, wet and chemical. Media preparation - inorganic nutrients, organic supplements, carbon source, vitamins, gelling agents, phytohormones and growth regulators; composition of commonly used culture media (MS and Gamborg's)

Unit-II

Cell, tissue and organ culture - Isolation of single cells, selection and types of cells. Tissue explants and organs for culture - Cell suspension cultures - batch, continuous. Synchronization of suspension culture, cellular totipotency, Cytological, cytochemical and vascular differentiations

Unit-III

Elite and ornamental Plants for propagation *in vitro*, Selection of superior biotypes of orchids, roses, jasmine, *Hibiscus* and crotons; Clonal propagation of elite germplasms, clonal propagation strategies for commercial exploitations.

Unit-IV

Micropropagation - Factors affecting morphogenesis and proliferation rate; technical problems in micropropagation. Organogenesis - formation of shoots and roots, production of virus free plants by meristem and shoot-tip culture

Unit-V

Somatic embryogenesis - Process of somatic embryogenesis, structure, stages of embryo development, factors affecting embryogenesis; production of artificial seeds; Cryopreservation.

Text Book:

1. Bhojwani S.S., Razdan M. K (2005) Plant tissue culture: Theory and practice, Studies in plant science 5, North Holland, Elsevier, New Delhi

References Books:

1. Adrian, J and Assoumani M (1983) Gums and hydrocolloids in nutrition. In: M. Rechcigl (Ed), hand book of nutritional supplements, Vol. II. Agricultural use. CRS Press, Boca Raton, FL.
2. Aiken M.M and Yeoman M.M (1986) A rapid screening technique for the selection of high yielding capsaicin cell line of *Capsicum frutescens* Mill. In: P. Morris *et al* (Eds.) Secondary Metabolism in Plant Cell Cultures. Cambridge University Press, London
3. Anderson S.B, Christiansen I and Faresveit B (1990) Carrot (*Daucus carota* L.): In vitro production of haploids and field trials. In: Y.P.S. Bajaj (Ed.) Biotechnology in Agriculture and Forestry, Vol. 12. Haploids in crop improvement I. Springer, Berlin.
4. Cervelli R and Senaratna T (1995) Economic aspects of Somatic embryogenesis. In: J. Aitken-Christie *et al.* (Eds.) Automation and environment control in plant tissue culture. Kluwer, Dordrest
5. Smith R.H (2000) Plant Tissue Culture: techniques and Experiments, Second edition, Academic Press, USA

Paper II - Applications of *in vitro* plant systems and nursery techniques

UNIT-I

Introduction to hands on techniques in plant tissue culture, preparation, handling, and establishing aseptic cultures; Explants selection, sterilization and inoculation; Callus and cell suspension cultures; Induction and growth parameters.

UNIT-II

Microscopy of *in vitro* cultures; Cytology and various staining procedures for ploidy analysis; microscopy with special emphasis on confocal, scanning and transmission electron microscopy; Principles and applications of flow cytometry and cell sorting; *In vitro* production of secondary metabolites - Classification of secondary metabolites, biosynthetic pathways, and applications. Immobilized cell cultures and biotransformation, elicitors and hairy root culture.

UNIT-III

Genetic manipulation of plants, protoplasts and somatic hybridization; Applications of *in vitro* systems in Agriculture, Horticulture and Forestry: Achievements and current trends in improvement of cereals, vegetable crops, oil yielding plants, ornamental Plants and forest trees; genetic transformation by *Agrobacterium tumefaciens*.

UNIT-IV

Transgenic plants for crop improvement (dicot and monocot including maize, rice, wheat, etc.) Resistance to herbicides, insecticides, virus and other diseases, FlavorSour tomato.

UNIT-V

Plant nursery technology, elite plants for propagation, condition for establishments and maintenance of nursery stock, Nutritional requirements of nursery stock, Macronutrients, micronutrients, Organic supplements, phytohormones and growth factors, mass production of nursery plants.

Text Book:

Noggle GR, Fritz GJ (2012) Introductory plant physiology. Prentice Hall India, New Delhi, India

Reference Books:

1. Arditti J (1977) Clonal propagation of orchids by means of tissue culture - A manual. In: J. Arditti (Ed.) Orchid biology, Reviews and perspective (Vol. 1) Cornell University Press, NY
2. Hartmann H.T., Kester D.E., Davies F.T., Geneve R.L (1996) Plant Propagation, Principles and Practices. 6th ed. Prentice Hall: New Jersey.
3. Thorpe TA., ed. (1981) Plant tissue culture: Methods and applications in agriculture, Academic Press, New York.
4. Heuser C.W., Stinson R.F (1996) Nursery Production (Eds.) Pennsylvania State University, University Park, PA
5. Raghavan V (2010) Experimental embryogenesis in vascular plants, Academic Press, London, UK

Paper III - Practical

Hands on practical: Commercial applications of plant tissue culture and nursery technology

1. Sterilization Techniques - Autoclave and Hot Air Oven,
2. Preparation of nutrient media.
3. Establishment of callus culture.
4. Organogenesis in callus cultures
5. Test tube plants
6. Micro propagation.
7. Isolation of plant secondary metabolites.
8. Importance of macro and micro nutrients, phytohormones, growth factors in Nursery technology.
9. Extension of shelf life of fruits and flowers

Reference Books:

1. Trigiano, R.N., D.J. Gray (Eds) 2010. Plant tissue culture, development and biotechnology, CRC Press, London, UK
2. Razdan, M. K. (2004). Introduction to Plant Tissue Culture. 2nd ed. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
3. Hammoond, J., McGarvey, P. and Yusibov, V. (2000). Plant Biotechnology. Springer Verlag, New York.
4. Phillipson J.D (1990) Plants as source of valuable products. In: B.V. Charlwood, and M.J.C. Rhodes (eds.), Secondary Products from Plant Tissue Culture. Oxford: Clarendon Press, UK
5. Holden RR, Holden MA, Yeoman MM (1988) The effects of fungal elicitation on secondary metabolism in cell cultures of *Capsicum frutescens*. In: Robins RJ, Rhodes MJC, editors. Manipulating secondary metabolism in culture. Cambridge England: Cambridge University Press, UK