

**SCHEME AND SYLLABUS OF
CERTIFICATE COURSE**

IN

**PLANT TISSUE CULTURE
(w.e.f. academic session 2022-23)**

**Department of Microbiology and
Bioinformatics**

Atal Bihari Vajpayee Vishwavidyalaya

Bilaspur (C.G.)

**(A State University, Established by the Government of
Chhattisgarh)**

1. About the Department

Department of Microbiology and Bioinformatics was established in Atal Bihari Vajpayee Vishwavidyalaya (formerly Bilaspur University), in the year 2013, with the objective of imparting quality education in the field of Microbiology and Bioinformatics. The Department has always produced quality professionals, holding important positions in Microbiology and Bioinformatics industry in Chhattisgarh, India and abroad. The Department has excellent infrastructure with well-equipped laboratories for conducting teaching, learning and research in the areas of Microbiology, Bioinformatics, Biotechnology, Botany and relevant disciplines. The Department has well qualified and experienced faculty members, who were always engaged with teaching and research. The staff holds funding from various government organizations and has published good number of books and research publications in reputed journals.

2. About the Course

The certificate programme in Plant tissue culture is recognized qualification provides better understanding on biological concept, propagation of rare and endangered plants and preservation of plant cultures. Those completing the course are awarded a CERTIFICATE and will be able to apply this knowledge for solving problems and making decisions associated with the plant propagation and practical applications in plant tissue culture methods.

3. Scope:

Plant tissue culture has a wide scope and opportunities all around the world. Plant tissue culture broadly refers to the in vitro cultivation of plants, seeds and various parts of the plants (organs, embryos, tissues, single cells, protoplasts). Plant tissue culture is one of the most rapidly growing areas of biotechnology because of its high potential to develop improved crops and ornamental plants. The certificate course provides job-oriented knowledge and applications in scientific methods which caters the need of society. Because of the wide range of applications, plant tissue culture attracts the attention of molecular biologists, plant breeders and industrialists.

4. Outcome of the Course:

Upon successful completion of the course, students should be able to:

- To impart comprehensive overview of the scientific and technical aspects of Plant tissue culture.
- To workout in understanding of metabolism, growth, differentiation and morphogenesis of plant cells.
- To target of creating a new plant or a plant with desired characteristics, tissue culture is often coupled with recombinant DNA technology.
- To understand the development of improved crops and ornamental plants. .
- To learn the improvement of the crop yield and quality.
- To develop theoretical and practical orientation of cultured in vitro methods to produce hybrids.

5. Eligibility Criteria

All those who have completed their Senior School Certificate Examination (Class XII) with Biology.

6. Fees Structure

One time registration/tuition fees of Rs. 3000/-

7. Intake – 15 seats

8. Course Duration – 6 months/ 24 weeks.

9. Attendance

Minimum attendance of 75 % is required in the classes for appearing in the examination.

10. Examination & Scheme and Concise Course Content

S. No.	Papers	Maximum Marks	Minimum Marks	Credits
1.	Paper I- Theory (Plant Tissue Culture)	100	30	4
2.	Paper II- Practical (Plant Tissue Culture Lab)	100	40	2
Total		200	80	6

11. Syllabus

Theory

Title: Plant biotechnology

Module 1:	Introduction To Plant Tissue Culture: Definition, History, principle and significance of tissue culture
Module 2:	Cellular totipotency – Cytodifferentiation: factors affecting vascular tissue differentiation, cell cycle and Tracheary Element differentiation; Organogenic differentiation: induction, factors affecting shoot bud differentiation
Module 3:	Laboratory Organization: Design and layout for wash area, Lab wares, Good laboratory practices, Good safety practices, Culture rooms, observation/data collection areas, media preparation, sterilization and storage room, transfer area for aseptic manipulations.
Module 4:	Instrumentation: Working principle, maintenance and management of following instruments: microscope, Laminar air flow, distillation unit, pH meter, orbital shaker, autoclave, deep freezer, Growth chamber Sterilization and Importance.
Module 5:	Tissue Culture Media: Introduction, Preparation of stocks, pH and Buffers and their significance in media. Types of Media and its importance; Micro and macro elements; Media Constituents (Vitamins, Unidentified supplements, carbohydrate for energy source, Nitrogen source and organic supplements, complex substances, hormones, Activate charcoal)
Module 6:	Plant Hormones: Role of Plant hormones in plant development - auxins, cytokinins, abscissic acid, ethylene and Gibberellins
Module 7:	Callus Culture Techniques- Introduction, principle, protocol, morphology and internal structure, genetic variations, applications.
Module 8:	Organogenesis- Introduction, History, principle, protocol, applications.
Module 9:	Organ Culture Technique- Introduction, History, principle, protocol, applications, with respect to shoot and root tip culture, leaf culture, ovary and ovule culture.
Module 10:	Suspension Culture Technique- Introduction, History, principle, protocol, types, growth measurement, viability test, synchronization, applications.
Module 11:	Plant Protoplast Culture and Fusion - Introduction, History, Principle, protocol for isolation- Mechanical and Enzymatic, protoplast culture methods, viability test, Applications.
Module 12:	Anther and Pollen Culture Technique- Introduction, History, principle, protocol, factors affecting, applications

Module 13:	Somatic embryogenesis - Process of somatic embryogenesis, structure, stages of embryo development, factors affecting embryogenesis, production of artificial seeds, Germplasm storage, Cryopreservation.
Module 14:	Micropropagation- Introduction, History, stages of Micropropagation, factors affecting, advantages and applications. Different Pathways of Micropropagation- Organogenesis, Axillary bud proliferation, meristem culture.
Module 15:	Somaclonal Variation- Introduction, History, terminology, origin, selection at plant level, selection at cell level, mechanism, assessment, applications and limitations. somaclonal variations for Biotic & Abiotic stress.
Module 16:	Agrobacterium mediated Transformation, Ti & Ri Plasmid
Module 17:	Bt gene and its applications, Edible vaccine; Genetically modified plants: Herbicide resistant plant and drought resistant plants

Laboratory

Title: Plant tissue culture lab

1. Study of surface sterilization
2. Preparation of M.S. stock solutions: A) Macrosalt B) Microsalt C) Vitamin
3. Preparation of plant growth regulator stocks
4. To study types of explant and its preparation
5. Aseptic culture techniques for establishment and maintenance of cultures Aseptic seed germination
6. Synthesis of artificial seeds
7. Embryo / Endosperm Culture
8. Callus culture technique- Initiation of culture, callus morphology
9. Cell suspension culture
10. Anther and Pollen Culture technique
11. Isolation of Protoplasts
12. Protoplast fusion
13. Somatic Embryogenesis : A) Direct Embryogenesis B) Indirect Embryogenesis
14. Isolation of plant genomic DNA by modified CTAB method
15. Separation of plant genomic DNA by Agarose gel electrophoresis

Suggested Books

1. Plant Biochemistry and Molecular Biology Second Edition Edited by Peter J. Lea and Richard C. Leegood, John Wiley & Sons Ltd, Chichester, United Kingdom, 1999
2. Gone to seed. Union of Concerned Scientists. Mellon and Rissler. 2004. Cambridge, USA
3. Unintended consequences of plant transformation: A molecular insight. Filipecki and Malepszy. 2006. J. Appl. Genet. 47(4): 277-286.
4. Plant Biotechnology: The genetic manipulation of plants. 1st edition. Slater A and others, Oxford University Press, New York, 2004
5. Plant propagation by tissue culture: vol 1. The background. George E.F. Springer, 2007
6. Cell Culture and Somatic Cell Genetics of Plants .Indra K. Vasil. 1980. Academic Press inc., New York.

Online resources

- <https://www.britannica.com>
<https://encyclopedia2.thefreedictionary.com>
<http://www.free-ebooks.net/>
<https://www.scribd.com>
<https://www.wikipedia.org/>

BUDGET PLAN FOR THE CERTIFICATE COURSE

S.No.	Income /course	Amount (in Rupees)
a)	Intake- 15 candidates with course fee 3000 rupees	45,000/-
S.No.	Expenditure Detail	Amount (in Rupees)
1.	Instruments and tools (one time)	0 (Established)
2.	Contingencies	8,000/-
3.	Stationary and printing	10,000/-
4.	TA and Conveyance	--
5.	Teaching (300 per class - 40 classes)	12,000
6.	Total	30,000

Year wise plan

S.No.	Expenditure Detail	Amount (in Rupees)
1.	For first year	30,000/-
2.	From second year (Contingencies and Teaching)	20,000/-