

1.1. Programme structure/Courses to be offered:

S. No.	Courses Offered	Duration	Eligibility/ qualification*	Curriculum	Fees (Rs.)	Intake
1.	Certificate course in Bioproducts and Bioprocesses	6 Months	12 th Science stream/ B.Sc./ B.Sc. (H)/ B.Sc. Ag.	Module 1	1500	20
2.	Certificate course in <i>In vitro</i> Techniques	6 Months	12 th Science stream/ B.Sc./ B.Sc. (H)/ B.Sc. Ag./ B.Tech.-Biotech/ M.Sc./ M. Phil./Ph. D in Life Science or related subjects	Module 2	1500	20
3	Certificate course in Tools and Techniques in Biosciences	6 Months	M.Sc./ M. Phil./Ph. D in Life Science or related subjects	Module 3	1500	20
4.	Diploma in Bioprocesses and Biotechniques	1 Year	12 th Science stream/ B.Sc./ B.Sc. (H)/ B.Sc. Ag./B.Tech.- Biotech/M.Sc./ M. Phil./Ph. D in Life Science or related subjects	Module 1 *Module 2 or Module 3 *Choice b/w Module 2 & 3	1500 Per Module	20
5.	Post Graduate Diploma in Bioprocesses and Biotechniques	2 Year	B. Sc./ B. Sc. (H)/ B. Sc. Ag./ M. Sc. in Botany/ Zoology/ Biochemistry Biotechnology/ Microbiology/ Life Sciences/ Pharmacy/ Food Technology Forestry/ Agriculture/ Dairy Technology/ Chemistry & allied sciences	Module 1 Module 2 Module 3 & 6 months Industry exposure**	1500 per Module	20

1.1. Job Opportunities

S.No.	Courses	Opportunity
1.	Certificate course in Bioproducts and Bioprocesses	Herbal plant propagation and ayurvedic industry, pharmaceuticals, phytocosmetics, perfumeries, nutraceuticals etc.
2.	Certificate course in <i>In vitro</i> Techniques	Plant Tissue Culture and Biotechnology Industry, Technical Assistant, Forestry, Microbial Technology, Food Industry, Dye Industry
3.	Certificate course in Tools and Techniques in Biosciences	Diagnostic And Therapeutic Laboratories, Technician Assistant, Research Officer, Chemical Industry, High End Instrument Industry
4.	Diploma in Bioprocesses and Biotechniques	Ayurvedic Industry, Pharmaceuticals, Phytocosmetics, Perfumeries, Nutraceuticals, Biotech Industries etc.
5.	Post Graduate Diploma in Bioprocesses and Biotechniques	Ayurvedic Industry, Pharmaceuticals, Biotechnology Industry, Forestry, Microbial Technology, Food Industry, Diagnostic Laboratories, Research Officer, Ayurvedic Industry, Pharmaceuticals, Phytocosmetics, Perfumeries, Nutraceutical industry.

1.2. Special Attraction of the courses

- Individual Hands-on-experiment based learning of all various basic and advanced techniques (every student will be able to perform every experiment on their own).
- Frequent visits and lectures by renowned Resource personals/ Visiting faculty/ Scientist/ Researchers from Industry and Research Institutes and Universities.
- One day or two days workshops on soft skills, personality development, etc. (Separate Certificate will be provided for these Workshops).
- Free Special Lectures/Talks on Future Prospects and career counseling services to all the participants.
- Well equipped laboratory with separate class rooms and Wi-Fi facility.
- Printed Protocol Booklet/ study material for every participant will be delivered
- Library and e-book facility along with computer facility
- Dedicated team well-connected through Facebook & Whatsapp for guiding students.
- Approved Certificate to all students on successful completion of training from Mohanal Sukhadia University, Udaipur- An “A” grade accredited University by NAAC.

Syllabus for module 1
Certificate course in Bioproducts and Bioprocesses
[6 month (I semesters) Certificate course equivalent to 2 Credits]

Theory:

UNIT-1

Plantation and maintenance of medicinal and aromatic plants in India: History, scope, opportunities, conventional and in vitro propagation and maintenance of medicinal and aromatic plants like- *Dioscoria*, *Gloriosa*, *Stevia*, *Coleus*, *Withania* (Ashwagandha), *Ocimum* (Tulsi), *Plantago* (Isabgol), *Aloe*, *Chlorophytum* (Safed musli), *Catharanthus* (Sadabahar), *Commiphora* (Guggal), *Rauvolfia* (Sarpagandha), *Psoralea* (Babchi).

UNIT-2

Post harvesting and processing methods: Methods of harvesting, drying and storage. Microbial contamination of stored product. Influence of temperature, time and combination of active principles.

UNIT-3

Extraction and analysis methods: Distillation, solvent extraction, separation, purification, identification and characterization of active principles from aromatic plants using advanced chromatographic and spectroscopic techniques like- TLC/HPLC/ HPTLC/GC-MS/LC-MS/FTIR/NMR. Practices of, Storage, preservation, packaging, herbal formulations determination and enhancement of self life, and value addition of aromatic compounds.

UNIT-4

Indian market scenario and Entrepreneurship: Assessing overall business environment in the Indian economy, Characteristics of Indian herbal product processing and export industry. Conducting market survey to the demand for herbal product. Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development.

UNIT-5

Policies and IPR's: Good manufacturing practice (GMP) and quality standards in herbal products, Export and Import Policies relevant to herbal sector, Intellectual property rights, Trade mark and Patent.

Practicals:

1. Identification and documentation
2. Plantation and *in vitro* propagation
3. Harvesting, drying and storage techniques
4. Processing and grinding
5. Distillation and solvent extraction
6. Separation of active ingredients using TLC
7. Identification and characterization of bioactive compounds using HPLC/ HPTLC/GC-MS/LC-MS techniques.
8. Identification of different odoriferous factors in essential oil with GC/GC-MS

9. Physico-chemical and sensory evaluation of oils and oleoresin, value added products from aromatic plants.
10. Up regulation of metabolites
11. Storage, preservation, packaging, determination and enhancement of shelf life and value addition of aromatic compounds.
12. Conducting market survey to the demand for product, preparing advertisements for popularization of product
13. Industrial/Institute visit

Suggested Readings:

1. Chadha, K.L. ICAR, 2001. Hand Book of Horticulture. Directorate of Information and Publications of Agriculture, Pusa, New Delhi.
2. Azhar Ali Farooqui and Sreeramu, B.S. 2001. Cultivation of medicinal and aromatic plants. United Press Limited.
3. Atal, E.K. and Kapur, B. 1982. Cultivation and Utilization of Medicinal and Aromatic plants. CSIR, New Delhi.
4. Kumar, N. J.B.M. Md. Abdul Khaddar, RangaSwamy, P. and Irulappan, I. 1997. Introduction to Spices, Plantation Crops Medicinal and Aromatic Plants. Oxford & IBH, New Delhi.
5. Jain, S.K. 1968. Medicinal Plants .National Book Trust New Delhi. Oxford & IBH, New Delhi.
6. Dastur, J.F. 1982. Medicinal plants of India Pakistan Taraprevalasoms and co-private Ltd.
7. Dharmvir, H. 2007. Bioactive medicinal plants, Gene Tech Books.
8. Farooqu, A.A., and Khan, M.M. and Vasundhara, M. 2001. Production technology of medicinal plants and aromatic crops. Natural Remedies Pvt. Ltd.
9. Panda, H. 2007. Medicinal plants, cultivation and their use. Asia Pacific Business Press.
10. Masoda, Y. 1986. Analysis of essential oil by GC-MS, John Wiley and Sons.
11. Paine, F.A. 1987. Modern processing, packaging and distribution systems for food, AVI Publication.
12. Sudhir K.P. and Indira V. B. 2008. Post harvest technology of horticultural crops, Horticulture Science Series. New India Publication Agency.
13. Ramawat K.G. and Merillon J-M. 2013. Natural Products. Phytochemistry, botany and metabolism of alkaloids, phenolics and terpenes, Springer.

Syllabus for module 2

Certificate course in *In vitro* Techniques

Unit I

Planning and design of tissue culture facility for mass propagation of plants: Concept of clean area. Mass media preparation, dispensation and storage. Autoclaving and contamination control. Hatcheries, transfer area, control of physical environment in growth room, air –handling and conditioning, culture room lighting, air exchange, humidity control.

Working principles, basic operation and application of caulogenesis, rhizogenesis, calligenesis and Hydroponic technology. Available technologies for micropropagation of ornamentals, fruit plants, plantation crops, spices and condiments, oil seeds and legumes, commercialization of plant tissue culture in India.

Unit II

Concept of cell culture and Production of pharmaceutically important drugs in culture – alkaloids (*Catharanthus*, *Nicotiana*, *Papaver*), anti-tumour agents (vincristine), saponins and sterols (diosgenin, guggul, ginseng); food additives (sweetners, flavours and colours) and insecticides. Process and operation, factors affecting the mass scale production and up regulation of secondary metabolites, Bioreactors, Biotransformations, Cell Immobilization and Hairy root culture.

Unit III

Biofertilizers: General account about the microbes used as biofertilizer – *Rhizobium*, *Azospirillum*, *Azotobacter*, Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, Mycorrhiza, Organic farming – Green manuring and organic fertilizers.

Biological control: Definition, Concept, biological control agents (BCA), *Trichoderma*, *Trichogramma*, Neem oil and Neem oil cake, natural control and natural balance. Types of interactions contributing to biological control. Mechanisms of biological control. Biocontrol agents, Commercial products and application.

Unit IV

Isolation of industrially important microorganisms for microbial processes. To test the production of enzymes: Amylase, proteinases, lipases and celluloses by microorganisms. Demonstration of citric acid production by *Aspergillus niger*. Methylene blue reductase test to determine the quality of milk sample. Study of food-spoilage microorganisms in fresh, canned, fermented food and meat. Production and analysis of SCP: *Spirulina*, yeast, *Chlorella*, mushroom. Production of yoghurt using specific starter cultures. Preparation of alcohol from fruit juices.

Unit V

Entrepreneurship: Global opportunities, growth of in vitro technology based industry in India. Scope of commercialization of tissue culture based technologies. Setting-up of a micropropagation based industry- SWOT analysis, capital and operational cost, market survey and product acceptance, technology demonstration , preparation of project report, financial institutions and supports, marketing strategies, Export potential. Field / Institutes/Industry visits.

Practicals:

Practicals based on theory papers

Suggested Readings:

1. Bhojwani, S.S. and Razdan, M.K. Plant Tissue Culture : Theory and Practice. Elsevier Science Publishers, New York. USA.
2. Slater,A., Scott, N. and Fowler, M. Plant Biotechnology: The Genetic Manipulation of Plants. Oxford University Press.
3. Gamborg, O.L. and Phillips, G.C. Plant Cell, Tissue and Organ Culture, Fundamental Methods. Narosa Publishing House, New Delhi.
4. Woung-YoungSouand Bhojwani,S.S.MorphogenesisinTissue Cultures(ed.).KluwerAcademicPublishers.
5. Edwin F. George, Michael A. Hall, Geert-Jan De Klerk .Plant Propagation by Tissue Culture(Vol I): The Background. Springer.
6. Michael R. Davey, Paul Anthony .Plant Cell Culture: Essential Methods. Wiley-Blackwell A John Wiley & Sons, Ltd.
7. Trevor A. Thorpe and Edward C. Yeung (Eds) .Plant Embryo Culture: Methods and Protocols. Springer.
8. Barbara M. Reed .Plant Cryopreservation: A Practical Guide. Springer.
9. Ignacimuthu,S. Biotechnology: An introduction. Narosa Publishing House.
10. Evans, D.E., Coleman ,J.O.D. and Kearns ,A. Plant Cell Culture. BIOS Scientific Publishers.
11. Purohit, S.D.: Introduction to plant cell, tissue and organ culture. Prentice Hall.
12. Ramawat, K. G. Plant Biotechnology. S. Chand & Co., New Delhi.
13. Ramawat, K.G. Biotechnology: Secondary metabolites : Plant and Microbes, Science Publisher
14. Ramawat, K.G. and Merillon, J.M. Biotechnology: Secondary metabolites, Science Publisher

Syllabus for module 3

Certificate course in Tools and Techniques in Biosciences

Unit:1

Basic Instruments and techniques: Working principles, basic operation and application of Microtome, weighing balance, PH meter, autoclave, Oven, laminar air flow, Water Baths, CO₂ Incubators, Shaking Incubators, Hot Air Ovens, Bio-Safety Hoods, Fume Hoods, Pipettes and MiliQ water system. Principle of asepsis and sterilization technique.

Unit:2

Microscopy and its modifications – Working principles, basic operation and application of Light, phase contrast and interference, Fluorescence, Confocal, Electron (TEM and SEM)

Centrifugation: Working principles, basic operation and application of micro-centrifuge, ultracentrifuge and density gradient centrifugation, applications (isolation of cell components), determination of molecular weight by sedimentation velocity and sedimentation equilibrium methods

Unit:3

Electrophoretic and PCR techniques: Working principles, basic operation and application of agarose, polyacrylamide and SDS-polyacrylamide gel electrophoresis, capillary electrophoresis, 2-D electrophoresis, pulsed field gel electrophoresis.

Working principles, basic operation and application of Gradient PCR, RT-PCR and Gel Documentation system.

Unit: 4

Chromatography techniques: Working principles, basic operation and application of TLC, gel permeation, ion exchange and affinity chromatography, HPLC.

Spectroscopy technique: Working principles, basic operation and application of UV-visible spectroscopy, fluorescence, NMR, ESR, plasma emission spectroscopy, Atomic Absorption Spectroscopy, GC-MS, LC-MS, FTIR and X-ray crystallography

Unit: 5

Calibration, Validation, and certification of instruments like PCR's, Ovens, Incubators, Volumetric Dispensers, Spectrophotometers, and Electronic Balances etc. using International Standards.

Documentation for Instrumentation systems and procurement procedures, design of typical laboratory, safety measurement and IPR's.

Practicals:

Practicals based on theory papers

Suggested Readings:

1. Freifelder D., Physical Biochemistry, Application to Biochemistry and Molecular Biology, W.H. Freeman and Company, San Fransisco.
2. Wilson, K. and Walker, J. Principles and Techniques of Practical Biochemistry Cambridge University Press.
3. Holmeand, D. and Peck, H. Analytical Biochemistry. Longman
4. Scopes, R. Protein Purification - Principles and Practices. Springer Verlag.
5. Patabhi V and Gautham N. Biophysics, Kluwer Academic Publishers.
6. Narayanan P. Essentials of Biophysics, New Age International Pvt Ltd.
7. Volkenshtein, M.V. General Biophysics Academic Press, Inc.
8. Daniel, M. Basic Biophysics for biologists Agrobios.
9. Van, Holde, Johnson, K. E., Cutis, W. and Shing Ho, P. Principles of physical biochemistry, Pearson education Pvt. Ltd.