



M. C. E. Society's
Abeda Inamdar Senior College
Of Arts, Science and Commerce, Camp, Pune- 1
(Autonomous) Affiliated to Savitribai Phule Pune University
NAAC accredited 'A' Grade

Program Objectives and outcomes:

Program objectives:

- 1) To give the exposure to the students to become self-employed by introducing them through bio-entrepreneurship.
- 2) To develop the skills to make students handle instruments independently required to perform various experiments.
- 3) To inculcate research aptitude in students.
- 4) To train the student in various techniques related to Animal Tissue Culture, Plant Tissue Culture, Environmental Biotechnology, Agricultural Biotechnology and Industrial Biotechnology.
- 5) To make students understand the applications of Animal Tissue Culture, Plant Tissue Culture, Environmental Biotechnology, Agricultural Biotechnology and Industrial Biotechnology in the field of research and industry.

Course structure of TYBSc Vocational Biotechnology

Semester	Paper code	Paper Title	Number of credits	Number of lectures or practicals
V	21SBBT351	Animal Tissue Culture & Plant Tissue Culture	2	36
	21SBBT352	Biotechnology in Industry	2	36
	21SBBT353	Lab Course V: Practical in Tissue Culture technique & Application in Biotechnology Industry	2	12 Practicals
VI	21SBBT361	Environmental Biotechnology and Agricultural Biotechnology	2	36
	21SBBT362	Biotechnology for Health and Bio-entrepreneurship	2	36
	21SBBT363	Project Work	2	



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T.Y.B.Sc. Biotechnology (Vocational)
2023-24 (CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Animal Tissue Culture & Plant Tissue Culture
Course Code	21SBBT351
Semester	V
No. of Credits	2

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To make student understand the concept animal tissue culture and its applications in research.
2.	To make the students familiar with the cell lines and various techniques in tissue culture.
3.	To inculcate the knowledge of basic techniques of plant tissue culture.
4.	To make students understand the concept of specialized techniques used in animal and plant tissue culture.
5.	To introduce the concepts of upcoming fields in reproductive technology by using the basics of tissue culture.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be acquainted with the concept and techniques in animal tissue culture.
2.	Students will have the knowledge regarding upcoming fields in reproductive technology by using the basics of tissue culture.
3.	Students will understand the role of tissue culture in modern research and drug development.

Syllabus

Unit No	Title and Contents	No of lectures
Credit No I	Animal tissue culture	18
Chapter 1	BASICS OF ANIMAL CELL CULTURE <ul style="list-style-type: none"> • Introduction and history • Lab design • Disaggregation of animal tissue • Primary culture & secondary culture. • Evolution of cell line & continuous cell line • Characterization of cell lines. • Maintenance of cell line. Common cell culture contaminants 	8
Chapter 2	SPECIALIZED TECHNIQUES <ul style="list-style-type: none"> • Cell fusion studies • Transplantation of cultured cells • Transfection in animal cells • Expression of cloned products in animal cells 	4
Chapter 3	APPLICATIONS OF ANIMAL TISSUE CULTURE <ul style="list-style-type: none"> • Production of special secondary metabolites/ products (insulin, growth, hormone, interferon, plasminogen activator, factor VIII etc) • Production of monoclonal antibodies and its applications • In vitro fertilization 	6
Credit No 2	Plant tissue culture	18
Chapter 4	ORGANOGENESIS I) Introduction to organogenesis II) Direct and indirect organogenesis III) Rhizogenesis and Caulogenesis	2
Chapter 5	EMBRYO CULTURE I) History and methodology II) Embryo rescue after wide hybridization III) Applications	2
Chapter 6	SOMATIC EMBRYOGENESIS I) Induction of somatic embryos II) Artificial seed production	3
Chapter 7	SOMACLONAL VARIATIONS I) Causes of somaclonal variation II) Selection and multiplication of somaclones III) Advantages and disadvantages	3
Chapter 8	GENE TRANSFER METHODS IN PLANTS I) Physical methods II) Biological methods	5
Chapter 9	SECONDARY METABOLITE PRODUCTION I) Hairy root culture II) Production of hairy root and precursors used III) Advantages and limitation	3

References:

1. Plant tissue culture: M.K.Razdan
2. Plant tissue culture: H.D.Kumar
3. Plant biotechnology-K.G. Ramawat
4. Elements of Biotechnology- P.K.Gupta
5. Animal Biotechnology – edited by R.E. Spier and J.B. Griffith
6. Principles and practice in animal tissue culture—Sudha Gangal university Press
7. Animal cell culture- Ian Freshney



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Course/ Paper Title	Biotechnology in Industry
Course Code	21SBBT352
Semester	V
No. of Credits	2

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To make students familiar with the basic knowledge of fermentation technology
2.	To introduce the concept of upstream and downstream processing.
3.	To introduce the process of production of bio-based products like citric acid, penicillin, vitamin B12, amylase, beverages like beer and wine.
4.	To make students understand the types of fermenters used in fermentation industry.
5.	To inculcate the knowledge of applications of biotechnology in industry.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be acquainted with the knowledge of fermentation and the applications of biotechnology in industry.
2.	Students will understand the process of production of bio-based products like citric acid, penicillin, vitamin B12, amylase, beverages like beer and wine in industry.
3.	Students will have the knowledge of upstream and downstream processing.

Syllabus

Unit No	Title with Contents	No. of Lectures
Credit I	Fermentation process and Types of fermenters	18
1	ROLE OF BIOTECHNOLOGY IN INDUSTRY- Definition and applications of industrial biotechnology.	01
2	FERMENTATION I) Definition and overview of its history II) Layout of typical fermentation unit III) Fermentation media IV) Screening (Primary and secondary) V) Concept of Strain improvement VI) Inoculum development (Bacteria and fungi) VII) Concepts of primary and secondary metabolites.	12
3	DIFFERENT TYPES OF FERMENTERS I) Design of a typical fermenter- Parts of a fermenter and their functions II) Batch fermenter, Continuous fermenter , Fed-batch fermenter, air lift fermenter	05
Credit II	Downstream processing and Applications of Biotechnology in industry	18
4	MEASUREMENT AND CONTROL OF DIFFERENT PARAMETERS DURING FERMENTATION I) pH II) Temperature	05

	III) Dissolved oxygen IV) Inlet and exit gas analysis	
5	DOWNSTREAM PROCESSING I) Basic steps involved in downstream processing II) Methods involved in downstream processing - Filtration, centrifugation, flocculation, and chromatographic techniques.	04
6	APPLICATIONS OF BIOTECHNOLOGY IN INDUSTRY I) Vitamins- Vitamin B12 II) Antibiotics - Penicillin III) Beverages – Beer, Wine IV) Organic acids- Citric acid V) Enzymes - Amylase	09

References:

1. General Microbiology – Stanier
2. Principles of Fermentation Technology - Whitaker, A. 2nd Edition
3. Microbial biotechnology –principles and applications 2nd Edition Lee yuan kun 2006
4. Industrial microbiology L.E.Casida 1968
5. Microbial Technology: Fermentation technology second Ed Pepler 2004
6. A textbook of biotechnology by BD Singh



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Course/ Paper Title	Lab Course V: Practical in Tissue Culture technique & Application in Biotechnology Industry
Course Code	21SBBT353
Semester	V
No. of Credits	2

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To introduce the process of basic culturing explants and its applications.
2.	To help students understand the role of various techniques like immobilization, determination of antimicrobial activity in industry and research.
3.	To help students understand the role of plant growth regulators and various components of Murashige and Skoog medium in Plant tissue culture
4.	To inculcate practical knowledge of industrial biotechnology and tissue culture techniques in various areas of research and industry.
5.	To help students understand the role and applications of basic techniques of Plant tissue culture in different areas of life science.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will have the knowledge of basic culturing explants and its applications in life science
2.	Students will be familiar with the concept of immobilization, determination of antimicrobial activity and its applications in research and industry.
3.	Students will understand the practical importance of industrial biotechnology and tissue culture techniques in research and industry.

Syllabus

Expt. No.	Topics	No. of Practicals
1	Determination of potency of antibiotics	02
2	Immobilization of yeast on calcium alginate and characterization of immobilized beads by invertase assay.	02
3	Isolation of microorganisms producing industrially important enzyme- amylase	02
4	Preparation of nutrient media for plant and animal cell and tissue culture with emphasis on composition and calculation of concentration of	02

	ingredients	
5	Study of effects of auxins on explants	01
6	Study of effects of cytokinins on explants	01
7	Production and estimation of Citric acid by titration method.	02

References:

1. Practical Book Of Biotechnology & Plant Tissue Culture by Nagar Santosh (Author), Adhav Madhavi ,S Chand & Company Publisher (1 December 2010), ISBN-10 : 8121932009, ISBN-13 : 978-8121932004
2. Analytical Techniques in Plant Sciences by Dr. Sanjeeb Kumar Nath (Author), Mahaveer Publications; 1st edition (12 June 2022), ISBN-10 : 9394095578, ISBN-13 : 9789394095571
3. Practical Fermentation Technology, by Brian McNeil, Linda M. Harvey, Wiley Publishers, ISBN:9780470014349.
4. Fermentation: A Practical Approach, by B. McNeil and L. M. Harvey, Oxford University Press, ISBN: 9780199630455.



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Semester IV

T.Y.B.Sc Biotechnology (Vocational)

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Course/ Paper Title	Environmental Biotechnology and Agricultural Biotechnology
Course Code	21SBBT361
Semester	VI
No. of Credits	2

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To help students understand the applications of biotechnology in agriculture
2.	To help students understand the applications of biotechnology in environment.
3.	To make students familiar with the role of biofertilizers, biopesticides, bioremediation, phytoremediation, biofuels and biosensors to create an eco-friendly environment.
4.	To introduce the concept of biofertilizers, biopesticides and xenobiotic degradation by microbes.
5.	To introduce the concept of bioremediation, phytoremediation, biofuels and biosensors.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will have the knowledge of basic concept of biofertilizers, biopesticides, xenobiotic degradation by microbes, bioremediation, phytoremediation, biofuels and biosensors.
2.	Students will understand the applications of biotechnology in agriculture and environment.
3.	Students will understand the role of biofertilizers, biopesticides, bioremediation, phytoremediation, biofuels and biosensors to create an eco-friendly environment.

Syllabus

Sr.No	Title with Contents	No. of Lectures
Credit I	Agricultural Biotechnology	18
1	ROLE OF BIOTECHNOLOGY IN AGRICULTURE I) Definition and introduction to agricultural biotechnology	01
2	BIOFERTILIZERS I) Nitrogen fixation- Definition, Structure of Nitrogenase	07

	enzyme, Features of nitrogen fixing microorganisms (<i>Rhizobium</i> , <i>Azotobacter</i> and <i>Azolla-Anabaena</i>), Small scale and large production of biofertilizers by using <i>Rhizobium</i> and <i>Azotobacter</i> II) Phosphate solubilizers III) Advantages of biofertilizers	
3	BIOPESTICIDES I) Definition of biopesticide II) Properties of an ideal biopesticide III) Cry protein, Role of <i>Bacillus thuringiensis</i> as a biopesticide IV) Advantages of biopesticides.	04
4	XENOBIOTIC DEGRADATION I) Pesticide degradation by microbes II) Herbicide degradation by microbes	03
5	GENETICALLY MODIFIED PLANTS I) Golden rice II) Antisense technology and FlavrSavr tomato	03
Credit II	Environmental Biotechnology	18
5	ROLE OF BIOTECHNOLOGY IN ENVIRONMENT I) Definition and Introduction	01
6	BIOREMEDIATION I) Definition and types of bioremediation- II) In- situ bioremediation (bioventing, biosparging) III) Ex-situ bioremediation (biopile process, land farming, composting) IV) Introduction to mycoremediation	06
7	PHYTOREMEDIATION I) Definition II) Types of phytoremediation- Phytodegradation, phytovolatilization, phytoextraction and phytosequestration.	04
8.	BIOFUELS I) Biogas production: Process of biogas production and micro-	03

	organisms involved in biogas production. ii) Microbial hydrogen gas production iii) Bio-ethanol production and its use as fuel, definition gasohol and "E" numbers.	
9.	BIOSENSORS I) Definition, principle and working of biosensors II) Types and applications of biosensors	04

References:

1. Environmental biotechnology – Dr.P.R.Yadav2006. Discover publishing House
2. Environmental biotechnology-S.N. Jogdand -Himalaya publishing house
3. Environmental biotechnology and cleaner processes. Edited by Eugenia Olegin ,Gloria Sanchez, Elizabeth Hernandez.
4. A textbook of biotechnology H.D.Kumar



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Semester IV

T.Y.B.Sc Biotechnology (Vocational)

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Course/ Paper Title	Biotechnology for Health and Bio-entrepreneurship
Course Code	21SBBT362
Semester	VI
No. of Credits	2

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To introduce the field of bio-entrepreneurship and various start-up ideas to students
2.	To make students aware about role of biotechnology in healthcare and medicine.

3.	To introduce the concept of enzyme therapy, regenerative medicine and nanoscience and its applications in healthcare.
4.	To make students aware of various funding agencies and organizations that promote bio-entrepreneurship.
5.	To introduce different ways of product formulation and market survey for launching new biobased products.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will get acquainted with the concepts of enzyme therapy, regenerative medicine and nanoscience and its applications in healthcare.
2.	Students will be aware of various funding agencies and organizations that promote bio-entrepreneurship.
3.	To make students acquainted with the concept of bio-entrepreneurship and the applications of biotechnology in healthcare.

Syllabus

Unit No	Title and Contents	No of Lectures
Credit I	BIOTECHNOLOGY AND HEALTHCARE	18
Chapter 1	BIOTECHNOLOGY AND HEALTHCARE I) Introduction II) Advancement of Diagnosis, therapy and intervention	01
Chapter 2	ENZYME THERAPY I) Introduction II) Enzymes as Therapeutics III) Therapeutic Enzymes IV) DNase I V) Alginate Lyase	06
Chapter 3	NANOMEDICINE I) Introduction II) Biosensors and Nanoparticles III) NanoBiochemical devices IV) Nanomedical diagnosis and treatment V) Applications of Nanomedicine	06
Chapter 4	REGENERATIVE MEDICINE I) Introduction II) Tissue Engineering	05

	III) Stem Cell Therapy- Definition and Scope, types of stem cells, characteristics and properties	
Credit II	BIOENTREPRENEURSHIP	18
Chapter 5	INTRODUCTION I) Concept, features, scope and importance of entrepreneurship II) Skills and attributes of an entrepreneur III) Types of entrepreneur	05
Chapter 6	BUSINESS ORGANIZATION I) Forms of business organizations (Sole proprietorship, partnership development, joint stock company, cooperative organization)	03
Chapter 7	ORGANIZATION PROMOTING ENTREPRENEURSHIP I) District industry Centre (DIC) II) MIDC (Maharashtra Industrial Development Corporation) III) Small Industries Service Institute (SISI) IV) SIDBI (State Industrial Development Bank) V) ICICI VI) NCIC VII) Financing institution for short and long term entrepreneurship	03
Chapter 8	ENTREPRENEURSHIP DEVELOPMENT I) Identification of opportunities for entrepreneurship II) Ideas to start new business III) Criteria for selection of new product or service IV) Market survey as a tool V) Project report and project formulation	07

References:

1. A textbook of biotechnology by BD Singh
2. "Introduction to Nanotechnology" by Poole C P and Owens F J
3. "Nanostructures & Nanomaterials: Synthesis, Properties & Applications" by Cao G
4. "Introduction to Nanoscience and Nanotechnology" by Chattopadhyay K K
5. Business Environment: Dr.G.V.Kayande Patil
6. Udyogvardhini –MCED
7. Basic Communication Skills: By P. Kiranmai Dutt & Geetha Rajeevan, 2000
8. Fundamentals of Office Management: By J.P. Mahajan , Office Management – By S. P. Arora, latest edition
9. A guide to small Scale Entrepreneurs, Director of Industries, Govt. of Tamil Nadu Chennai, latest edition
10. Entrepreneurship and small Business Management- Dr. C. B. Gupta & Dr. Khanna



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Course/ Paper Title	Project Work
Course Code	21SBBT363
Semester	VI
No. of Credits	2

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To help students understand the current trends in the field of biotechnology and life science.
2.	To inculcate the basis of the learning processes in project education in combination of research activities.
3.	To help students understand the working and applications of various interdisciplinary techniques used in research and innovations.
4.	To make students familiar with the basics of writing a project thesis and literature review.
5.	To help students in organizing research ideas, and objectives for their dissertation and development of communication skills.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will learn to write a project thesis.
2.	Students will understand the applications of various techniques in life science.
3.	Students will have the practical knowledge of using their novel ideas in the field of research, industry and innovations.

Guidelines for Project work

- The students have to opt for this course in the 6th Semester, for a duration of 3 months, making it a total of 2 credit course (**21SBBT363- Project work**).
- It involves laboratory based experimental work under the guidance of a supervisor, leading to presentation of a comprehensive report based on the experimental learning, through focused skill building activity.
- The objective of this course is to help students in organization of research ideas, material, and objectives for their Dissertation and development of communication skills.

After completion of this course, the students will have to present a detailed project report comprising of :

1. Aims, Objectives and Rationale of the study
 2. Review of literature
 3. Methodology/Technology used
 4. Experimental outcome
 5. Summary and Conclusion
 6. References in appropriate referencing styles.
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- In the 6th Semester, students will submit the detailed Project report and will be assessed as per oral presentation and Viva.
 - Credit and workload of project is equivalent to Practical credit and workload as per CBCS system.

Guidelines for writing spiral bound project report to be submitted to the department before oral presentation:

- Aims, Objective and Rationale of the study
- Review of literature
- Methodology/Technology used
- Experimental outcome
- Summary and Conclusion
- References in appropriate referencing styles