CBCS: 2019 Pattern T. Y. B. Sc. Vocational Biotechnology
Savitribai Phule Pune University (SPPU), Pune

SAVITRIBAI PHULE PUNE UNIVERSITY
(Formerly University of Pune)

T.Y.B. Sc.
VOCATIONAL BIOTECHNOLOGY

Choice Based Credit System [CBCS] 2019 Pattern

Syllabus for Third Year
(To be implemented from Academic Year 2021-2022)

Instructions:

Evaluation Pattern (As per CBCS rules, SPPU 2019 Pattern)

1. Each theory and practical course carry 50 marks equivalent to 2 credits.
2. Each course will be evaluated with Continuous Assessment (CA) and University Assessment mechanism.
3. Continuous assessment shall be of 15 marks (30%) while University Evaluation shall be of 35 marks (70%).
4. To pass each course, a student has to secure 40% mark in continuous assessment as well as University assessment i.e. 6 marks in continuous assessment and 14 marks in University assessment for the respective course.
5. For Continuous Assessment (internal assessment) minimum two tests per paper will be organized.
6. Method of assessment for internal exams: Written test, MCQ type test, Viva-Voce, tutorials, assignments, group discussion, etc.

7. Students can for opt for Microbiology or Chemistry as their principal subject in T.Y. B.Sc. along with Vocational Biotechnology subject.

8. Students who opt for Microbiology and Vocational Biotechnology combination in their T.Y. B.Sc. will have following Theory and Practical Courses in Semester V.

VBt-311 Animal & Plant Tissue Culture

VBt-312- Industrial Biotechnology

VBt-313 Lab Course V: Practical in Tissue Culture techniques & Industrial Biotechnology

***in lieu* of following Theory and Practical Courses**

MB -355 Fermentation Technology-I

MB -356 Agricultural Microbiology

MB -359 Practical Course-III

9. Students who opt for Microbiology and Vocational Biotechnology combination in their T.Y. B.Sc. will have following Theory and Practical Courses in Semester VI.

VBt-321 Biotechnology in Agriculture & Environment,

VBt-322 Section I- Bio-entrepreneurship Section II - Biotechnology for Health

VBt-323 Project Work

***in lieu* of following theory and practical courses**

MB-365 Fermentation Technology-II

MB-366 Food Microbiology

MB 369 Practical Course-III

10. Students who opt for Chemistry and Vocational Biotechnology combination in their T.Y. B.Sc. will have following Theory and Practical Courses in Semester V.

VBt-311 Animal & Plant Tissue Culture,

VBt-312- Industrial Biotechnology

VBt-313 Lab Course V: Practical in Tissue Culture techniques & Industrial Biotechnology

***in lieu* of following Theory and Practical Courses**

CH-504 Inorganic Chemistry-I

CH-505 Industrial Chemistry

CH-506 Inorganic Chemistry Practical-I

11. Students who opt for. Chemistry and Vocational Biotechnology combination in their T.Y. B.Sc. will have following Theory and Practical Courses in Semester VI.

VBt-321 Biotechnology in Agriculture & Environment,

VBt-322 Section I- Bio-entrepreneurship Section II - Biotechnology for Health

VBt-323 Project Work

***in lieu* of following Theory and Practical Courses**

CH-604 Inorganic Chemistry-II

CH-605 Inorganic Chemistry-III

CH-606 Inorganic Chemistry Practical-II

Savitribai Phule Pune University
Syllabus of Vocational Biotechnology (CBCS 2019 Pattern)
Course Structure
F.Y. B. Sc. (Vocational Biotechnology)

Semester	Paper Code	Paper Title	Credits	No. of Lectures	Marks
I	VBt-111	Biological Chemistry	2	30	50 (35 External +15 Internal)
	VBt-112	Biotechnology: Concepts and Applications	2	30	50 (35 External +15 Internal)
	VBt-113	Lab Course I: Practical in Biochemistry	1.5	15 Practical	50 (35 External +15 Internal)
II	VBt-121	Bioinstrumentation	2	30	50 (35 External +15 Internal)
	VBt-122	Biostatistics & Computers for Biologists	2	30	50 (35 External +15 Internal)
	VBt-123	Lab Course II: Practical in Bioinstrumentation, Biostatistics & Computers.	1.5	15 Practical	50 (35 External +15 Internal)

S.Y. B.Sc. (Vocational Biotechnology)

Semester	Paper Code	Paper Title	Credits	No. of Lectures	Marks
III	VBt-211	Cell biology & Microbial Genetics	2	30	50 (35 External +15 Internal)
	VBt-212	Molecular Biology	2	30	50 (35 External +15 Internal)
	VBt-213	Lab Course III: Practical in Cell & Molecular Biology.	2	15 Practical	50 (35 External +15 Internal)
IV	VBt-221	Genetic Engineering	2	30	50 (35 External +15 Internal)
	VBt-222	Bioinformatics	2	30	50 (35 External +15 Internal)
	VBt-223	Lab Course IV: Practical in Genetic Engineering & Bioinformatics	2	15 Practical	50 (35 External +15 Internal)

Syllabus of T.Y. B.Sc. Vocational Biotechnology, CBCS 2019 pattern

Semester	Paper Code	Paper Title	Credits	No. of Lectures	Marks
V	VBt-311	Animal & Plant Tissue culture	2	30	50 (35 External +15 Internal)
	VBt-312	Industrial Biotechnology	2	30	50 (35 External +15 Internal)
	VBt-313	Lab Course V: Practical in Tissue Culture techniques & Industrial Biotechnology	2	15 Practical	50 (35 External +15 Internal)
VI	VBt-321	Biotechnology in Agriculture & Environment.	2	30	50 (35 External +15 Internal)
	VBt-322	Section I- Bio-entrepreneurship Section II - Biotechnology for Health.	2	30	50 (35 External +15 Internal)
	VBt-323	Project Work	2	30	50 (35 External +15 Internal)

Savitribai Phule Pune University, Pune
T.Y. B.Sc. Vocational Biotechnology (CBCS Semester pattern)
Revised Syllabus w.e.f. June 2021
Subject Code: VBt -311- ANIMAL AND PLANT TISSUE CULTURE

2-Credit course
Total Lectures -30

Unit	Title and Contents	No of lectures
Sr. No	**SECTION 1: ANIMAL TISSUE CULTURE**	
Chapter 1	**BASICS OF ANIMAL CELL CULTURE** • 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 culture. Common cell culture contaminants.	5
Chapter 2	**SPECIALIZED TECHNIQUES** • Cell fusion studies • Transplantation of cultured cells • Transfection in animal cells • Expressing cloned products in animal cells	4
Chapter 3	**APPLICATIONS OF ANIMAL TISSUE CULTURE** • 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
	SECTION 2: PLANT TISSUE CULTURE	
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	2

	II) Artificial seed production	
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	3
Chapter 9	**SECONDARY METABOLITE PRODUCTION** I) Hairy root culture II) Production of hairy root and precursors used III) Advantages and limitation	3

Reference Books

1) M.K.Razdan. Introduction to Plant Tissue Culture**,** Oxford and IBH Publishers, (2019), 3rd edition, ISBN-13: 9788120417939
2) DeKalyan Kumar. Plant tissue culture, New Central Book Agency, (2008), ISBN – 9788173810923
3) Ramawat K.G. Plant biotechnology, S Chand & Co Ltd Publishers,(2008), ISBN: 9788121919876
4) P.K.Gupta. Elements of Biotechnology, Rastogi Publications,(2009), ISBN-10- 8171339379
5) R. Spier J. Griffiths. Animal Cell Biotechnology, Academic Press, (1994), Volume 6 6th Edition, ISBN-13- 9780126575569
6) Sudha Gangal. Principles and practice of animal tissue culture, Universities Press, (2007), ISBN-13- 978-8173715785
7) R. Ian Freshney. Culture of animal cells- A manual of basic technique and specialized applications, John Wiley & Sons, Inc.,(2010), 6th edition, ISBN-13- 9780470528129.

Savitribai Phule Pune University, Pune
T.Y. B.Sc. Vocational Biotechnology (CBCS Semester pattern)
Revised Syllabus w.e.f. June 2021
Subject Code: VBt -312- INDUSTRIAL BIOTECHNOLOGY

2-Credit course
Total Lectures -30

Unit	Title and Contents	No of Lectures
Chapter 1	**INTRODUCTION TO INDUSTRIAL BIOTECHNOLOGY**	01
Chapter 2	**FERMENTATION** I) Definition, history and importance II) Layout of typical fermentation unit III) Concepts of primary and secondary metabolites. IV) Fermentation media V) Screening (Primary and secondary) VI) Concept of Strain improvement VII) Inoculum development (Bacteria and fungi)	12
Chapter 3	**TYPES OF FERMENTERS :** I) Design of typical batch fermenter II) Continuous fermenter , Fed batch fermenter, air lift fermenter) III) Measurement and control of different parameters during fermentation (pH, Temperature, dissolved oxygen)	08
Chapter 4	**DOWNSTREAM PROCESSING :** I) Basic steps involved in downstream processing II) Methods involved in downstream processing - Filtration, centrifugation, flocculation, and chromatographic techniques.	03
Chapter 5	**APPLICATIONS OF INDUSTRIAL BIOTECHNOLOGY** I) Vitamins- Vitamin B12 II) Antibiotics - Penicillin III) Beverages - Beer IV) Organic acids- Citric acid V) Enzymes - Amylase	06

References :

1. Casida L. E. J. R. Industrial Microbiology. New Age International PrivateLimited, (2016), ISBN-13- 9788122438024
2. Patel.A. H. Industrial Microbiology, Trinity Press (Publisher), (2016), ISBN-13- 9789385750267
3. Peppler H. L. and Perlman D. Microbial Technology. Volume 1: Microbial Processes, Academic Press New York, (1979), ISBN- 13- 978-0-12-551501-6
4. Samuel Cate Prescott , Cecil Gordon Dunn and Gerald Reed, Prescott and Dunn's Industrial Microbiology,Palgrave Macmillan, (1982), ISBN-13- 978-0333336304
5. Stanbury P. F., Whitaker A. and Hall S. J. Principles of Fermentation Technology,

Butterworth-Heinemann, (2016), 3rd Edition, ISBN: 9780080999531
6. Meshram S. U. and Shinde. G. B. Applied Biotechnology, I K International Publishing House, (2009), ISBN-13: 978-93-80026-56-5
7. B.D Singh. Biotechnology expanding Horizons, Kalyani Publisher, (2014), ISBN-13-9789327222982

Laboratory Practical:
Revised Syllabus w.e.f. June 2021
VBt-313-Lab Course V: PRACTICAL IN TISSUE CULTURE TECHNIQUES & INDUSTRIAL BIOTECHNOLOGY

2 Credit course

Sr. No	Practical in Tissue Culture techniques & Industrial Biotechnology	Total Practical (15)
1	Screening of antibiotic producers from soil samples	02
2	Determination of potency of antibiotics	02
3	Immobilization of yeast on calcium alginate	01
4	Microorganisms producing industrially important enzyme- amylase	02
5	Laboratory design and equipments in animal tissue culture facility Methods of sterilization of apparatus and glasswares for plant and animal cell/ tissue culture	01
6	Working and principles of different instruments- Autoclave, Laminar air flow, pH-meter, Water distillation unit.	02
7	Monitoring of contamination in media /reagents in animal cell culture	01
8	Demonstration on Culture of lymphocytes from blood/tissue sample	01
9	Preparation of nutrient media for plant and animal cell and tissue culture with emphasis on composition and calculation of concentration of ingredients	01
10	Study of effects of auxins on explants	01
11	Study of effects of cytokinins on explants	01

References:

1. S. Kulandaivel & S. Janarthanan. Practical Manual on Fermentation Technology, I K International Publishing House, (2012), ISBN-13 978-9381141809
2. Nagar Santosh and AdhavMadhavi. Practical Book Of Biotechnology & Plant Tissue Culture, S Chand & Company, (2010), ISBN-13 978-8121932004

Savitribai Phule Pune University, Pune
T.Y. B.Sc. Vocational Biotechnology (CBCS Semester pattern)
Revised Syllabus w.e.f. June 2021
Subject Code: VBt -321- BIOTECHNOLOGY IN AGRICULTURE AND ENVIRONMENT

2-Credit course
Total Lectures -30

Unit	Title and Contents	No of Lectures
	AGRICULTURAL BIOTECHNOLOGY	
Chapter 1	**INTRODUCTION TO AGRICULTURAL BIOTECHNOLOGY**	01
Chapter 2	**BIOFERTILIZERS** I) Nitrogen fixing microorganisms enriching the soil with assimilable nitrogen (*Rhizobium, Azotobacter, Azolla-anabaena*) II) Phosphate solubilizers III) Advantages of biofertilizers	06
Chapter 3	**BIOPESTICIDES** I) Definition of biopesticide II) Properties of an ideal biopesticide III) Role of *Bacillus thuringeinsis* as a biopesticide IV) Advantages of biopesticides.	03
Chapter 4	**XENOBIOTIC DEGRADATION** I) Pesticide degradation by microbes II) Herbicide degradation by microbes	03
Chapter 5	**GENETICALLY MODIFIED PLANTS** I) Golden rice II) Flavrsavr tomato	02
	ENVIRONMENTAL BIOTECHNOLOGY	
Chapter 6	**INTRODUCTION TO ENVIRONMENTAL BIOTECHNOLOGY**	01
Chapter 7	**BIOREMEDIATION** I) Definition and types of bioremediation- II) In- situ bioremediation (bioventing, biosparging) III) Ex-situ bioremediation (biopile process, land farming, composting)	04
Chapter 8	**PHYTOREMEDIATION** I) Definition II) Types of phytoremediation- Phytodegradation, phytovolatilization, phytoextraction and phytosequestration.	04
Chapter 9	**BIOFUELS** I) Biogas production using methanogenic bacteria ii) Microbial hydrogen gas production	03

	iii) Ethanol production and its use as fuel, eg. Gasohol	
Chapter 10	**BIOSENSORS** I) Definition, principle and working of biosensors II) Types and applications of biosensors	03

References

1. N. S. SubbaRao. Soil microbiology, Oxford and IBH publication co. New Delhi, ISBN- 978-1886106185
2. Dr.P.R.Yadav and Dr. Rajiv Tyagi. Environmental biotechnology, Discovery Publishing House New Delhi, 2006, ISBN-13- 9788183560719
3. Prof. S.N. Jogdand, Environmental biotechnology, Himalaya Publishing house, (2010), ISBN-13- 978-8184889048
4. Eugenia Olegin ,GloriaSanchez,Elizabeth Hernandez. Environmental biotechnology and Cleaner processes CRC Press, (1999) ,1st edition, ISBN -13- 978-0748407293
5. H.D.Kumar. A textbook of biotechnology, East West publisher, 2000, 2nd edition, ISBN- 13-978-8185938905
6. B.D Singh, Biotechnology expanding Horizons, Kalyani Publisher, (2014), ISBN-13-9789327222982

Savitribai Phule Pune University, Pune
T.Y. B.Sc. Vocational Biotechnology (CBCS Semester pattern)
Revised Syllabus w.e.f. June 2021
Subject Code: VBt -322- BIOENTREPRENEURSHIP AND BIOTECHNOLOGY FOR HEALTH

2-Credit course
Total Lectures -30

Sr.No	Title and Contents	No of Lectures
	SECTION I - BIOTECHNOLOGY AND HEALTHCARE	
Chapter 1	**BIOTECHNOLOGY AND HEALTHCARE** I) Introduction II) Advancement of Diagnosis, therapy and intervention III) Brief introduction to Genomic medicine, personalized medicine etc.	02
Chapter 2	**ENZYME THERAPY** I) Introduction II) Enzymes as Therapeutics III) Therapeutic Enzymes IV) DNase I V) Alginate Lyase	04
Chapter 3	**NANOMEDICINE** I) Introduction II) Biosensors and Nanoparticles III) NanoBiochemical devices IV) Nanomedical diagnosis and treatment V) Applications of Nanomedicine	04
Chapter 4	**REGENERATIVE MEDICINE** I) Introduction II) Tissue Engineering III) Stem Cell Therapy- Definition and Scope, types of stem cells, characteristics and properties	03
Chapter 5	**AN INTRODUCTION TO NATIONAL AND INTERNATIONAL GOVERNMENT REGULATORY BODIES** I) FDA (Food and Drug Administration) II) IAEC(Institutional Animal Ethics Committee) III) IBSC (Institutional Biosafety Committee)	02
	SECTION II- BIOENTRPRENEURSHIP	
Chapter 6	**INTRODUCTION** I) Concept, features, scope and importance of entrepreneurship II) Skills and attributes of an entrepreneur III) Types of entrepreneur	04
Chapter 7	**BUSINESS ORGANIZATION**	03

	I) Forms of business organizations (Sole proprietorship, partnership development, joint stock company, cooperative organization)	
Chapter 8	**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	03
Chapter 9	**ENTRENEURSHIP DEVELOPMENT** I) Identification of opportunities for entrepreneurship II) Start-ups, Incubators for novel ideas/ business/ Start up and case studies III) Criteria for selection of new product or service IV) Market survey as a tool V) Project report and project formulation	05

Reference Books

1. B.D Singh. Biotechnology expanding Horizons, Kalyani Publisher, (2014), ISBN-13- 9789327222982
2. Charles P Poole andFrank J Owens. Introduction to Nanotechnology, Wiley-Interscience publisher, (2003), 1st edition, ISBN -13- 978-0471079354
3. Cao Guohaug. Nanostructures &Nanomaterials: Synthesis, Properties & Applications, Imperial College press, (2004), 2nd edition, ISBN-13- 978-1860944154
4. K K Chattopadhyay and A.N. Banerjee. Introduction to Nanoscience and Nanotechnology, PHI Publisher, (2009), ISBN-13 978-8120336087
5. P. Kiranmai Dutt & Geetha Rajeevan. Basic Communication Skills , Foundation books publisher, (2006), Revised edition, ISBN -13- 978-8175963429
6. J.P Mahajan, Anupama Mahajan and Deepika Dewan, Management Principles And Applications, Vikas Publishing, (2017), ISBN- 13 - 978-9352590599
7. Dr. C. B. Gupta & Dr. S.S Khanna. Entrepreneurship and small Business Management, Sultan Chand & Sons, (2014), ISBN-13- 978-8180548987

Savitribai Phule Pune University, Pune
T.Y. B.Sc. Vocational Biotechnology (CBCS Semester pattern)
Revised Syllabus w.e.f. June 2021
Subject Code: VBt -323- PROJECT WORK

2 Credit course

- 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 **(VBt -323- 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 :

i Aims, Objectives and Rationale of the study
ii Review of literature
iii Methodology/Technology used
iv Experimental outcome
v Summary and Conclusion
vi References in appropriate referencing styles.

- 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.