"Dissemination of Education for Knowledge, Science and Culture"
-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

VIVEKANAND COLLEGE, KOLHAPUR

(AN EMPOWERED AUTONOMOUS INSTITUTE)

DEPARTMENT OF BIOTECHNOLOGY OPTIONAL

Three/Four- Years UG Programme

Department/Subject Specific Core or Major (DSC)

NEP- 3.0

Curriculum, Teaching and Evaluation Structure

(as per NEP-2020 Guidelines)

for

B.Sc.-I Biotechnology Optional

Semester-I & II

(Implemented from academic year 2026-27 onwards)

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for

B.Sc.-I Biotechnology Optional Semester-I & II

(Implemented from academic year 2026-27 onwards)

Verified by

Sr. No.	Name	Designation	Signature
1	Mr.S.G.Kulkarni	BoS Chairman	
2	Dr. S.S. Ankushrao	Dean	
3	Prof. (Dr.) A. S. Kumbhar	NEP Nodal Officer	
4	Prof. (Dr.) C. B. Patil	Principal	

B.Sc. in Biotechnology Optional

B.Sc.: Program Outcomes (POs):

Program Outcomes (POs):

PO1: Disciplinary Knowledge: Graduates will gain an in-depth understanding in their specific major or discipline, mastering the foundational principles and theories, as well as advanced concepts. Execute strong theoretical and practical understanding developed from the specific programme in the area of work.

PO2: Problem-Solving Skills: Graduates will learn to use their knowledge to identify, analyze, and solve problems related to their field of study.

PO3: Analytical Skills: Graduates will gain the ability to collect, analyze, interpret, and apply data in a variety of contexts. They might also learn to use specialized software or equipment.

PO4: Research Skills and Scientific temper: Depending on the field, graduates might learn how to design and conduct experiments or studies, analyze results, and draw conclusions. They might also learn to review and understand academic literature.

PO5: Communication Skills: Many programs emphasize the ability to communicate effectively, both orally and in writing. Graduates may learn to present complex information clearly and succinctly, write detailed reports, and collaborate effectively with others.

PO6: Ethics and Professionalism: Graduates may learn about the ethical and professional standards in their field, and how to apply them in real-world situations.

Program Specific Outcomes (PSOs)

PSO1: Apply foundational knowledge: for understanding basic processes in Biotechnology and bestow the students with all the research skills required to work independently

PSO2: Application of technical knowledge: For a clear understanding of basic subjects of biotechnology as biotechnology is an interdisciplinary course and empowers the students to acquire technological know-how.

PSO3: Utilize modern tools and techniques: To inculcate nature care by imparting knowledge of advanced modern techniques, and laboratory equipment to design, analyze, and test biotechnology-related skills.

PSO4: Development of scientific temperament – to develop scientific temperament and social responsibilities in students

PSO5: Inculcation of research-based perspective: Acquire knowledge in students of biotechnology to enable their application in research and industry

Vivekanand College, Kolhapur (An Empowered Autonomous)

Department of Biotechnology Optional

NEP-3.0

Departmental Teaching and Evaluation scheme

(2026-27 onwards)

Three/Four- Years UG Programme

Department/Subject Specific Core or Major (DSC)

(as per NEP-2020 Guidelines)

First Year Semester-I & II

Sr. No.	Course Abbr.	Course code	Course Name	Teaching Scheme Hours/week		Examination Scheme and Marks					Course Credits
						Theory		Practical		Total	
				TH	PR	SEE	CIE	SEE	CIE	Marks	
Semester-I											
1	DSC-I	3DSC03BIT11	Fundamentals of Biotechnology-I	2	-	30	20			50	2
2	DSC-II	3DSC03BIT12	Fundamentals of Biotechnology-II	2	-	30	20			50	2
3	DSC BIT-PR-I	3DSC03BIT19	DSC Biotechnology Lab -1	-	4	-	-	30	20	50	2
Semester –I Total				**4**	**4**	**60**	**40**	**30**	**20**	**150**	**6**
Semester-II											
1	DSC -III	3DSC03BIT21	Microbiology	2	-	30	20			50	2
2	DSC -IV	3DSC03BIT22	Basics of Cell biology and genetics	2	-	30	20			50	2
3	DSC BIT - PR-II	3DSC03BIT29	DSC Biotechnology Lab-2	-	4	-	-	30	20	50	2
Semester –II Total				**4**	**4**	**60**	**40**	**30**	**20**	**150**	**6**

Abbreviations: TH-Theory, PR-Practical, SEE- Semester End Examination, CIE-Continuous Internal Examination

Note: Minimum passing for 20 marks Internal evaluation = 08 marks

Minimum passing for 30 marks Theory paper/Practical = 12 marks

Separate passing for each Head - SEE, CIE (Theory and Practicals)

Semester -I

B. Sc. Part – I Semester – BIOTECHNOLOGY OPTIONAL

DSC-I: 3DSC03BIT11: FUNDAMENTALS OF BIOTECHNOLOGY-I

Credits: 02 **Theory: 30hrs.** **Marks-50**

Course Outcomes: At the end of this course students will able to

CO1: Explain the fundamental concepts, scope, applications, and ethical aspects of biotechnology.

CO2: Describe the structure, classification, and biological functions of amino acids and proteins.

CO3: Explain the structure, classification, properties, and biological significance of carbohydrates, including diabetes mellitus.

CO4: Describe the classification, properties, biological functions, and clinical significance of lipids and lipid profile tests.

Unit -1: Basic of Biotechnology: **(7 Lectures.)**

Definition, History of biotechnology, Scope, and importance of Biotechnology, Branches of Biotechnology, Biotechnology in India, Commercial potential of Biotechnology, Achievements of biotechnology Misuse of biotechnology, Prevention of misuse of biotechnology, Future of Biotechnology

Unit -2: Amino acids and Protein: **(8 Lectures.)**

Introduction, General structure of amino acids, Structural classification of amino acids based on R-side chain, single and triple letter code, Structure of peptide bond, biological functions of protein, structural levelsof protein- Primary, Secondary, Tertiary (Myoglobin), Quaternary (Hemoglobin), Protein classification based on solubility (Simple, Conjugated, Derived), **protein classification based on solubility**.

Unit -3: Carbohydrates: **(8 Lectures.)**

General classification of carbohydrates, biological functions of carbohydrates, structural Classification of monosaccharide, ring formation in monosaccharide, mutarotation, formation of glycosidic bonds, study with respect to structure, chemical properties, hydrolysis of disaccharides (e.g., sucrose, maltose, lactose), oligosaccharides, Polysaccharides (e.g. starch,glycogen, Cellulose).Diabetes Mellitus cause, type, remedies

Unit-4: Lipids: **(7 Lectures.)**

Definition, classifications of lipids, Simple lipids (triacylglycerol, waxes), Compound lipids (Phospholipids, Sphingolipids, Cerebrosides), Derived lipids (Cholesterol), Chemical and physical properties of lipids, biological functions of lipids, Lipid profile test

Reference Books:

- Text book of biotechnology- Pradip Parihar student ed. Jodpur (2004)
- Biotechnology expanding horizons- B. D. Singh, Kalyani Published
- Elements of biotechnology- P. K. Gupta, Rastogi publications.
- Outline of biochemistry- Conn & Stumph
- Biochemistry- Lubert Stryer
- Principles of Biochemistry- Jeffory, Zubey
- Textbook of Biotechnology – R. C. Dubey
- Biochemistry by Lehninger
- Biochemistry – U. Satyanarayana

B. Sc. Part – I Semester -I BIOTECHNOLOGY
DSC-I: 3DSC03BIT11: FUNDAMENTALS OF BIOTECHNOLOGY-II

Credits: 02 **Theory: 30hrs.** **Marks-50**

Course Outcomes: After the completion of the course the student will be able to:

CO1: Apply different techniques of cell disruption and protein purification for the isolation and purification of proteins.

CO2: Explain the principles of centrifugation and apply different centrifugation techniques for biological sample separation.

CO3: Explain the principles of microscopy and compare the working and applications of compound and electron microscopes.

CO4: Apply the principles of UV-Visible spectroscopy and colorimetry and explain their applications in biological analysis, including X-ray crystallography.

Unit-1: Protein Purification: **(7 Lectures.)**

Method of cell disruption (Blenders, grinding with abrasives, presses, enzymatic method, sonication); Salt participation- Salting in, salting out, organic solvent precipitation, dialysis, ultrafiltration.

Unit-2: Centrifugation: **(8 Lectures)**

Basic principles, RCF, Sedimentation coefficient, Svedberg's constant, Types of centrifuges: Desktop, High speed, and Ultracentrifuge, Preparative centrifugation: Differential and density gradient centrifugation

Unit- 3: Microscopy: **(7 Lectures)**

General principles of microscopy- Image formation, magnification, numerical aperture, resolving powerof the microscope and working distance. b) Ray diagram, special features, applications and comparative study of the compound microscope and Electron Microscope (Scanning and Transmission Electron Microscope).

Unit-4: UV-Visible Spectroscopy, Colorimetry **(8 Lectures)**

Introduction to spectroscopy, properties of electromagnetic radiation Electromagnetic spectrum, Lambert-Beer's law Principle, Instrumentation and applications of colorimeter.

Principle, Instrumentation and applications of colorimeter.

Principle, Instrumentation and applications of x-raycrystalography

Reference books:

- Practical Biochemistry principles and techniques – Willson and Walker
- Protein purification by Robert Scope
- Biophysical chemistry- Nath Upadhyay
- Bioinstrumentation - Veerakumari

DSC- PR-I : 3DSC03BIT19: DSC BIOTECHNOLOGY LAB-I
Practical: Four lectures of 60 minutes per week per batch
Marks: 50 (Credits 02)

BIOTECHNOLOGY LAB I

1. Preparation of Molar and Normal solutions
2. Isolation of casein from milk
3. Study of Lambert Beer's law by copper Sulphate method.
4. Estimation of glucose by DNSA method
5. Isolation of starch from potato
6. Estimation of protein by biuret method
7. Quantitative analysis of reducing sugar by Benedict's method
8. Estimation of ribose by Orcinol method
9. Estimation of deoxyribose by Diphenyl amine method.
10. Identification of amino acid by paper chromatography.
11. Determination of acid value of given fat
12. Study of instruments in biochemistry- Colorimeter, Spectrophotometer, Centrifuge, electrophoresis apparatus, water bath
13. Quantitative analysis of SAP value
14. Preparation of Buffer solution
15. Isolation of chloroplast

Semester -II

B. Sc. Part – I Semester -II BIOTECHNOLOGY OPTIONAL
DSC-III: 3DSC03BIT21: MICROBIOLOGY

Theory: 30 hrs. **Marks-50** **(Credits: 02)**

Course Outcomes: After the completion of the course the student will be able to:

CO1: Explain the history, diversity, beneficial and harmful activities, and applications of microorganisms.

CO2: Describe bacterial morphology and explain the structure and functions of bacterial cell components.

CO3: Classify culture media and apply appropriate methods of sterilization for microbiological practices.

CO4: Apply pure culture isolation and staining techniques for the identification and differentiation of microorganisms.

Unit-1: Introduction **(7 Lectures.)**

History of microbiology (Contributions of Anton van Leeuwenhoek, Alexander Fleming, , Robert Koch) Types of Microorganisms – Bacteria, Algae, Fungi, Protozoa, and Viruses, Beneficial and harmful activities of microorganisms, Applied branches of Microbiology

Unit-2: Morphology and cytology of Bacteria: **(7 Lectures.)**

Morphology of Bacteria – i) Size, ii) Shape, iii) Arrangements

Cytology of Bacteria – Structure of Typical Bacterial Cell.

Structure and functions of Bacterial cell parts: i) Cell wall ii) Cell membrane iii) Capsule and slime layer iv) Flagella v) Pilli vi) Nuclear material vii) Mesosome viii) Ribosome

Unit-3 Culture media and Sterilization **(8 Lectures.)**

Common components of media and their functions Peptone, Yeast extract, NaCl, Agar, and Sugar Culture media - a) Living Media (Lab. animals, plants, bacteria, embryonated eggs, tissue cultures), b) Nonliving media – i) Natural, ii) Synthetic, iii) Semi-synthetic, iv) Differential, v) Enriched, vi) Enrichment, vii) Selective.Sterilization- Methods of sterilization1. Physical method- Dry heat and Moist heat and radiation 2. Chemical methods 3. Filtration

Unit-4: Pure culture techniques and staining procedures: **(8 Lectures.)**

Methods for isolation of pure cultures- Streak plate, pour plate, spread plate.
Definition of dye and stain Classification of stains – Acidic, Basic, and Neutral

Principle, Procedure, Mechanism, and Application of staining procedures: Simple staining, Negative staining, differential staining: Gram staining and Acid fast staining

Reference Books:

- Fundamentals of Microbiology- Frobisher
- Microbiology-Pelczar.
- General Microbiology- Stanier.
- Text book of Microbiology- Ananthnarayan & Panikar.
- Cell and molecular biology- Arumugham

B. Sc. Part – I Semester -II BIOTECHNOLOGY OPTIONAL

DSC-IV: 3DSC03BIT22: BASICS OF CELL BIOLOGY & GENETICS

Theory: 30 hrs. **Marks-50** **(Credits: 02)**

Course Outcomes: After the completion of the course the student will be able to:

CO1: Explain the historical development of cell biology, cell theories, cell types, cell cycle, mitosis and meiosis.

CO2: Describe the structure and functions of major cell organelles and relate their ultrastructure to cellular functions.

CO3: Apply Mendelian laws and genetic principles to explain inheritance, gene structure and modern concepts of the gene.

CO4: Analyze chromosome structure, special chromosomes, extrachromosomal inheritance, linkage and crossing over in relation to genetic inheritance.

Unit-1: History of Cell biology: **(7 Lectures)**

Introduction of cell and concept of prokaryotic andEukaryotic cell.

Cell biology before 19th century, cell biology in19th century,formulation of cell theory, protoplasm theory, germplasm theory,Cell biology in 20th century- organismal theory, Branches of Cell Biology.

Cell division and cell cycle- phases of cell cycle,Mitosis. Meosis

Unit-2: Structure and function of Cell organelles **(8 Lectures)**

Ultrastructure and function of cell membrane, golgibodies, Endoplasmic reticulum (rough & smooth) Ribosome, cytoskeleton structure(actin, microtubules), Mitochondria, chloroplast, Lysosomes, peroxisomes, Nucleus.

Unit-3: Classical genetics **(8Lectures)**

Classical genetics/ Unit factors – Mendel, Mendels Law (Low of Dominance, Low of Segregation, Law of independent assortment) Concept of Incomplete dominance and Codominance Multiple alleles Types of gene Prokaryotic and Eukaryotic gene structure

Modern concept of gene proposed by S. Benzer . Benzer's experiment (complementation assay)

Unit-4: Chromosome **(7 Lectures)**

Chemical composition of chromosome. Structure of chromosome

Special Type of chromosome- Lamp brush chromosome and Polytene chromosome

Extrachromosomal inheritance- Plastids and mitochondrial inheritance Linkage definition, coupling and repulsion hypothesis, linkage groups, Crossing over- Mechanism and theory

Reference books:

- Cytology genetics and evolution- Agrwal and Varma8.Cell biology- C. B. Pawar
- Cell- Cooper.
- Cell biology- Gilard Karp
- Biology of Microorganisms- Brock1
- Cell biology – Albert Brown
- Cell and molecular biology by Arumgum
- Cell and molecular biology by De Robertis

DSC- PR-II : 3DSC03BIT29 : DSC BIOTECHNOLOGY LAB-II
Practical: Four lectures of 60 minutes per week per batch
Marks: 50 (Credits 02)

1. Use and care and study of a compound microscope.
2. Preparation of Culture media- Peptone water, Nutrient broth, and Nutrient Agar.

   MacConkey Agar, Starch agar, Milk agar
3. Monochrome staining
4. Gram's staining
5. Negative staining
6. Motility by Hanging drop method
7. Mounting and identification of molds.
8. Isolation, colony characters, Gram staining, and motility of bacteria isolated from- Air.
9. Isolation, colony characters, Gram staining, and motility of Gram positive bacteria
10. Isolation, colony characters, Gram staining, and motility of Gram negative bacteria
11. Enumeration of Bacteria from the soil by Spread plate count. (SPC)
12. Demonstration of some lab. equipment –Autoclave, Hot air oven, Incubator, Laminar air flow,

    Colony counter, Water distillation unit.
13. Study of mitosis
14. Sums of Mendelian genetics
15. Study of the effect of temperature on the cell membrane.
16. Study of the effect of organic solvent on the cell membrane.

Question Paper Format:

Seat No.	

Ques. paper code	

VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

B.Sc. Part- I (Biotechnology Optional) (Semester-I) Examination……………..

Course Code and Name:2 DSC03 BIT11: FUNDAMENTALS OF BIOTECHNOLOGY

Day: Time: 1 AND 1/2 hours

Date: --/--/---- Marks : 30

Instructions:

1) All the questions are compulsory.

2) Figures to the right indicate full marks.

3) Draw neat labeled diagrams wherever necessary.

Q. 1. Select correct alternative (One mark each): **[4]**

i) Xyzabcdefghijklmnop --------------
a) -------- b) -------- c) -------- d) --------

ii) Xyzabcdefghijklmnop --------------
a) -------- b) -------- c) -------- d) --------

iii) Xyzabcdefghijklmnop --------------
a) -------- b) -------- c) -------- d) --------

iv) Xyzabcdefghijklmnop --------------
a) -------- b) -------- c) -------- d) --------

Q.2. Attempt any TWO (Eight marks each): **[14]**

i) Xyzabcdefghijklmnop.

ii) Xyzabcdefghijklmnop.

iii) Xyzabcdefghijklmnop.

Q.3. Attempt any THREE (Four marks each): **[12]**

i) Xyzabcdefghijklmnop.

ii) Xyzabcdefghijklmnop.

iii) Xyzabcdefghijklmnop.

iv) Xyzabcdefghijklmnop.

v) Xyzabcdefghijklmnop.

i) **Evaluation Pattern for Theory Course:**

Level	Semester	Activities per Semester	Marks
4.5	I & II	1) Home Assignment	10
		2) Midterm test	10
		Total Marks	**20**
5.0	III & IV	1) Seminar/Quiz/Open Book Exam	10
		2) Midterm test	10
		Total Marks	**20**
5.5	V & VI	1)Case study/Problem solving/Book review/Group Discussion/Poster Presentation/Seminar	10
		2) Midterm test	10
		Total Marks	20

Evaluation Pattern for practical Course:

Marks Distribution of Practical (LAB) course: Total Marks: 100

Course Name	CIE -Practical			SEE -Practical			
	Experimental work	Oral	Total Marks	Experimental work	Oral	Journal assessment	Total Marks
Major	15	05	20	20	05	05	30
OE	15	05	20	20	05	05	30

Note: CIE Practical Examination shall be conducted at midterm(after completion of 50% experiments)

Equivalence of Courses:

B.Sc. Part I (Semester I and II)

Sem.	Course in NEP Phase-II					
	Course code	Course Name	Credits	Course code	Course Name	Credits
I	2DSC03BIO11	Fundamentals of Biotechnology-I	2	3DSC03BIO11	Fundamentals of Biotechnology-I	2
	2DSC03BIO12	Fundamentals of Biotechnology - II	2	3DSC03BIO12	Fundamentals of Biotechnology -II	2
	2DSC03BIO19	DSC Biotechnology Lab-1	2	3DSC03BIO19	DSC Biotechnology Lab-1	2
II	2DSC03 BIO21	Microbiology	2	3DSC03 BIO21	Microbiology	2
	2DSC03BIO22	Basics of Cell biology and genetics	2	3DSC03BIO22	Basics of Cell biology and genetics	2
	2DSC03BIO29	DSC Biotechnology Lab-1	2	3DSC03BIO29	DSC Biotechnology Lab-1	2