



**VIVEKANAND COLLEGE, KOLHAPUR
(AUTONOMOUS)**

**DEPARTMENT OF BIOTECHNOLOGY
OPTIONAL
Three/Four- Years UG Programme
Department/Subject Specific Core or Major (DSC)**

NEP- PHASE-II

**Curriculum, Teaching and
Evaluation Structure**

(As per NEP-2020 Guidelines)

For

B.Sc.-I Biotechnology Optional

Semester-I & II

(Implemented from the academic year 2024-25 onwards)

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

Department of Biotechnology Optional

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.

B.Sc. in Biotechnology Optional

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.



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VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

Department of Biotechnology (Optional)

NEP-Phase-II

Departmental Teaching and Evaluation scheme

(2024-25 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
					PR	SEE	CIE	PR	Marks	
Semester-I										
1	DSC-I	2DSC03BIT11	Fundamentals of Biotechnology-I	-	40	10	-	50	2	
2	DSC-II	2DSC03BIT12	Fundamentals of Biotechnology-II	-	40	10	-	50	2	
3	DSC BIT-PR-I	2DSC03BIT19	DSC Biotechnology Lab -1	4	-	-	25	25	2	
4	OEC BIT-PR-I	2OEC03CHS11	Chemical Science-I	4	-	-	25	25	2	
Semester -I Total				8	80	20	50	150	8	
Semester-II										
1	DSC III	2DSC03BIT21	Microbiology	-	40	10	-	50	2	
2	DSC -IV	2DSC03BIT22	Basics of Cell biology and genetics	-	40	10	-	50	2	
3	DSC BIT-PR-II	2DSC03BIT29	DSC Biotechnology Lab-2	4	-	-	25	25	2	
4	OEC BIT-PR-II	2OEC03CHS11	Chemical Science-II	4	-	-	25	25	2	
Semester -II Total				8	80	20	50	150	8	

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

Note: Minimum passing for 10 marks Internal evaluation = 04 marks
 Minimum passing for 40 marks Theory paper = 16 marks
 Minimum passing for 25 marks Practical = 10 marks
 Passing percentage for Democracy, Election and Good Governance (DEGG) and Environmental Studies papers should be 40%

Separate passing for each Head - SEE, CIE and Practicals

Semester -I



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B. Sc. Part – I Semester – BIOTECHNOLOGY OPTIONAL
DSC-I: 2DSC03BUT11: FUNDAMENTALS OF BIOTECHNOLOGY-I
Credits: 02 Theory: 30hrs. Marks-50

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

CO 1: Describe various proteins with respect to their structural level.

CO 2: Classify types of vitamins & able to state their deficiency syndromes.

CO 3: Specify types of Diabetes & can counsel remedies.

CO 4: Outline types & uses of Sugars & Lipids

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, Reaction of amino acids, Structure of peptide bond, biological functions of protein, structural levels of protein- Primary, Secondary, Tertiary (Myoglobin), Quaternary (Hemoglobin), Protein classification based on solubility (Simple, Conjugated, Derived)

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- Jeffery, Zubey
- Textbook of Biotechnology – R. C. Dubey
- Biochemistry by Lehninger
- Biochemistry – U. Satyana:ayana



B. Sc. Part – I Semester -I BIOTECHNOLOGY OPTIONAL
DSC-II: 2DSC03BIT12: 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: Isolate & purify particular protein.
- CO2 Explain the principle of centrifugation
- CO3: Understand the working of Microscope
- CO4: Discuss the instrumentation & working of UV visible spectroscopy.

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 power of 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 & Sterilization: (8 Lectures)

Introduction to spectroscopy, properties of electromagnetic radiation Electromagnetic spectrum, Lambert-Beer's law Principle, Instrumentation and applications of colorimeter.
Principle, Instrumentation, Applications of UV and Visible Spectrophotometer
Methods of sterilization: a) Physical agents: i) Temperature - dry heat, moist heat ii) Radiation- U.V, Gamma radiation iii) filters- membrane filter b) Chemical agents- Phenol & Phenolic compounds, Alcohol,

Reference books:

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

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DSC- PR-1 : 2DSC03B: DSC BIOTECHNOLOGY LAB-I
Practical: Four lectures of 60 minutes per week per batch
Marks: 25 (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



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Semester -II

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

DSC-III: 2DSC03BIT21: MICROBIOLOGY

Theory: 30 hrs.

Marks-50 (Credits: 02)

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

- CO1: Elucidate the harmful activities of bacteria.
- CO 2: Design media to culture-specific bacterial strains.
- CO 3: Conclude the importance of sterilization
- CO 4: Compare various types of staining.

Unit-1: History of Microbiology:

(7 Lectures.)

Contributions of Anton van Leeuwenhoek, Alexander Fleming, Louis Pasteur, Robert Koch, Joseph Lister.

Introduction to 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) Pili vi) Nuclear material vii) Mesosome viii) Ribosome

Unit-3 Culture media and pure culture techniques:

(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.

Methods for isolation of pure cultures- Streak plate, pour plate, spread plate.

Unit-4: Stains and staining procedures:

(8 Lectures.)

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 & Parikar.
- Cell and molecular biology- Arumugham

B. Sc. Part – I Semester -II BIOTECHNOLOGY OPTIONAL
DSC-IV: 2DSC03BIT22: 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:

- CO 1: List various cell organelles with functions.
- CO 2: Differentiate Prokaryotic & Eukaryotic Cells.
- CO 3: Elaborate the Mendelian Genetics.
- CO 4: Predict how crossing over helps inspecies diversity & evolution

Unit-1: History of Cell biology:

(7 Lectures)

Introduction of cell and concept of prokaryotic and Eukaryotic cell.

Cell biology before 19th century, cell biology in 19th 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. Meiosis

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

(8 Lectures)

Classical genetics/ Unit factors – Mendel, Mendels Law (Law of Dominance, Law 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 Varma
- Cell biology- C. B. Pawar
- Cell- Cooper.
- Cell biology- Gilard Karp
- Biology of Microorganisms- Brock I
- Cellbiology – Albert Brown
- Cell and molecular biology by Arumgum
- Cell and molecular biology by De Robertis

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Vivekanand College, Kolhapur (Empowered Autonomous)

DSC- PR-II : 2DSC03B: DSC BIOTECHNOLOGY LAB-II
Practical: Four lectures of 60 minutes per week per batch
Marks: 25 (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 bacteria isolated from- water (Serial dilution and spread plate technique)
10. Enumeration of Bacteria from the soil by Spread plate count. (SPC)
11. Demonstration of some lab. equipment –Autoclave, Hot air oven, Incubator, Laminar air flow, Colony counter, Water distillation unit.
12. Study of mitosis
13. Sums of Mendelian genetics
14. Study of the effect of temperature on the cell membrane.
15. Study of the effect of organic solvent on the cell membrane.



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B.Sc.I BIOTECHNOLOGY (OPTIONAL)

CBCS syllabus with effect from July 2024

OPEN ELECTIVE SYLLABUS

SEMESTER I

S.N.	Content	Credit
1	Use of Internet in Bioinformatics.	
2	Use of Computer in Bioinformatics.	
3	Browsing and understanding of NCBI Webpage	
4	Introduction of Literature database - PubMed	
5	Exploring Nucleic acid database. And its type	
6	Exploring Nucleic acid database from bacterial cell source	
7	Exploring Nucleic acid database from yeast cell source	
8	Exploring Nucleic acid database from plant cell.	
9	Exploring Protein Structural Database	
10	PUBMED and PUBMED Central Database	
11	Exploring Protein Structural Database RASMOL PART -1	
12	Exploring Protein Structural Database RASMOL PART -2	



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Vivekanand College, Kolhapur (Empowered Autonomous)

B.Sc.I BIOTECHNOLOGY (OPTIONAL)

CBCS syllabus with effect from July 2024

OPEN ELECTIVE SYLLABUS

SEMESTER II

S.N.	Content	Credit
1	Study Of human Genome Project.	
2	Protein Structure exploring database – Protein data bank (PDB).	
3	Use of RASMOL to 3 dimensional structure of protein.	
4	Getting Gene sequence from primary DNA sequence.	
5	Getting the Protein sequence from Protein database.	
6	Phylogenetic Tree using Clustal W	
7	Pair wise and Multiple sequence alignment	
8	Basic Bio python modules for handling sequence and structure data.	
9	In silico drug sequencing	
10	Homology modeling and validation	
11	Pharmacomodeling	
12	Molecular docking- protein modelling	



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Question Paper Format:

Seat No.	
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Ques. paper code	
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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:
Date: --/--/----

Time: 2 hours
Marks : 40

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):

[8]

- i) Xyzabcdefga) ----- b) ----- c) ----- d) -----
- ii) Xyzabcdefga) ----- b) ----- c) ----- d) -----
- iii) Xyzabcdefga) ----- b) ----- c) ----- d) -----
- iv) Xyzabcdefga) ----- b) ----- c) ----- d) -----
- v) Xyzabcdefga) ----- b) ----- c) ----- d) -----
- vi) Xyzabcdefga) ----- b) ----- c) ----- d) -----
- vii) Xyzabcdefga) ----- b) ----- c) ----- d) -----
- viii) Xyzabcdefga) ----- b) ----- c) ----- d) -----

Q.2. Attempt any TWO (Eight marks each):

[16]

- i) Xyzabcdefg- ii) Xyzabcdefg- iii) Xyzabcdefg

Q.3. Attempt any FOUR (Four marks each):

[16]

- i) Xyzabcdefg- ii) Xyzabcdefg- iii) Xyzabcdefg- iv) Xyzabcdefg- v) Xyzabcdefg- vi) Xyzabcdefg

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Evaluation Pattern for practical Course:

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

Course	Experimental work	Journal assessment	Seminar/ Mini Project	Total Marks
Major	20	05	-	25
OE	20	05	-	25

Equivalence of Courses:

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

Sem.	Old Course			Course in NEP Phase-II		
	Course code	Course Name	Credits	Course code	Course Name	Credits
I	DSC-1009A1	Basics of Biotechnology-I	2	2DSC03BIO11	Fundamentals of Biotechnology-I	2
	DSC-1009A2	Basics of Biotechnology-II	2	2DSC03BIO12	Fundamentals of Biotechnology -II	2
II	DSC-1009B1	Microbiology	2	2DSC03 BIO21	Microbiology	2
	DSC-1009B2	Basics of Cell biology and genetics	2	2DSC03BIO22	Basics of Cell biology and genetics	2
	DSC-1009A & DSC-1009B	Biotechnology Lab-1	4	2DSC03BIO19	DSC Biotechnology Lab-1	2
				2DSC03BIO29	DSC Biotechnology Lab-2	2

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