



**VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)**

DEPARTMENT OF BIOTECHNOLOGY

OPTIONAL

Three/Four- Years UG Programme

Department/Subject Specific Core or Major (DSC)

**Curriculum, Teaching and
Evaluation Structure**

for

B.Sc.-I Biotechnology

Optional

Semester-I & II

(Implemented from the academic year 2023-24 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.



VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS)

Department of Biotechnology (Optional)

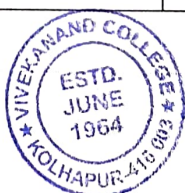
Teaching and Evaluation scheme

Three/ Four- Years UG Programme

Department/ Subject Specific Core or Major (DSC)

First Year Semester-I&II

Sr. No.	Course Abbr.	Course code	Course Name	Teaching Scheme Hours/week		Examination Scheme and Marks				Course Credits
				TH	PR	ESE	CIE	PR	Marks	
Semester-I										
1	DSC-I	DSC03BIT11	Fundamentals of Biotechnology-I	2	-	40	10	-	50	2
2	DSC-II	DSC03BIT12	Fundamentals of Biotechnology-II	2	-	40	10	-	50	2
3	MIN-I	MIN03BIT11	Basics of Biotechnology-I	2	-	40	10	-	50	2
4	MIN-II	MIN03BIT12	Basics of Biotechnology-II	2	-	40	10	-	50	2
5	OEC-I	OEC03BIT11	Scope of Biotechnology-I	2	-	40	10	-	50	2
6	OEC-II	OEC03BIT12	Scope of Biotechnology-II	2	-	40	10	-	50	2
Semester-II										
1	DSC-III	DSC03BIT21	Microbiology	2	-	40	10	-	50	2
2	DSC-IV	DSC03BIT22	Cell biology and genetics	2	-	40	10	-	50	2
3	MIN-III	MIN03BIT21	Basics of Microbiology	2	-	40	10	-	50	2
4	MIN-IV	MIN03BIT22	Basics of Cell Biology	2	-	40	10	-	50	2
5	OEC-III	OEC03BIT21	Immunology	2	-	40	10	-	50	2
6	OEC-IV	OEC03BIT22	Techniques in r-DNA	2	-	40	10	-	50	2
7	SEC-I	SEC03BIT29	Basic Instrumentation in Biotechnology	-	4	-	-	50	50	2
Annual										
1	DSC-PR-I	DSC03BIT29	DSC Biotechnology Lab Course-1	-	4	-	-	50	50	4
2	MIN-PR-I	MIN03BIT29	MIN Biotechnology Lab Course-1	-	4	-	-	50	50	4
3	OEC-PR-I	OEC03BIT29	OEC Biotechnology Lab Course-1	-	4	-	-	50	50	4
Total				24	16	480	120	200	800	38



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

Theory: 30 hrs.

Marks-50 (Credits: 02)

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

CO 1: Describe various proteins concerning their structural level.

CO 2: Understand biotechnology Scope and importance and types of Biotechnology

CO 3: Specify types of Diabetes, symptoms and 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 according to solubility- Simple, Conjugated, Derived protein.

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 Strayer
- Principles of Biochemistry- Jeffery, Zubey
- Textbook of Biotechnology – R. C. Dubey
- Biochemistry by Lehninger
- Biochemistry – U. Satyanarayana



B. Sc. Part – I Semester -I BIOTECHNOLOGY OPTIONAL
DSC-II: DSC03BIT12: FUNDAMENTALS OF BIOTECHNOLOGY-II
Theory: 30 hrs.
Marks-50 (Credits: 02)

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 a Microscope and its types like compound to electron 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



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

DSC-III: DSC03BIT21: MICROBIOLOGY

Theory: 30 hrs.

Marks-50 (Credits: 02)

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

- CO 1: 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) Pilli 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 & Panikar.
- Cell and molecular biology- Arumugham



**B. Sc. Part – I Semester -II BIOTECHNOLOGY OPTIONAL
DSC-IV: DSC03BIT22: 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 and Eukaryotic Cells.
- CO 3: Elaborate the Mendelian Genetics.
- CO 4: Predict how crossing over helps in species 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 the 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, and Nucleus.

Unit-3: Classical genetics

(8Lectures)

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
- Cellbiology – Albert Brown
- Cell and molecular biology by Arumgum
- Cell and molecular biology by De Robertis



DSC- PR-I: DSC03BIT29: DSC BIOTECHNOLOGY LAB-I & II

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 sulfate 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 acids 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

BIOTECHNOLOGY LAB II

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.



Vivekanand College, Kolhapur (Empowered Autonomous)

B. Sc. Part – I Semester -I BIOTECHNOLOGY OPTIONAL MIN-I: MIN03BIT11: BASICS OF BIOTECHNOLOGY-I

Theory: 30 hrs.

Marks-50 (Credits: 02)

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

CO 1: Describe various proteins concerning their structural level.

CO 2: state scope of Biotechnology at national and international level.

CO 3: Specify types of Diabetes, causes and remedies.

CO 4: To understand the types and 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 level protein- Primary, Secondary, Tertiary (Myoglobin), Quaternary (Hemoglobin)

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 OPTIONAL
MIN-II: MIN03BIT12: BASICS OF BIOTECHNOLOGY-II
Theory: 30 hrs.**

Marks-50 (Credits: 02)

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

- CO1: Isolate and purify particular protein.
- CO2 Explain the principle of centrifugation
- CO3: Understand the workings of Microscope
- CO4: Discuss the instrumentation & and 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 the 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



**B. Sc. Part – I Semester -I BIOTECHNOLOGY OPTIONAL
MIN-III: MIN03BIT21: BASICS OF 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.
- Textbook of Microbiology- Ananthnarayan & Panikar.
- Cell and molecular biology- Arumugham



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

MIN -IV: MIN03BIT22: BASICS OF CELL BIOLOGY

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 and evolution

Unit-1: History of Cell Biology:

(7 Lectures)

Introduction of cell and concept of prokaryotic and Eukaryotic cell.

Cell biology before the 19th century, cell biology in the 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 the cell membrane, Golgi bodies, 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 biology- Gilard Karp
- Biology of Microorganisms- Brock l
- Cellbiology – Albert Brown
- Cell and molecular biology by Arumgum
- Cell and molecular biology by De Robertis



MIN-PR-I: MIN03BIT29: MIN BIOTECHNOLOGY LAB-1 & II

Practical: Four lectures of 60 minutes per week per batch

Marks: 50 (Credits 02)

BIOTECHNOLOGY LAB COURSE 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

BIOTECHNOLOGY LAB II

1. Use and care and study of compound microscope.
2. Preparation of Culture media- Peptone water, Nutrient broth and Nutrient Agar. MacConkey's Agar, Sabroude's Agar, Sraach agar, Milk agar
3. Microscopic examination of bacteria- Monochrome staining
4. Gram 's staining
5. Negative staining
6. Motility
7. Mounting and identification of molds.
8. Isolation, colony characters, Gram staining and motility of bacteria isolated from- Air(Solid impaction technique)
9. Isolation, colony characters, Gram staining and motility of bacteria isolated from- water(Serial dilution and spread plate technique)
10. Enumeration of Bacteria from soil by total viable count by Spread plate count.
11. Demonstration of some lab. Equipment's –Autoclave, Hot air oven, Incubator, Laminar air flow, Colony counter, Water distillation unit
12. Study of mitosis
13. Sums of menellian genetics
14. Study of effect of temperature on cell membrane.
15. Study of effect of organic solvent on cell membrane.



B. Sc. Part – I Semester -I BIOTECHNOLOGY
OEC-I: OEC03BIT11: SCOPE OF BIOTECHNOLOGY-I

Theory: 30 hrs.

Marks-50 (Credits: 02)

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

CO1: Understand the fundamental Biotechnology

CO2: Understand new and old Biotechnology

CO3: Understand the Biotechnology and environmental impact

CO4: Understand food Biotechnology

Unit -1: Introduction to Biotechnology

(7Lectures)

Biotechnology is an applied interdisciplinary science, green biotechnology, red biotechnology, and blue biotechnology. White biotechnology, grey biotechnology, Scope and importance of biotechnology,

Unit -2: Old and new biotechnology

(8 Lectures)

Introduction, history of biotechnology, Biotechnology in India, Recent trends in Biotechnology, GMOs, and bioethical principles.

Unit -3: Biotechnology in agriculture

(7 Lectures)

Transgenic plant, Gene construction and transmission method, Herbicide resistance plant (Round up ready) Insect resistance plant (BT-cotton), Nutritional quality food-Golden rice.

Unit-4: Food biotechnology

(8 Lectures)

Introduction to food biotechnology. Fermented products – milk products (yogurt, Cheese) Wine Beer, Single Cell Protein(SCP)

Reference Books:

- A textbook of Biotechnology – R.C, Dubey
- A. textbook of Biotechnology- U. Sattynarayan
- Textbook of biotechnology- Pradip Parihar student ed. Jodpur (2004)
- Biotechnology expanding horizons- B. D. Singh, Kalyani Published
- Elements of biotechnology- P. K. Gupta, Rastogi publications



B. Sc. Part – I Semester -I BIOTECHNOLOGY
OEC -II: OEC03BIT12: SCOPE OF BIOTECHNOLOGY-II

Theory: 30 hrs.

Marks-50 (Credits: 02)

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

- CO1: Understand the principles of health biotechnology
- CO2: Understand the bioprocesses related to Biotechnology
- CO3: Understand the construction, and applications of Plant tissue culture
- CO4: Understand the construction, and applications of animal tissue culture

Unit-1: Health Biotechnology

(7 Lectures)

Vaccine and its type, Gene therapy, Stem cell technology and its application in biotechnology

Hybridoma technology – Monoclonal antibody production.

Unit-2: Industrial Biotechnology

(8 Lectures)

Introduction to bioprocess, Design of fermenter, upstream and downstream processing .
Production of antibiotics Penicillin, and production of amylase

Unit- 3: Techniques in plant tissue culture

(7 Lectures)

Introduction, Landmarks in plant tissue culture, Scope and applications of plant tissue culture.

Infrastructure and organization of laboratory. Media preparation and aseptic technique.
Callus culture

Unit-4: Animal Biotechnology

(8 Lectures)

Introduction, Landmarks in animal tissue culture, Scope and applications of animal tissue culture. Infrastructure and organization of laboratory. Media preparation and aseptic technique. Basic technique in mammalian cell culture,

Reference Books:

- A textbook of Biotechnology – R.C, Dubey
- A. textbook of Biotechnology- U. Satyanarayana
- Textbook of biotechnology- Pradip Parihar student ed. Jodpur (2004)
- Biotechnology expanding horizons- B. D. Singh, Kalyani Published
- Elements of biotechnology- P. K. Gupta, Rastogi publications



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

OEC-III: OEC03BIT21: IMMUNOLOGY

Theory: 30 hrs.

Marks-50 (Credits: 02)

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

CO1: Understand the role of immunity in an individual

CO2: Understand the importance of cells and organs of the immune system

CO3: Understand the nature of antigen and mode of action

CO4: Understand the nature of antibodies and their action against antigen

Unit-1: Immunity:

(7 Lectures)

Introduction of immunology, Types of defense mechanism – first line and second line of defense

Unit-2: Organs and cells of the immune system

(7 Lectures)

Primary and secondary lymphoid organs- Cells Monocytes, Macrophages, Granulocytes, Mast Cells, Dendritic cells, and NK cells. B and T cells

Unit-3 Antigen:

(8 Lectures)

Definition, chemical nature, and types of antigen, Factors affecting antigenicity

Unit-4: Antibody:

(8 Lectures)

Definition, chemical nature, Basic structure of immunoglobulins, types of antibodies, theories of antibody production

Reference Books:

- Essential immunology by Riott
- Immunology- Kuby
- General Microbiology – Stainer
- Immunology- Nandini Shetty



B. Sc. Part – I Semester -II BIOTECHNOLOGY OPTIONAL
OE -IV: OEC03BIT22: TECHNIQUES IN r-DNA TECHNOLOGY

Theory: 30 hrs.

Marks-50 (Credits: 02)

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

- CO1: Understand Scope of r-DNA technology
- CO2: Understand different techniques in r-DNA technology
- CO3: Explore the concept and types of PCR
- CO4: Understand the DNA sequencing techniques

Unit-1: r-DNA technology (7 Lectures)

Definition, Tools of r-DNA technology, Process of r-DNA technology, applications of r-DNA technology and gene cloning , Production of r-insulin

Unit-2: Blotting techniques (8 Lectures)

Procedure and applications of Southern blotting, Northern blotting, Western blotting

Unit-3: Polymerase Chain Reaction (PCR) (7 Lectures)

Concept, types and applications – Reverse transcriptase, real time PCR, Nested PCR, Hot start PCR, Multiplex PCR, Colony PCR

Unit-4: DNA sequencing techniques (8 Lectures)

Maxam and Gilbert method, Sanger's method and Automated DNA sequences.
Safety measures- biological risk for r-DNA work, Hazards in genetic engineering

Reference Books:

- A textbook of Biotechnology – R.C, Dubey
- A. textbook of Biotechnology- U. Satyanarayana
- Gene technology – S.N. Jogdand
- Introduction to Biotechnology- B.D. Singh
- Genome by T.A. Brown



OE-PR-I: OEC03BIT29: OEC ELECTRONICS LAB-1
Practical: Four lectures of 60 minutes per week per batch
Marks: 50 (Credits 02)

SCOPE OF BIOTECHNOLOGY LAB COURSE I

1. Lab. Organization and general techniques in PTC
2. Preparation of MS media and Stock solution
3. Sterilization and inoculation of explant
4. Callus culture technique
5. Suspension culture
6. Formation of artificial seed
7. Anther Culture
8. ATC laboratory design
9. ATC lab equipment
10. Agrobacterium-mediated transformation in dicot plants

IMMUNOLOGY AND r-DNA technology LAB Course II

1. Isolation of Genomic DNA from bacteria
2. Isolation of plasmid DNA from bacteria
3. Demonstration of gel electrophoresis.
4. Demonstration of DNA amplification by PCR
5. DNA sequencing by analysis of autoradiogram
6. Demonstration of southern blotting.
7. DOT ELISA
8. Qualitative WIDAL test
9. Radial Immuno Diffusion Assay (RID)
10. Rapid Plasma Reagin (RPR)



B. Sc. Part – I Semester -I BIOTECHNOLOGY
SEC -I: SEC03BIT29: BASIC INSTRUMENTATION IN BIOTECHNOLOGY

Theory: 30 hrs.

Marks-50 (Credits: 02)

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: Basic instrumentation

(7 Lectures.)

Introduction principle, application of electrophoresis- Agarose and PAGE

Construction and working of pH meter, Autoclave, and Laminar airflow

Unit-2: Centrifugation:

(8 Lectures)

Types of centrifuges: Desktop, High speed, and Ultracentrifuge, Preparative centrifugation:

Differential and density gradient centrifugation, Care and use

Unit- 3: Microscopy

(7 Lectures)

special features and applications of the compound microscope and

Electron Microscope (Scanning and Transmission Electron Microscope).

Fluorescence and phase contrast microscope, Inverted microscope, Atomic force microscopy

Unit-4: Spectroscopy

(8 Lectures)

Introduction to spectroscopy, Principle, Instrumentation and applications of colorimeter.

Principle, Instrumentation, Applications of UV and Visible Spectrophotometer.

Fluorescence spectroscopy, Atomic spectroscopy

S.N.	Title of techniques
1.	Demonstration of of UV and Visible Spectrophotometer and colorimeter, pH meter, Laminar airflow
2.	Demonstration of SDS-PAGE
3.	Separation of mitochondria by centrifugation
4.	Special Staining- Capsule staining by Mannvales method

Reference books:

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

Nature of theory question paper
Paper- I

Total Marks-40

Instruction:-

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Draw net labelled diagram wherever necessary.

Q.1 Choose correct alternative, rewrite the sentences.

8M

1. a. b. c. d.
2. a. b. c. d.
3. a. b. c. d.
4. a. b. c. d.
5. a. b. c. d.
6. a. b. c. d.
7. a. b. c. d.
8. a. b. c. d.

Q.2 Attempt any Two of the following

16M

- A.
- B.
- C.

Q.3 Attempt any Four of the following

16M

- a.
- b.
- c.
- d.
- e.
- f.

For internal examination 10 marks each paper
Assignment/ Seminar/ test

10M



Practical Examination

Q.1 One major practical (Biochemistry)	10M
Q.2 One Miner Practical (Biochemistry)	05 M
Q.3 One major practical (Cell biology and Microbiology)	10M
Q.4 One Miner Practical (Cell biology and Microbiology)	05 M
Q.5 Spotting	10M
Q.6 Journal	10M

