

Sri Sathya Sai College for Women, Bhopal

(An Autonomous College affiliated to Barkatullah University, Bhopal)

(NAAC Accredited 'A' Grade)



SYLLABUS

PG

SESSION- 2023-24

Class: M.Sc. Semester-I & II

SUBJECT: Biotechnology

Sri Sathya Sai College for Women, Bhopal
 (An Autonomous College Affiliated to Barkatullah University, Bhopal)
 Department of Higher Education, Govt. of M.P.
 Post Graduate Semester Wise Syllabus
 As recommended by Central Board of Studies and approved by the Governor of M. P.
Session 2023-24

M.Sc. – Biotechnology

SEMESTER I

Paper	Course Curriculum: 2020-21 <u>Title of the Paper</u>	Theory	Min. Marks for Passing
	(A) Theory Papers		
I	Cell Biology	85	31
II	Structure, function & Metabolism of Biomolecules	85	31
III	General & Applied Microbiology	85	31
IV	Bioinstrumentation	85	31
	(B) Practicals I (based on paper I, II, III and IV)	100	36
	(C) Internal Assessment CCE – I Paper CCE – II Paper CCE – III Paper CCE – IV Paper Written Test based on each paper (each of 05 marks)	15 15 15 15	05 in each test

Total marks = Theory + CCE

100 = 85 + 15

Passing marks = 36 out of 100 for each paper

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Prof. V. K. S. B. in Govt. Hqs

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Sri Sathya Sai College for Women, Bhopal
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Department of Higher Education, Govt. of M.P.

Post Graduate Semester Wise Syllabus

As recommended by Central Board of Studies and approved by the Governor of M. P.

Session 2023-24

M. Sc. First Semester

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|--------------------|---|--------------------|-----------------------------------|---|-----|
| 1. CourseCode | : | | 6. MaximumTheoryMarks | : | 500 |
| 2. CourseName | : | M.Sc.Biotechnology | 7. MinimumPassingPercentage | : | 36 |
| 3. TotalPaper | : | 04 | 8. Laboratory | : | 100 |
| 4. CompulsoryPaper | : | 04 | 9. Laboratory Passing Percentage: | | 36 |
| 5. Laboratory | : | 01 | | | |

Sub Code	Subject Name	Theory									Practical		Total	
		Paper					CCE		Total Marks		Max.	Min.	Max.	Min.
		1st	2nd	3rd	Max.	Min.	Max	Min.	Max.	Min.				
	Cell Biology	85	0	0	85	31	15	5	100	36	0	0	100	36
	Structure, function & Metabolism of Biomolecules	85	0	0	85	31	15	5	100	36	0	0	100	36
	General & Applied Microbiology	85	0	0	85	31	15	5	100	36	0	0	100	36
	Bioinstrumentation	85	0	0	85	31	15	5	100	36	0	0	100	36
	Laboratory-I	0	0	0	0	0	0	0	100	36	0	0	100	36

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Post Graduate Semester Wise Syllabus

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Class	-	M.Sc.
Semester	-	I
Subject	-	Biotechnology
Paper	-	I
PaperName	-	Cell Biology

Max Marks: 85

UNIT-I: General structure of Cell. Historical origins of cell biology: The discovery of cell, development of the cell theory. The molecular evolution. Chemical bonds and functional groups in biological molecules.

UNIT-II: The structural and functional organization of cell membrane, ionic transport (Passive and active transport) the extra cellular matrix of eukaryote's cellwall.

UNIT-III: Structure and functions of endoplasmic reticulum, golgi complex, ribosome lysosomes, peroxisomes (glyoxysomes), plastids and mitochondria. Biogenesis of mitochondria and chloroplast.

UNIT-IV: Steps in cell cycle, cell cycle check points, yeast as model system, cell division control and regulation yeast cdc gene. Genes for social control of cell, proto-oncogenes.

Cell signaling: Exocrine, Endocrine, Paracrine and Synaptic strategies of chemical signaling, surface receptor mediated transduction (G-Proteins, Tyrosine kinases, steroid receptor and mediators: DAG, Ca⁺², c-AMP)

UNIT-V: Cytoskeleton and cell motility: Microtubules, microfilaments and intermediate elements. Nuclear ingredients: Nuclear membrane, Organization of Chromatin: chromosome structure. Nature of the genetic material, proteins associated with nuclei. Packaging of genetic material: nucleosome model,

RECOMMENDED BOOKS:

Molecular Biology of Cells, (2002), 4th Edition; Albert's et al. Molecular Cell Biology (2004), Lodish et al.

Cell and Molecular Biology; Concepts & Experiments (2004). Karp, G. The Cell: A molecular Approach (2004), Cooper, G.M

Cell & Molecular biology, de Robertis & de Robertis.

Cell proliferation and apoptosis (2003); Hughes & Mehnert. Biochemistry & Molecular Biology of plants (2004); Buchanan et al. Lehninger Principles of Biochemistry, (2005) Nelson & Cox.

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As recommended by Central Board of Studies and approved by the Governor of M. P.
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Class - **M.Sc.**
Semester - **I**
Subject - **Biotechnology**
Paper - **II**

Paper Name - Structure, Function & Metabolism of Biomolecules

Max Marks: 85

UNIT-I: Some important properties of water: The law of Mass action; Dissociation of water and its ion product. pH, Bronsted Acids, ionization of weak acids and bases; Henderson-Hasselbalch equation, Titration curves and buffering action, physiological buffers. Principle of Thermodynamics.

UNIT-II: Carbohydrates: Classification, structure, function and properties of sugars, storage polysaccharides and cell walls. Glycolysis, gluconeogenesis, HMP shunt and glycogen metabolism. Synthesis of cellulose and starch. Oxidative phosphorylation, compartmentation of respiratory metabolism. Regulation of carbohydratemetabolism.

UNIT-III: Proteins-Amino Acids: essential and non essential amino acids; common, rare and non-protein amino acids; acid base properties and chemical reactions of amino acids; stereochemistry and absorption spectra of amino acids. Biosynthesis and degradation of following amino acids: alanine, serine, lysine cysteine, arginine, methionine, tryptophan, phenylalanine glutamine. Proteins: Primary, secondary, tertiary and quaternary structure of proteins. Optical and chemical properties of peptides and small proteins. Hydrolysis of proteins: Action of different proteases. Regulation of amino acid metabolism.



UNIT-IV: Nucleic acids: general structure and functions of purines, pyrimidines, nucleosides, nucleotides; hydrolysis of nucleic acids. Biosynthesis of purines and pyrimidines, nucleosides and nucleotides. Degradation of purines and pyrimidines. Salvage pathway.

UNIT-V: Lipids: Classification, nomenclature and structure of fatty acids, triacylglycerols, sphingolipids and phospholipids, waxes, glycolipids and sterols. Beta-oxidation of fatty acids, biosynthesis of fatty acids and triacylglycerols. Lipid proteins system and transport of lipoproteins of blood plasma. Regulation of lipid metabolism.

RECOMMENDED BOOKS:

Lehninger Principles of Biochemistry (2005), Nelson & Cox. Biochemistry (2004); Stryer, L.

Text book of Biochemistry (1997), Devlin, Thomas, M.

Biochemistry (1993) Zubay, G.

Biochemistry Fundamentals, Voet et al. Biochemistry, Friedlander, D.

Practical Biochemistry, Plummer.

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Session 2023-24

Class	-	M.Sc.
Semester	-	I
Subject	-	Biotechnology
Paper	-	III
Paper Name	-	General & Applied Microbiology

Max Marks: 85

UNIT-I: Introduction to Microbiology: Historical background & scope, Difference between prokaryotic and eukaryotic organisms, structure of cell wall and peptidoglycan, Methods of Microbiology: Pure culture techniques, sterilization techniques, principle of microbial nutrition, preparation of culture media, enrichment culture techniques for isolation of microbes.

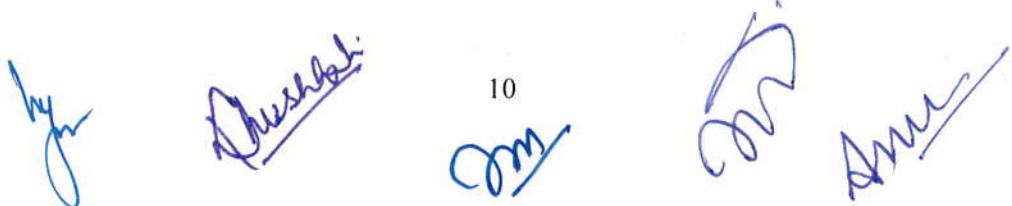
UNIT-II: Classification of Bacteria: Basic principle and techniques used in bacterial classification. Phylogenetic polyphasic taxonomy and numerical taxonomy. New approaches of bacterial taxonomic classification including genetic methods, Ribotyping, Ribosomal RNA sequencing, characteristic of primary domains.

UNIT-III: Viruses: General characteristics, Morphology, Classification and structure of plant, animal and bacterial viruses, Cultivation of viruses, a brief account of Adenoviruses, Herpes, Retrovirus, Viroids and prions.

Microbial Growth: The definition of growth, bacterial generation and doubling time, specific growth rate and yield measurement, Monoauxic, Diauxic and synchronized growth curve. Factors affecting microbial growth. Culture collection & maintenance of culture. Sporulation in bacteria.

UNIT-IV: Control of Microorganism by Physical & chemical agents: Antimicrobial agents, Sulfa drugs, Antibiotics (penicillin and cephalosporin) Broad Spectrum antibiotics, antibiotics from prokaryotes, Anti fungal antibiotics, Mode of action (a brief account), resistance of antibiotics (a brief account)

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UNIT-V: Microbial Ecology: Microbial flora of soil, Interaction among soil microorganisms.
Nitrogen fixation (a brief account), Symbiotic association-types, functions and establishment of symbiosis. *A. niger*, yeast, *Pseudomonas putida*,

RECOMMENDED BOOKS:

Alcamo's Fundamental of Microbiology, (2004); Pommerville et al.
Microbiology (1996); Prescott, Harley & Klein
Microbiology (2004); Tortora, F.
Foundation in Microbiology (1996); Talaro & Talora. Food
Microbiology (2004); Adam, M.R.
Principles of Microbiology (1994); Atlas, R.M. Pharmaceuticals
Microbiology (2003); Purohit & Saluja. Microbiology: A Lab
Manual, Cappuccino et al.
Brock Biology of Microbiology, Martinko, M.T & Parker, J.

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Class	-	M.Sc.
Semester	-	I
Subject	-	Biotechnology
Paper	-	IV
PaperName	-	Bioinstrumentation

Max Marks: 85

UNIT-I: Microscopic Techniques: Principles and Applications of Light, Phase Contrast, Fluorescence Microscopy, Scanning and Transmission Electron Microscopy, Confocal Microscopy, Cytophotometry and Flow Cytometry, patch clamping, advances of microscopy. Microtomy and its application.

Centrifugation: Preparative and Analytical Centrifuges, Sedimentation analysis RCF, Density Gradient Centrifugation.

UNIT-II: Chromatography Techniques: Theory and Application of Paper Chromatography, TLC, Gel Filtration Chromatography, Ion Exchange Chromatography, Affinity Chromatography, GLC and HPLC.

UNIT-III: Electrophoretic Techniques: Theory and Application of PAGE (SDS and native), Agarose Gel Electrophoresis 2 Dimensional Electrophoresis, Iso-electric Focusing, Immuno diffusion, Immuno Electrophoresis, ELISA, RIA. Southern, Northern and Western Blotting.

UNIT-IV: Spectroscopic Techniques: Theory and Application of UV and Visible Spectroscopy, Fluorescence Spectroscopy, MS, NMR, ESR, Atomic Absorption Spectroscopy, X-ray Spectroscopy, LASAR, Raman Spectroscopy. MALDI.

UNIT-V: Radio-isotopic Techniques: Introduction to Radioisotopes. Radioactive Decay – Types and Measurement, Principles and Applications of GM Counter, Solid and Liquid Scintillation Counter, Autoradiography, RIA, Radiation Dosimetry. Biological Applications of Radioisotopic techniques,

RECOMMENDED BOOKS:

- Physical Biochemistry: Application to Biochemistry and Molecular Biology – Freilder.
- Biochemical Technique : Theory and Practice , - Robyt & White
Principle of Instrumental Analysis – Skoog & West
- Principle & Technique – Practical Biochemistry 5th Ed. (2000) - Walker J. & Wilson K.
Biochemical Technique Theory & Practical- White, R.
- Principle of Instrumental Analysis – Skoog et al.
- Microbiology – Fundamental & Application (1995) - Atlas, R.M.
Biophysical Chemistry – Upadhyay & Nath.

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Class - **M.Sc.**
Semester - **I**
Subject - **Biotechnology**
PaperName - **Laboratory**

Max Marks: 100

Laboratory-I

1. Chromosome preparation: mitosis-onion root tip, rat/mouse cornea/ human lymphocyte.
2. Chromosome preparation meiosis- rat / mouse testis, grasshopper testis.
3. Polytene chromosome preparation from Drosophila salivary gland.
4. Histochemical localization of DNA and RNA in onion peel.
5. Demonstration of microbiological technique-sterilization, autoclaving and incubation etc.
6. Preparation of liquid and solid media for growth of microorganism.
7. Preparation of different stain –simple stain, gram stain and differential stain.
8. Isolation and maintenance of microorganism by plating, streaking and serial dilution method. slants and sub culture for storage of microorganism.
9. Isolation of pure culture from air, soil, water and study of colony characteristic.
10. Staining of bacterial culture –endospores and capsule.
11. Measurement of growth by colony forming unit and turbidometry.
12. Biochemical characterization of selected microbes.
13. Analysis of water for potability and determination of MPN.
14. One step growth curve of coliphage.
15. Determination of lambda max, verification of Beer's law.
16. Titration of amino acid.
17. Colorimetric determination of pk.
18. Quantitative assay of protein by Lowry, Biuret and Bradford method.
19. Quantitative assay of sugar by DNSA and Benedict reagent.
20. Separation of amino acid and sugar by paper and thin layer chromatography.
21. Electrophoresis of protein, native and under denaturing condition.
22. Separation of sub-cellular organelles by differential centrifugation.
23. Analysis of oil, iodine number, saponification & acid number.
24. Quantitative analysis of amino acids.
25. Quantitative analysis of carbohydrates.
26. Quantitative estimation of lecithins.
27. Calculation of ratio of ionized & unionized dye with known pK value after the pH of the solution is altered.

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M.Sc. – Biotechnology

SEMESTER II:

I	Molecular Genetics	85	31
II	Basic Enzymology & Enzyme Technology	85	31
III	Molecular Biology	85	31
IV	Immunology & Animal Cell Culture	85	31
	(B) Practicals I (based on paper I, II, III and IV)	100	36
	(C) Internal Assessment CCE – I Paper CCE – II Paper CCE – III Paper CCE – IV Paper Written Test based on each paper (each of 05 marks)	15 15 15 15	05 in each test

Total marks = Theory + CCE

100 = 85 + 15

Passing marks = 36 out of 100 for each paper

15

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Class - **M.Sc.**
Semester - **II**
Subject - **Biotechnology**
Paper - **I**
Paper Name - **Molecular Genetics**

Max Marks: 85

UNIT-I: History, Scope of genetics, Mendelian law of inheritance, Variations of mendelian analysis, Linkage and crossing over, Linkage mapping, Sex determination and Sex linked inheritance, Gene Mapping.

UNIT-II: Microbial Genetics: gene transfer mechanism in microbe transformation, transduction, conjugation and recombination, Horizontal gene transfer, genetics of model organism- Neurospora, Yeast and E.coli.

UNIT-III: Mutation: Types of mutation, molecular mechanism of mutation, chromosomal mutations changes-changes in the structure and number of chromosomes, polyploidy, types of DNA repair.

UNIT-IV: Gene concept: Classical concept, molecular concept of the gene. Jumping genes, Split genes, Pseudo genes, overlapping gene, repeated gene, natural gene amplification. Molecular basis of cancer - oncogene, tumor suppressor genes,.

UNIT-V: Lytic and Lysogenic cycles, IS, and Tn elements in bacteria, Bacterial plasmids, gene regulation during development, E coil recombination system.

RECOMMENDED BOOKS:

1. Genetics: Strickberger, M.W.
2. Principle of Genetics (2001) 8th Ed. - Gardener etal.
3. Microbial Genetics (1994) 2nd Ed. - Maloy etal
4. Concept of Genetics 7th Ed. (2003) - Klug & Cummings.
5. Microbial Genetics-Fridfelder
6. Advanced Genetics (2002) - Miglani , G.S.
7. Bacterial Genetics (2004) – NancyTrun

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Class - **M.Sc.**
Semester - **II**
Subject - **Biotechnology**
Paper - **II**
Paper Name - **Basic Enzymology and Enzyme Technology**

Max Marks: 85

UNIT-I: Introduction to Enzymes: Enzyme nomenclature, enzyme commission numbers, and classification of enzymes. Isolation and purification of enzymes, preparation of purification chart, Enzyme activity, Specific activity and turn over number, Markerenzymes.

UNIT-II: Enzyme Kinetics: Steady state, pre-steady state, equilibrium kinetics, Michaelis and Menten Equation and its derivation, Different methods to calculate the K_m and V_{max} and their significance.

UNIT-III: Factor affecting enzyme activity and catalysis: pH, substrate and enzyme concentration, temperature, coenzyme and cofactors, Mechanism of action of enzymes involving two/more substrates. Role of metal ions in enzyme catalysis. Enzyme inhibition, different types of inhibitors and activators.

UNIT-IV: Structure and function of enzymes: Lysozyme, chymotrypsin, DNA polymerase, RNase, proteases. Enzyme regulation and control of their activity. Introduction to allosteric enzymes and isozymes.

UNIT-V: Enzyme Technology: Immobilization of enzymes and their application, commercial production of enzymes, RNA-catalysis, Catalytic antibodies -abzymes, Protein and Enzyme engineering: Design and construction of novel enzymes. Structure and Application of protease, lipases, papain.

RECOMMENDED BOOKS:

1. Enzyme Kinetics (1995) –Palmer
2. Enzyme Kinetics -Dixon
3. Fundamental of Enzymology – Price & Steven
4. The Enzymes Vol. 1 & 2 –Boyer
5. Enzyme Structure & Mechanism – AlanFersht
6. Enzyme Biotechnology – Tripathi,G.
7. Industrial Enzyme & their Application (1998) –Uhlig,H.
8. Enzyme 3rd Ed. (1979) – Dixon M. & Webb,E.C.
9. Enzyme Kinetics –Voet&Voet



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Session 2023-24

M. Sc. Second Semester

- | | |
|------------------------------------|--------------------------------------|
| 1. CourseCode : _____ | 6. MaximumTheoryMarks : 500 |
| 2. CourseName : M.Sc.Biotechnology | 7. MinimumPassingPercentage : 36 |
| 3. TotalPaper : 04 | 8. Laboratory : 100 |
| 4. CompulsoryPaper : 04 | 9. Laboratory Passing Percentage: 36 |
| 5. Laboratory : 01 | |

Sub Code	Subject Name	Theory									Practical		Total	
		Paper					CCE		Total Marks		Max	Min	Max	Min
		1st	2nd	3rd	Max	Min.	Max	Min	Max	Min				
	Molecular Genetics	85	0	0	85	31	15	5	100	36	0	0	100	36
	Basic Enzymology & Enzyme Technology	85	0	0	85	31	15	5	100	36	0	0	100	36
	Molecular Biology	85	0	0	85	31	15	5	100	36	0	0	100	36
	Immunology and Animal Cell Culture	85	0	0	85	31	15	5	100	36	0	0	100	36
	Laboratory-II	0	0	0	0	0	0	0	100	36	0	0	100	36

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Class	-	M.Sc.
Semester	-	II
Subject	-	Biotechnology
Paper	-	III
PaperName	-	MOLECULARBIOLOGY

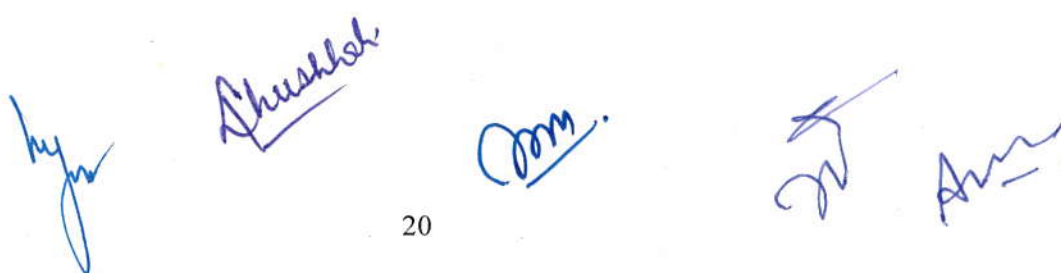
Max Marks: 85

UNIT-I: Nucleic Acid Structure: DNA as genetic material, Chemical structure and base composition of nucleic acids, Double helical structures. Different forms of DNA, Forces stabilizing nucleic acid structure. DNA Supercoiling. Properties of DNA, Renaturation and denaturation of DNA - T_m and Cot curves. RNA – structure, types and function.

UNIT-II: DNA Replication: General features of DNA replication, Enzymes and proteins of DNA replication. Models of replication – Conservative, semi-conservative and dispersive. Regulations of DNA replication, Prokaryotic and eukaryotic replication mechanism. Replication in phages. Reversetranscription

UNIT-III: Transcription: Mechanism of transcription in prokaryotes and eukaryotes. RNA polymerases and promoters. Post-transcriptional processing of tRNA, rRNA and mRNA (5' capping, 3' polyadenylation and splicing). RNA as an enzyme-Ribozyme.

UNIT-IV: Translation: Genetic code, General features, Deciphering of genetic code, Code in mitochondria, Translational mechanism in prokaryotes and eukaryotes, Post translational modifications (acetylation, glycosylation, phosphorylation etc.) and transport, Protein targeting, Non ribosomal polypeptide synthesis - Antibiotic inhibitors and translation.



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Class	-	M.Sc.
Semester	-	II
Subject	-	Biotechnology
Paper	-	IV
Paper Name	-	Immunology and Animal Cell Culture

Max Marks: 85

UNIT-I: Immunology: An introduction and historical perspective, antigens and antigenicity, adjuvants, immune system organs, tissues & cell lymphocytes, lymphoid organs , mono nuclear phagocytic system, myeloid system, immunity-active & passive, Natural humoral and cellular immunity.

Immunoglobulins: Structure of IgG (b), various classes of antibodies, Antibodies diversity-theories and molecular mechanism, class- switching, monoclonal antibodies (hybridoma technology) , recombinant antibodies, antigen- antibody interaction.

UNIT-II: Complement System: Classical, alternative and lactic pathways and their regulations.

Immunological Responses: Cell mediated immune response, Major Histocompatibility Complex, Cellular interactions in the immune response-antigen processing and presentation. recognition of antigens by T & B cells, T – cell receptor complex, B-cells receptor complex.

Dendritic cells and N cells. cytokines, immunological tolerance, hypersensitivity, anti-immune diseases & AIDS.

UNIT-III: Autoimmunity: Mechanism and therapeutic approaches, immunodeficiency syndrome and their diagnosis, vaccines-active and passive immunization, whole organism vaccines, macromolecules as vaccines, recombinant vector vaccines, synthetic peptide vaccines and subunit vaccines, DNA vaccines, Immunodiagnostic: precipitation techniques, agglutination, fluorescence techniques.

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UNIT-IV: Animal cell culture: An introduction, concept of aseptic techniques, animal tissue culture media, cell propagation, preservation and storage of cells, detection of contamination, safety consideration in laboratory cellculture.

General cell culture techniques: Dispersion and disruption of tissue, monolayer culture technique, measurement of growth and viability of cell, determination of 50% end point titer, Bulk culturing of animal cells, Concept of bioreactors for mass culture of mammalian cell, Micro carrier culture, harvesting and purification methods for end products recovery.

UNIT-V: Specialized Techniques: Cell immobilization techniques, cell transmission, Amniocentesis, CEA production and its clinical application, Interferons derived from human cells, 3-D animal cell culture and tissue engineering, FISH and application of animal cell culture.

RECOMMENDED BOOKS:

- Essentials of Immunology – Roitt
Immunology 3rd Ed. (1997) – Kuby J.
- Immunology – An Introduction (2004) –Tizard, I.R., Thompson Pub.
Immunology – Roitt.
- Principle & Practice of Immunoassay 2nd Ed. – Christopher & David
Animal Cell Culture (1987) – Freshney, R.T.
- Culture of Animal Cell (2003) – Freshney, R.T.
- Animal Cell Culture & Technology – Basic from Background to Bench (2004) Taylor & Francis.

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Class	-	M.Sc.
Semester	-	II
Subject	-	Biotechnology
PaperName	-	Laboratory

Max Marks: 100

Laboratory-II

1. Assay of antibiotics and demonstration of antibiotic resistance.
2. Study of mutation by Amu test.
3. Isolation of antibiotic resistant bacterial population by gradient plate method.
4. UV induced auxotrophic mutant production and isolation of mutant by replica plating technique.
5. Effect of UV radiation on bacteria.
6. Demonstration of UV repair mechanisms.
7. Immobilization of microorganisms and enzyme.
8. Amylase and urease production in the microorganisms.
9. Assay of acid phosphatase in plant seeds.
10. Assay of alkaline phosphatase in kidney and liver.
11. Determination of Km value of alkaline phosphatase. st.
13. Preparation of standard curve of DNA by DPA method.
12. Measurement of relative enzyme activity of cellulose by reducing sugar assay to
14. Preparation of standard curve of DNA by orcinol method and qualification of RNA from yeast.
15. Isolation of DNA from prokaryotic cell.
16. Isolation of DNA from eukaryotic cell.
17. Determination of Tm of nucleic acid.
18. Electrophoresis of DNA-linear, circular and super coiled.
19. Protein-DNA interaction.
20. Isolation of plasmid DNA.
21. Preparation of competent cells from *E.coli*.
22. Demonstration of Blotting techniques.
23. Blood film preparation and identification of cells.
24. Double diffusion and Immuno-electrophoresis.
25. Radial Immunodiffusion.
26. Detection of antigen through ELISA.
27. Preparation of antibody-enzyme conjugates.
28. Purification of IgG from serum.
29. Cell counting and cell viability.
30. Preparation of serum free media.
31. Culturing continuous cell lines.
32. Extraction/estimation of DNA/RNA/protein from animal tissues.
33. Preparation of single cell suspension from spleen and thymus.

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SYLLABUS

PG

SESSION- 2023-24

Class: M.Sc. Semester-III & IV

SUBJECT: Biotechnology

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M.Sc. – Biotechnology

SEMESTER III:

Paper	Course Curriculum: 2020-21 Title of the Paper	Theory	Min. Marks for Passing
I	Genetic Engineering	85	31
II	Biostatistics and Bioinformatics	85	31
III	Plant Biotechnology	85	31
IV	Bioprocess & Biochemical Engineering	85	31
V	Applied Biotechnology	85	31
	(B) Practicals I (based on paper I, II, III and IV)	100	36
	(C) Internal Assessment CCE – I Paper CCE – II Paper CCE – III Paper CCE – IV Paper CCE- V Paper Written Test based on each paper (each of 05 marks)	15 15 15 15 15	05 in each test

Total marks = Theory + CCE

100 = 85 + 15

Passing marks = 36 out of 100 for each paper

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(V-K. Jindal)

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Sri Sathya Sai College for Women, Bhopal
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 Department of Higher Education, Govt. of M.P.
 Post Graduate Semester Wise Syllabus
 As recommended by Central Board of Studies and approved by the Governor of M. P.
Session 2023-24

M. Sc. Third Semester

- | | | | | |
|--------------------|---|-----------------------------------|---|-----|
| 1. CourseCode | : | 6. MaximumTheoryMarks | : | 500 |
| 2. CourseName | : | 7. MinimumPassingPercentage | : | 36 |
| 3. TotalPaper | : | 8. Laboratory | : | 100 |
| 4. CompulsoryPaper | : | 9. Laboratory Passing Percentage: | | 36 |
| 5. Laboratory | : | | | 01 |

Sub Code	Subject Name	Theory								Practical		Total		
		Paper				CCE		Total Marks		Max	Min.	Max	Min.	
		1st	2 ⁿ	3 ^r	Max	Min.	Ma x.	Mi n.	Max					Mi n.
	Genetic Engineering	85	0	0	85	31	15	5	100	36	0	0	100	36
	Biostatistics and Bioinformatics	85	0	0	85	31	15	5	100	36	0	0	100	36
	Plant Biotechnology	85	0	0	85	31	15	5	100	36	0	0	100	36
	Bioprocess & Biochemical Engineering	85	0	0	85	31	15	5	100	36	0	0	100	36
	Applied Biotechnology	85	0	0	85	31	15	5	100	36	0	0	100	36
	Laboratory-III	0	0	0	0	0	0	0	100	36	0	0	100	36

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Post Graduate Semester Wise Syllabus

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Session 2023-24

Class	-	M.Sc.
Semester	-	III
Subject	-	Biotechnology
Paper	-	I
Paper Name	-	Genetic Engineering

Max Marks: 85

UNIT-I: Introduction: Historical background, Restriction enzymes and modifying enzymes, Restriction mapping, Construction of chimaeric DNA- staggered cleavage, Addition of poly dA and dT tails, Blunt end ligation, Genecloning.

UNIT-II: Cloning and Expression Vectors: Vehicles for gene cloning, Plasmids, Bacteriophages, Cosmids and Phagemids as vectors, P1 vectors, F- factor based vectors, Plant and animal viruses as vector, Artificial chromosomes as vectors (YAC, BAC, PAC and MAC vectors), Expression vectors- use of promoters and expression cassettes, Baculoviruses as expression vectors, Virus expression vectors, Binary and shuttlevectors.

UNIT-III: Isolation Sequencing and Synthesis of Genes: Methods of gene isolation, Construction and screening of genomic and cDNA libraries, Chromosome walking, Chromosome jumping, Transposone tagging, Map based cloning, DNA sequencing Techniques (Maxam Gilbert's chemical degradation methods, Sanger's dideoxy chain termination method, High throughput sequencing and pyrosequencing), Automated DNA sequencing, and Organochemical genesynthesis.

UNIT-IV: Molecular Probes and PCR: Molecular probes, Labeling of probes, Radioactive vs. Non radioactive labeling, Uses of molecular probes. Polymerase Chain Reaction- basic principle, Modified PCR (Inverse PCR, Anchored PCR, PCR for mutagenesis, asymmetric PCR, Real time and reverse Transcriptase PCR, Primer walking), Gene cloning Vs. Polymerase chain reaction; Applications of PCR in biotechnology, Ligase chainreaction.

UNIT-V: Molecular Markers and DNA Chip Technology: Molecular-Markers- types and applications, Construction of molecular maps (genetic and physical maps), DNA chip Technology & Microarrays (a Brief account). **Genomics and Proteomics:** Whole genome sequencing and functional genomics (a brief account), Applications of genomics and Proteomics with special reference to Arabidopsis and Rice.

RECOMMENDED BOOKS:

- Genomes (2002) 2nd edition Brown, T.A.
- Principles of Gene Manipulation (1994), Old and Primerose Gene Cloning: An introduction, Brown
- A Passion for DNA: Genes, Genome & Society (2000), Watson
- Genetic Engineering: An Introduction to Gene Analysis and Exploitation In eukaryotes (1998), Kingsman & Kingsman .
- Molecular Cloning: A Laboratory Manual (2000), Sambrook & others Molecular Genetics of Bacteria- Dale
- Genes & Genomes (1991), Singer & Berg Molecular Biotechnology (1996), Glick & Pasternak
- Plant Molecular Biology (Vol.I and II 2002), Gilmartin & Bowler Recombinant DNA (1992), Watson et al.,

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Class - **M.Sc.**
Semester - **III**
Subject - **Biotechnology**
Paper - **II**
Paper Name - **Biostatistics and Bioinformatics**

MaxMarks:85

UNIT-I: Introduction and definition of Biostatistics. Concept of variables in biological systems.

Collection, classification, tabulation graphical and diagrammatic representation of numerical data. Measures of central tendency: mean, median and mode and their relationship, measures of dispersion: Range, quartile deviation, mean deviation, standard deviation. Coefficient of variation, skewness and kurtosis. Probability: Random experiment, events, sample space, mutually exclusive events, independent and dependent events. Various definitions of probability, addition and multiplication theorems of probability (only statement), Random variables (discrete and continuous). Probability density functions and its properties.

UNIT-II: Some probability distributions such as binomial, Poisson and normal (Basic idea about these distributions) and their applications. Concept of populations and sample. Simple random sampling without replacement. Definition of simple random sample. Chi-square (X^2), student's t and f-distributions (derivations not required) their properties and uses. Concept of standard error. Correlation and Regression, linear and quadratic regression Analysis of variance: One-way and two-way classifications with single observation per cell.

UNIT-III: Introduction to Bioinformatics: Definition, role, scope different areas, and limitation of Bioinformatics. Data mining techniques and its applications—hidden markov model, neural network. Database management system (basic idea). Biological data & databases:

Classification of biological database. Nucleic acid sequence database: GenBank, EMBL, DDBJ. Protein Resources: UniProtKB. Expression database: Swiss-2D-PAGE, GEO, ArrayExpress, Secondary sequence databases: PROSITE, Pfam, PRODOM. Structure database: PDB and CATH.

Small Molecule database: DrugBank, ChemSpider, PubChem. Specialized Database: KEGG. Data formats: GenBank, UniProt, PDB, FASTA, PHYLIP, ClustalW.

UNIT-IV: Sequence Comparison: Pairwise alignment – Dot matrix methods, Dynamic programming. Concept of gap penalty and scoring matrix- PAM and BLOSUM, Significance, Significance of alignment. Sequence Homology Search: BLAST and FASTA algorithm, various programs and application. Multiple sequence alignment: Concept, Algorithm, tools and importance, Phylogenetic analysis: concept of tree, methods and tools. Gene Prediction methods and tools, primer designing tools, codon usage analysis and tools. Pattern and motif analysis.

UNIT-V: Structural Bioinformatics: Introduction & Importance. Coordinate systems. Visualization & presentation of structure. Molecule Visualization models, Molecular visualization and modeling software (Introductory notes and feature application) – SPDBV, RASWIN, ChemSketch, PyMOL, ArgusLab, AutoDock, Discovery Studio, LeadIT-FlexX. Protein Structure Prediction: Chau-Fasman, GOR, Neural Network, Homology modeling, Threading method. Protein Folding: Interacting forces, theories of protein folding, methods of protein folding study, protein folding in-vivo. Molecular Modeling – molecule designing, force field types, conformational search methods, Molecular docking – concept and methods. Drug Discovery and drug Designing.

RECOMMENDED BOOKS:

Statistics:

- An Introduction Biostatistics Glover
- An Introduction Biostatistics- Mishra & Mishra, Kalyani Publication

Bioinformatics:

- Bioinformatics: Sequence and Genome Analysis – Cold Spring Harbor Laboratory Press – by David Mount
- Emerging trends in Bioinformatics - **The Book Syndicate Publications** - Edited by Irfan A. Khan and Atiya Khanum, Ukaaz.
- Introduction to Bioinformatics (3rd Edi) – Oxford University Press - by Arther lark. Molecular Modeling and Drug Design – Topics in Molecular and Structural Biology. CRC Press. J. G. Vinter and Mark Gardner (Edi)
- Molecular Modeling in Drug Design, Academic Press. N. Claude Cohen (Edi)

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Session 2023-24

Class	-	M.Sc.
Semester	-	III
Subject	-	Biotechnology
Paper	-	III
Paper Name	-	Plant Biotechnology

Max Marks: 85

UNIT-I: Plant tissue culture: Cleaning, sterilization, sterile handling of tissue culture of plant. Nutritional requirement for in vitro culture. Concept of cellular totipotency, single cell culture, micro propagation, somoclonal variation and its application for plant improvement, somatic embryogenesis, anther and ovule culture, haploid and double-haploid production.

UNIT-II: Protoplast culture: Isolation ,fusion and culture, somatic hybridization, selection system for hybrids , cybrid production and their application in crop improvement, cryobiology of plant cell culture and establishment of gene banks, production of virus freeplants using meristem culture.

UNIT-III: Plant cloning vectors: Ti and Ri plasmid and viral vectors (CaMV based vectors, Gemini virus, TMV based vectors). Mechanism of DNA transfer, role of virulence genes, use of 35S promoters, use of reporter genes, methods of nuclear transfer, particle bombardment, electroporation, microinjection, transformation of monocots, transgene stability and gene silencing for herbicide, insect and salt resistance , Plant DNA fingerprinting - Hybridization , Genetic markers, molecular markers, PCR based markers (RFLP, SSRs, RAPD, QTLS , SCARS , AFLP etc.)

UNIT-IV: Biological nitrogen fixation and biofertilization, molecular mechanism of nitrogen fixation, genetics of nif gene.
Plant diseases- general account, biological control of pests and disease, biopesticides, seed production technique, plant cell culture for the production of useful secondary metabolism-pigments, perfumes, flavor, pharmacologically important compounds, biodegradable plastics. Automation in Plant Tissue Culture for its commercial application.

30

UNIT-V: Transgenic plants, commercial status and public acceptance, Bio-safety guidelines for research involving GMO's, benefits and risks. Socio economic impact and ecological consideration of GMO's, Gene flow, IPR and IPP. Patenting of biological.

RECOMMENDED BOOKS:

Plant Tissue Culture: Theory & practice a revised edition(2004) Bhojwani&Rajdan Plant Biotechnology (2000),Hammond et al

Plant Tissue Culture –Bhojwani,S.S.

Plant Cell & Organ culture(2004) Gamberg, O.L

Principles of Plant Biotechnology, Montell, et al Plant Cell Culture (2003) EvansD.A.

Plant Molecular Biology- vol.I and II, Gimartin& Bowler Genetic Engineering of Crop Plants, Lycett G.W. & Grierson D.

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Class	-	M.Sc.
Semester	-	III
Subject	-	Biotechnology
Paper	-	IV
Paper Name	-	Bioprocesses & Biochemical Engineering

Max Marks : 85

UNIT-I: Introduction to Bioprocesses Engineering. Isolation, Preservation & Maintenance of Industrial microorganisms. Factors that influence solid-state fermentation. Kinetic of microbial growth and death, Media for industrial fermentation.

UNIT-II: Air and media sterilization, safety in fermentation laboratory. Strain improvement of industrially important microorganism. Bioreactors: Principle, Kinetics, types, design, analysis and application. Types of fermentation processes: analysis of batch, Fed-batch and continuous Bioreactions, stability of microbial reactions.

UNIT-III: Aeration and Agitation systems for bioreactor. Flow behavior of fermentation fluids. Gas-Liquid mass transfer, Solid and Liquid-phase mass transfer and Heat transfer. Measurement and control of bioprocess parameters.

UNIT-IV: Downstream processing: Introduction, removal of microbial cells and solid matter. Foam reparation, precipitation, centrifugation, cell disruption, chromatography. Product recovery processes and Unit operations. Safety consideration in down stream processing Bioprocess economics

UNIT-V: Classification of product formation, Product synthesis kinetics, Mass balance in bioprocesses system, Energy balance in Bioprocess system.

RECOMMENDED BOOKS:

1. Biochemical Engineering, Aiba et al
2. Biochemical Engineering Fundamentals, Baily and Ollis
3. Principles of Fermentation Technology (1997), Stanbury P.F, and Whitaker
4. Fermentation Biotechnology-Principles, Process and Products(1998), Ward, O.P
5. Process Engineering in Biotechnology, Jackson A.T.
6. Bioreaction Engineering Principles, Nielson & Villadsen
7. Industrial Microbiology (1992) 4th edition, Prescott & Dunn
8. Microbial Biotechnology (1998) Glazer & Nikaido
9. A Text Book of Industrial Microbiology, 2nd edition (2002), Cruger and Cruger
10. Manual of Industrial Microbiology & Biotechnology 2nd edition (1999), Arnold et al

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Session 2023-24

Class	-	M.Sc.
Semester	-	III
Subject	-	Biotechnology
Paper	-	V
Paper Name	-	Applied Biotechnology

Max Marks: 85

UNIT-I: Industrial Biotechnology: Microbial strain of industrial importance, microbial production of antibiotics (penicillin, streptomycin & tetracycline), Vitamins (Vit B12), amino acids (glutamic acid) & enzymes (amylase, protease, invertase & pectinase), microbial production of alcoholic beverages (whisky & brandy), vinegar, citric acid, acetic acid, glycerol, acetone, foods-SCP, Biotransformation of steroids and pesticides.

UNIT-II: Agricultural Biotechnology: Role of biofertilizers and biopesticides in sustainable development, petrocrops, aquaculture, Improvement of nutritional value of seed storage protein, starch, oil. Transgenic plants for increased shelf life molecular mapping of genes of agricultural importance, sericulture, transgenic fish Plant Variety Protection Act, Plant breeders rights, International Convention on biological diversity.

UNIT-III: Food Biotechnology: Prokaryotic & Eukaryotic based products (fermented meats, milk products, yoghurt, cheese, cereal, wine, beer), Impact of biotechnology on microbial testing of food, current/traditional methodology and new approaches (use of gene probes, RDT, Bioluminescence), Safety evaluation of genetically engineered enzyme/novel food products, Natural Control of Micro Organism and preservation, Biogums, Bio-colours Fumaric acid, sweetener, fat substitutes, natural & modified starch, fats & oils food.

UNIT-IV: Environmental Biotechnology: Environmental pollution and their management, concept of Global Warming and Ozone depletion (Ecofarming, Green house effect & acid rain), Waste water treatment, solid waste management, conventional & modern fuels & their environmental impact, Bioremediation, Biodegradation of xenobiotic compounds, Biomineralization, Biotechnological approaches for preserving biodiversity (Gene banks, Germ Plasm Banks & their management).

UNIT-V: Frontiers in Biotechnology: Stem Cell Technology, Human Cloning Ethical issues & risks associated with it, Nano biotechnology:- Introduction to nanoscience, size matter, tools for measuring nanostructure Biosensor development and application, Nanofabrication, Nanotech impact on types of DNA chips & their production, SNP and genome mismatch signals, functional proteomics – RT PCR Human Genome Project, Bioterrorism.

RECOMMENDED BOOKS:

- Fundamental of food Biotechnology (1996). Lee, B.H.
- Biotechnology & Food Ingredients (1991) Goldberg, I & Williams, R. Food Biotechnology: Micro Organisms (1995) Hui, Y.H. Biotechnology: Food Fermentation Vol. I & II (1999), Joshi, V.K. & Pandey, A.
- Pesticide Microbiology, Hill I.R. & Asight, S.J.L.
- Biotech in Industrial Waste treatment & Bioremediation (1996) Hickey, R.F. Smith, G.
- Biodegradation & Bioremediation: Soil Biology (2004). Singh, A., Word, O.P. Environmental Biotechnology (1998), Agarwal, S.K.
- Plant Biotechnology & Molecular Markers (2004) Shrivastava et al Agricultural Biotechnology (1998) Altman, A.
- Plant Biotechnology: The Genetic Manipulation of Plant (2004) Adrianstater et al
- Legal Aspect of Gene Technology (2004) Brian, C.
- The GMO Hand Book: Genetically Modified Animals, Microbes & Plant (2004) Sarad, R.P.
- Food & Vegetable Biotech (2004) Valpuseta A passion of DNA, Watson J.D.
- DNA Microarrays & gene expression, Baldi, P & Hatfield, G.W. Nanobiotechnology- Next Big Idea, Mark et al
- Gene Cloning, Brown, T.A.

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Session 2023-24

Class - **M.Sc.**
Semester - **III**
Subject - **Biotechnology**
PaperName - **Laboratory**

Max Marks: 85

Laboratory-III

1. Bacterial culture and antibiotic selection media. Preparation of competent cells.
2. Isolation of phage DNA.
3. Restriction mapping of plasmid DNA.
4. Preparation of single stranded DNA template.
5. Gene expression of *E.coli* and analysis of gene product.
6. Preparation of helper phage and its titration.
7. PCR.
8. Calculation of the mean, median, mode and standard deviation using MS –Excel.
9. Graphical representation of various types of biological data using MS – Excel.
10. Biological data resources and data retrieval.
11. Sequence analysis using BioEdit software tools and other online tools.
12. Structural bioinformatics.
13. Protein structure prediction.
14. Isolation of industrially important microbes from environment.
15. Determination of TDP and TDT of microorganisms for design of a sterilizer.
16. Determination of growth curve of industrial organism and substrate degradation profile, also compute specific growth rate and growth yield.
17. Comparative study of ethanol production using different substrates.
18. Microbial production of citric acid using *Aspergillus niger*.
19. Preparation of media for plant tissue culture.
20. Sterilization of plant tissue.
21. Study of the effect of different tissue sterilizing agents.
22. Study of antifungal properties of plant extracts.
23. Callus induction from different explants: - seed, root & shoot.
24. Determination of organogenesis in mulberry.
25. Isolation of protoplast and culture.
26. Agrobacterium culture, selection of transformants, receptor genes (GUS) assays
27. Genomic DNA isolation from seed and plant tissue and their electrophoretic analysis
28. Restriction digestion of plant genomic DNA
29. Viability testing of seeds under different environmental conditions
30. Isolation of nitrogen fixing organisms like Cyanobacteria and Rhizobium and their characterization.
31. Measurement of nitrate reductase from *Nostoc muscorum*.
32. Analysis of total protein content of seeds by TCA precipitations method.
33. Isolation of VAM from soil by wet sieving and decanting method.
34. Isolation and cultivation of mushroom.
35. Determination of pesticide /metal detoxification by microbial species
36. Isolation of bacteriophage from sewage water.
37. Isolation and study of fungus responsible for food spoilage.
38. Detection of coliforms from determination of purity of potable water.
39. Determination of BOD of a sewage sample.
40. Determination of COD of a sewage sample.
41. Survey of degradative plasmid in microbes growing in polluted environment
42. Bioinsecticide isolation, purification and assay.

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M.Sc. – Biotechnology

SEMESTER -IV

Paper	Course Curriculum: 2020-21 Title of the Paper	Theory	Min. Marks for Passing
I	Advance in Fermentation and Food Biotechnology	85	31
II	Applied Immunology and Immunodiagnostics	85	31
III	Principles of Drug Designing	85	31
	Training/Survey/Visit in a private industry/ treatment plant or lab at national or regional level for one month 50 marks for report 50 marks for presentation before external examiner	50	18
	(B) Practicals I (based on paper I, II and III)	50	18
	(C) Internal Assessment CCE – I Paper CCE – II Paper CCE – III Paper CCE – IV Paper Written Test based on each paper (each of 05 marks)	15 15 15 15	05 in each test
	TOTAL	400	
	OR		
	DISSERTATION FOR SIX MONTHS FOR STUDENTS GETTING ABOVE 60%	(250+150 = 400)	
	GRAND TOTAL (all semester)	2000	

Total marks = Theory + CCE

100 = 85 + 15

Passing marks = 36 out of 100 for each paper

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M.Sc.Fourth Semester

- | | | | | | |
|---------------------|---|---------------------|----------------------------------|---|-----|
| 1. Course Code | : | | 6. Maximum Theory Marks | : | 400 |
| 2. Course Name | : | M.Sc. Biotechnology | 7. Minimum Passing Percentage | : | 36 |
| 3. Total Paper | : | 03 | 8. Laboratory | : | 50 |
| 4. Compulsory Paper | : | 03 | 9. Laboratory Passing Percentage | : | 18 |
| 5. Laboratory | : | 01 | 10. Internship/Project | : | 50 |

Sub Code	Subject Name	Theory									Practical		Total	
		Paper					CCE		Total Marks		Max.	Min.	Max.	Min.
		1 st	2 nd	3 rd	Max.	Min.	Max.	Min.	Max.	Min.				
	Advances in Fermentation and Food Biotechnology	85	0	0	85	31	15	5	100	36	0	0	100	36
	Applied Immunology and immunodiagnosics	85	0	0	85	31	15	5	100	36	0	0	100	36
	Principles of Drugs Designing	85	0	0	85	31	15	5	100	36	0	0	100	36
	Training/Survey/ Visit in a private industry/ treatment plant or lab at national or regional level for one month 50 marks for report 50 marks for presentation before external examiner	0	0	0	0	0	0	0	50	18	0	0	50	18
	Laboratory-IV	0	0	0	0	0	0	0	50	18	0	0	50	18

OR

DISSERTATION FOR SIX MONTHS FOR STUDENTS GETTING ABOVE 60% (250+150= 400 MARKS)

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Post Graduate Semester Wise Syllabus

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Class - **M.Sc.**
Semester - **IV**
Subject - **Biotechnology**
Paper - **I**
Paper Name- **Advances in Fermentation and Food Biotechnology**
Max Marks: 85

UNIT-I Characterization and Techniques of fermentation systems. Role of Fermentation, Biochemistry of Fermentation-Fermentation of Carbohydrates, Protein. Lipid Metabolism, Formation of flavour.

UNIT-II Advanced continuous fermentation for anaerobic microorganisms, Fermentation process development of carbohydrate based therapeutics, Bioprocess development for detoxification and decolorization, Fermentation process validation. Genetic manipulation of industrially important microorganisms-Methods of reproduction. Recombination, strain modification, Stabilization of transformants, Autonomous replication. Production of foreign protein, Commercial production of plant proteins in microorganisms.Economics of fermented products.

UNIT-III Microorganisms involved in natural fermentation, Microbial succession. Sources of Food spoilage, Food Toxicology, Food Processing and preservation.

UNIT-IV Composition and nutrition of fermented products. Microbial toxins – control of mycotoxin and algal toxin in food. Sensory evaluation of fermented food.Bioreactors in food fermentation.Packaging of fermented foodproducts.

UNIT-V Protein engineering in food technology: methods, targets and applications in foods. Biosensors. Biological monitoring of foods, waste management and food processing, HACCP and hurdle technology.

RECOMMENDED BOOKS:

- Fermentation biotechnology - B.C.Saha
- Biotech food fermentation- Vol I & II – V.K. Joshi & Ashok Pandey
- Food microbial fundamentals and frontiers – Doyle, Beuhat and Montville.

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Class	-	M.Sc.
Semester	-	IV
Subject	-	Biotechnology
Paper	-	II
Paper Name	-	Applied Immunology and Immunodiagnostics
		Max Marks: 85

UNIT-I Immunization, routes of immunization, adjuvants; Equilibrium dialysis to measure antibody affinity and avidity, Precipitation reaction, Immunoelectrophoresis, ELISA, ELISPOT assay, Phage display libraries for antibody V-region production.

UNIT-II Immunofluorescence microscopy; Immunoelectron microscopy; Immunohistochemistry; Immunoblotting (Western blotting).

UNIT-III Isolation of lymphocytes by Ficoll-Hypaque gradient, Flow Cytometry, Fluorescence Activated Cell Sorting (FACS), Congenic mice, SCID-HU mice and their use in immunology

UNIT-IV Immunodiagnostics for detection of infectious agents, cancer, and autoimmune diseases; Immunosensors.

UNIT-V Therapeutic monoclonal antibodies; Biological response modifiers, Recombinant vaccines.

RECOMMENDED BOOKS:

- Immunology-Roitt et.al. Immunochemistry- Kear and Thorpe. Immunology-Abbas.
- Cellular and Molecular Immunology-Abbs, Lichtman and Pober. Immunology-Tizzard.

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Class	-	M.Sc.
Semester	-	IV
Subject	-	Biotechnology
Paper	-	III
Paper Name	-	Principles of Drug Designing

Max Marks: 85

UNIT-I Organized drug discovery & development: Pharmacological, microbial, recombinant, biochemical and molecular level screening system and their construction strategies. Alternative strategies in lead identification and lead optimization. Preclinical development: clinical trials, patenting & clearance for application.

UNIT-II Quantitative Structure Activity Relationships (QSAR): Types of QSAR models, Classification of parameters utilized in QSAR studies, Statistical concept of QSAR, Hansch model of QSAR, De Novo model of QSAR, Hammett and Taft model of QSAR equations, Applications of QSAR in drug design. Receptor versus enzyme mediated drug action. Principles in Agonist and antagonist action.

UNIT-III Thermodynamic and structural principles: Objective & approaches in the native ligand modification; Molecular graphics and modeling tools: hardware and software component of molecular graphics. Molecular modeling methods: MO theory, empirical methods, geometry optimization, force field, Conformational search, Perturbation free Energy. Molecular Mechanics: electrostatic models, point charges, Solvents, modeling reactivity.

UNIT-IV Simulated annealing: Conformational space search algorithms, dynamic monte carlo simulation, modeling multimolecular system. Calculation and analysis of molecular field: electrostatic potential, electrostatic field, steric field, other fields and comparison. Drug design by receptor site fit, active site confirmation, docking problems and methods. 3D database search methods. Automated structure construction methods.

UNIT-V Modeling drug receptor interaction: Receptor- introduction and source of informations.

Receptor fitting. Receptor mapping- pharmacophore concept. Pseudoreceptor. Role of solvent. Peptidomimetic design- goal and achievement. Enzyme catalytic principle - recapitulation, affinity labels, principles of suicide inactivation, design strategies scope and limitations. Illustrative examples of hydrolases, PLP based enzyme, isomerases & redox enzymes in inhibitors. Synthetic peptide libraries, peptide libraries through phage display: application in epitope mapping & in synthetic vaccine designing.

RECOMMENDED BOOKS:

- Comprehensive medicinal chemistry (Vol. I-VI) Academic press, Hansch
- Ansel's Pharmaceutical Dosage forms a Drug delivery system-8th. Alen Popovich & Ansel
- Molecular Modeling in Drug Design, Academic Press. N. Claude Cohen (Edi) Molecular Modeling and Drug Design – Topics in Molecular and Structural Biology. CRC Press. J. G. Vinter and Mark Gardner (Edi)
- Drug Design-Kulkarni & Bothara S



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Class - **M.Sc.**

Semester - **IV**

Subject - **Biotechnology**

Paper Name-

Training / Survey / Visit in a private industry / treatment plant or lab at national or regional level for one month

25 marks for report and 25 marks for presentation before external examiner.





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Class - **M.Sc.**
Semester - **IV**
Subject - **Biotechnology**

LABORATORY-IV

Max Marks: 50

- Immuno diffusion. Immuno electrophoresis.
- Study of agglutination & rosette formation.
- PAGE on nativegel & study of isozymeby activity staining. Permanent slide on mammalian physiology.
- Determination of as part at econtentis given sample by enzymatic method.
- To immobilize chymotrypsinon agarose gel beads by Oxirane method.
- Production of monoclonal antibody against purified protein.
- To detect nitratereductie in leaf extracts by immuno diffusion test.
To detect antibodies in sera by competitiveELISA.
- Identification of bacteria by using fluorescent antibody techniques (FAT). Quality testing of milk by resazuring test.
- Determination of phasphatase activity in butter,whey, milkpowder. Microbiological analysis of food production.
- Presumptive test for coliform in butter.
- Analysis of mycotoxin in fungal contaminated food materials.

Note: 70% of the above list should be compulsorily performed.

