

DEPARTMENT OF BIOTECHNOLOGY

**CHAITANYA (DEEMED TO BE)
UNIVERSITY, HIMAYATH NAGAR,
MOINABAD, RANGA REDDY
DISTRICT, HYDERABAD, TELANGANA
INDIA**

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History of the Department

The Department of Biotechnology at graduation level was started during the academic year 2000-01, with an intake of 24 students, The combination was BTZCA. The combinations now offered are BTMBC, BTBCC & BTCCA. At present the strength is 540.

The Department of Biotechnology at post graduation (MSc) level started during the academic year 2007-08 by the management of "**Viswa Bharati Education Society**". It is the only institution affiliated under the jurisdiction of Kakatiya University, Warangal which has started Biotechnology. The initial intake of students was 27 and in subsequent years the intake of students was increased to 36. In the year 2008 college attained **Autonomous status**.

To meet increasing demand 5 years **Integrated Biotechnology** course was also started in this college with an intake of 15 students.

The faculty is highly qualified with research experience in order to provide excellent teaching in biotechnology at Under Graduate level. Apart from teaching, the Department is also engaged in assessing the student's progress from time to time by conducting periodical tests. The students whose performance is poor are counseled to overcome their deficiencies and are given assignments to improve the conceptual understanding. The Department also organizes group discussions under the supervision of faculty members to improve their precipitation of the subject.

Students are encouraged to deliver seminars in class rooms by choosing a topic of their interest under the guidance of a faculty member. The level of improvement in student is constantly monitored by the above said methods and if necessary, group counseling is done to enhance the standards of students.

The Department imparts excellent instruction in Biotechnology with the support of three well equipped and well furnished spacious laboratories named as Plant tissue culture, Molecular Biology, Bioinformatics and Analytical technique laboratories.

The Department has a library with nearly 120 books catering to the needs of students. It has rare collection of books for reference and even for advanced studies. The Department is in constant touch with the institutions like University of Hyderabad, NIT Warangal, Kakatiya University, Osmania University. It

also interacts with CCMB, CDFD, CPMB, NIN, ICRISAT, CFTRI upgrading it self for the benefit of student community.

The faculty members of this Department to their credit have several national and international publications. The faculty members are interested in adopting themselves to modern methods of teaching by attending to various refresher courses, seminars, work shops, pursuing the latest exchanges in the subject by going through scientific journals and internet explorer. Extension lectures from the eminent persons from various institutions of high repute are arranged periodically to enhance the knowledge of the students. The Department meetings are held very frequently, during which the latest trends in the subject are discussed thoroughly and elaborately.

The Department is enriched by advanced teaching aids like over head projectors and other audio visual devices for teaching purpose. The Department has internet facility to go through the latest developments in the subject.

CURRICULAR ACTIVITIES:

As per the almanac issued by the University the academic schedule are prepared and followed strictly. The staff maintains teaching diaries, teaching plans, Synopsis, attendance registers and seminar registers. All these academic records are regularly scrutinized by incharge Department and Principal.

The staff members have been attending refresher and orientation courses, seminars, conferences and work shops regularly for updating their knowledge and to keep themselves abreast with latest trends in the subject.

Student seminars are conducted every for first, second, and final year students to make them learn the subject along with teaching and presentation skills. Slip tests and assignments are regularly conducted for all students for assessing their knowledge in the subject. A separate register is maintained to record their marks. Semester internal and external end examinations in the subject for all papers are also conducted regularly during the academic year to train the students for university examinations. Question

papers for internal and semester end exams will prepared according to the rules and regulations of autonomous status of the college.

DEPARTMENT MEETINGS:

Department meetings are conducted periodically to review the results of the students and to take steps to improve their performance. Allotment of workload, maintenance of various academic records adherence to teaching schedule and purchase laboratory equipment are also discussed.

EXTRA CURRICULAR ACTIVITIES:

Students of Biotechnology take active part in all the extra curricular activities of the college like NSS, NCC, Clean & Green, Eco club programs and participate in rallies held to promote **AIDS** awareness, ban of usage polythene bags, Blood donation, etc.,

Courses offered

And

SYLLABUS

COU

RSES OFFERED

The Department of Biotechnology offers BSc , MSc & Integrated MSc courses.

Under Graduation Courses

- B.Sc, Biotechnology, Microbiology, Chemistry (Bt, Mb, C)
- B.Sc, Biotechnology, Biochemistry, Chemistry (Bt, Bc, C)
- B.Sc, Biotechnology, Chemistry, Computer Applications (Bt, C, CA)

Post Graduation Courses

- M.Sc. 2 year Biotechnology (4 Semesters)
- 5 years Integrated M.Sc. Biotechnology (10 semesters)

**B.Sc. BIOTECHNOLOGY
SEMESTER-I**

Title: CELL BIOLOGY & MICROBIOLOGY

UNIT-I: CELL BIOLOGY

1. Structure of prokaryotic and Eukaryotic cell (Comparative account)
2. Structure and functions of plasma membrane, endoplasmic reticulum, Golgi apparatus, ribosomes, plastids, mitochondria,
3. Structure and functions of nucleus.

UNIT II: CYTOLOGY

1. Chromosomes: Structure and chemical composition of Eukaryotic, special types of chromosomes

(Polytene, lampbrush) and their organization.

2. Cell division-mitosis and meiosis
3. Cell cycle (G1, S, G2, M-phase) and its regulation (Check points, kinases, cyclin, cdk's complexes, M-phase factors)

UNIT III: MICROBIOLOGY

1. Concept of sterilization and methods of sterilization
Dry Heat – Hot air oven
Wet Heat – Autoclave Filtration–
Laminar airflow

Radiation–ionizing–Gamma rays, cathode rays
Chemical agents–Alcohol, Phenols, Halogens etc. Hg, Ag, Cu Gases – Ethylene
2. Structure, Reproduction & Economic importance of Bacteria and Fungi
3. General properties, structure and reproduction of Viruses

UNIT IV: MICROBIAL INTERACTION

1. Microbe-microbe-interaction:
Mutualism, Antagonism, Antibiosis, Competition, Exploitation, Parasitism, Predation.
2. Plant-microbe interaction: Rhizosphere, Root nodule, Mycorrhizae, TMV
3. Animal-microbe interaction: Mycobacterium, Salmonella, Hepatitis, HIV, Onco Virus

Recommended books

- | | |
|-----------------------------|----------------|
| 1. Cellbiology | C.B.Powar |
| 2. Thecell | G.Karp |
| 3. GeneralMicrobiology | R.PSingh |
| 4. AtextbookofMicrobiology | Ananthnarayana |
| 5. Microbiology | Prescott |
| 6. Biostatistics | KathambaRajan |
| 7. Genetics | B.D.Singh |
| 8. Cellbiology | De Roertis |
| 9. Cell&Molecular biology | PKGupta |
| 10. Genetics | PundanSingh |
| 11. Bioinformatics | M.Mohan |
| 12. Microbiology&Immunology | B.D.Singh |

**B. Sc BIOTECHNOLOGY (I yr) SEMESTER-
I(PRACTICALPAPER–I,SYLLABUS)**

Time:3 hrs

Max.Marks:35

MICROBIOLOGY TECHNIQUES

1. Preparationofmedia(Bacterial&Fungal)
2. Simplestaining methodfor Bacteria
3. Gramstainingtechniques
4. Growthcurveof microbes
5. Colonypurification– Streakculture

II. ISOLATIONTECHNIQUES

1. Isolationofmicrobesfromwater
2. Isolationofmicrobesfromair
3. Isolationofmicrobesfromsoil(DilutionofPourplatingtechnique)
4. Antibioticsensitivityofmicrobes.

III SPOTTING:

- | | |
|----------------|--|
| 1. Aspergillus | 11. Legume Nodule |
| 2. Pencillium | 12. VAM |
| 3. Yeast | 13. SpecialtypesofChromosomes(Salivarygland&Lampbrush) |
| 4. Nostoc | 14. Antigen- AntibodyInteraction |
| 5. Spirulina | |
| 6. Spirillum | |
| 7. Bacillus | |
| 8. Cocci | |
| 9. Vibrio | |
| 10. Endospore | |

IV. RECORD& VIVA VOCE

B.Sc. BIOTECHNOLOGY

SEMESTER-IIPAPER-2

Title: BIOCHEMISTRY, BIOPHYSICS & BIostatISTICS

I. BIOCHEMISTRY

1. Introduction, classification, structure and biological significance of Carbohydrates (Mono, Di and Polysaccharides), lipids, amino acids and proteins
2. Structure and chemistry of Nucleic acids–Nucleotides in DNA & RNA
3. Enzymes introduction, classification, Mechanism of Enzyme action, factors effecting on enzyme catalyzed reactions.

II. BIOENERGETICS

1. Bio Energetic of living cell, energy conservation and dissipation: Definition, concept of Bio-energetics: Thermodynamics laws related to bioenergetics (1st law & 2nd law), Enthalpy, Entropy, free energy, High energy bond, High energy compounds, ADP-ATP cycle, Biological oxidation.
2. Electrical properties of membranes: The ion concentrations inside and outside of the cell, carrier proteins and their functions, Na⁺K⁺ pumps, ion channel and the membrane potentials

III. BIOPHYSICS

1. Biophysical methods. (Principle, Description and Applications)
 - a) Chromatography: (Paper, Thin layer, Ion exchange, Affinity, HPLC)
 - b) Electrophoresis: (Agarose, PAGE)
 - c) Centrifugation: (Ultra centrifugation)
 - d) Spectroscopy: (UV, Visible, IR)
2. Hydrodynamics of biological molecules–Viscosity, Diffusion, Osmosis.
3. Imaging Techniques: ECG, EEG, MRI

IV. BIostatISTICS

1. Probability; additional, multiplication and their applications.
2. Sampling methods–Random and Non-Random sampling, test of hypothesis, level of significance.
3. Measure of central tendencies : Mean, Mode & Median Measures of deviation: Analysis of variance.

Referencebooks

- | | |
|-------------------------------|------------------|
| 1. ATextbookofBiochemistry | U.Satyanaraya. |
| 2. Biochemistry | Cambell |
| 3. FundamentalsofBiochemistry | J.LJain |
| 4. PracticalBiochemistry | Wilson&Walker |
| 5. ExperimentalBiochemistry | Deshpande |
| 6. Biochemistry | UpadyayaUpadyaya |
| 7. Biochemistry | Harpur |
| 8. Biostatistics | M.Mohan |
| 9. Biophysics | Mahajan |

B.Sc BIOTECHNOLOGY (I yr) SEMESTER-II
(PRACTICAL PAPER–II, SYLLABUS)

Time:3 hrs

Max.Marks:35

BIOPHYSICAL&BIOCHEMICAL TECHNIQUES

1. Estimation of DNA by DP method
2. Estimation of RNA by Orcinol method
3. Estimation of Proteins by Lowry's method.
4. Estimation of Carbohydrates
5. Separation of Amino acids by Paper Chromatography
6. Separation of Carbohydrates by TLC
7. Separation of Lipids by Paper Chromatography
8. Separation of Chlorophyll pigments by Paper Chromatography

II. BIostatistics

1. Mean
2. Mode
3. Standard Error
4. Standard Deviation

III SPOTTING:

- | | |
|---------------------------------|-----------------------------|
| 1. Spectrophotometer | 11. Mean |
| 2. IR | 12. Mode |
| 3. Calorimeter | 13. Affinity Chromatography |
| 4. ECG | 14. PAGE |
| 5. EEG | |
| 6. Paper chromatography | |
| 7. TLC | |
| 8. HPLC | |
| 9. Centrifuge | |
| 10. Agarose gel Electrophoresis | |

IV. RECORD & VIVA VOCE

SEMESTER– III
Paper – III Course
Type:CC3-A
GENETICS

Unit-I:

1. Medelian Principles: Pre-Mendelian ideas on heredity, Mendel's experiments - Monohybrid, Dihybrid cross, backcross and test crosses.
2. Mendel's laws of heredity - Law of dominance, segregation and independent assortment.
3. Gene interaction: Definition, Bateson & Punnett experiments in poultry.
4. Complementary genes, Duplicate genes, Epistasis Dominant and recessive; Lethal genes.

Unit-II:

1. Linkage and crossing over; Bateson & Punnett's theory of coupling and repulsion, concept of linkage, Linkage groups, types of linkage.
2. Concept of crossing over, cytological demonstration of crossing over (Stern's experiment in *Drosophila* and Mc Clintock's experiment in maize),
3. Types of crossing over; Chromosomal maps - 2 point and 3 point test crosses; Chromosome mapping.
4. Interference and coincidence, significance of crossing over.

Unit-III:

1. Mutation: Definition, Brief history, types of mutations, Mutation rate, Detection of Mutations, spontaneous mutations, induced mutations.
2. Physical mutagens (effect of ionizing and non-ionizing radiation).
3. Chemical mutagens; Molecular basis of mutations - transitions, transversions and frame shift mutations: Applications of mutations and chromosomal mutations (change in number and structure).
4. Recombination of microorganisms: Molecular mechanism of transformation, conjugation and transduction, parasexuality and tetrad analysis.

Unit-IV:

1. Gene concept: Classical & modern concept of gene: RII locus, Benzer model of gene structure, Cistron, Recon and Muton.
2. Evolution of Gene concept - prokaryotic and eukaryotic genome organization
3. Types of genes (Split, Overlapping, Transposons).
4. Chloroplast and Mitochondrial genome organisation.

References:

1. Genetics -P.K.Gupta
2. Genetics -B.D.Singh
3. Genetics -PundanSingh
4. MolecularBiology -Prof.S.RamReddy
5. MicrobialGenetics -B.D.Singh
6. Genetics -MohanP.Arora
7. Genetics -Gordner

SEMESTER–III Practical Paper–III (GENETICS)

1. Cytological preparation by Squash method of mitosis
2. Identification of meiotic divisions by squash method
3. Determination of calibration factor of ocular divisions in micrometry
4. Measurement of cell/m.o/chromosome size by micrometry
5. Identification of lampbrush chromosomes

II. GENETIC PROBLEMS

1. Gene Interaction (Non-Mendelian Ratios)
2. Chromosome mapping (2- point test cross)

III. SPOTTING

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|-----------------------------------|-----------------------|
| 1. Chloroplast genome | 2. Tetrad analysis |
| 3. Mitochondrial genome | 4. Turner's syndrome |
| 5. Down's syndrome | 6. 2 point test cross |
| 7. Transversions | 8. Thymine dimers |
| 9. Transformation | 10. Transudation |
| 11. Pachytene division of meiosis | 12. Anaphase |
| 13. Metaphase | 14. Telophase |
| 15. Frameshift mutation | |

IV. RECORD

V. VIVA VOCE

SEMESTER– IV

Paper –IV Course

Type:CC4-A

MOLECULARBIOLOGY&r-DNA TECHNOLOGY

Unit–I:

1. ReplicationofDNA,Differenttypes,enzymesandmechanismofDNAreplication.
2. DNArepair,includingenzymes. FormationofRNA'stypesofRNA's
3. MolecularOrganisationofprokaryoticandEukaryoticGene(Exons, Introns&Regulators)

Unit–II:

1. Gene expression (prokaryotes and Eukaryotes): Central dogma, Transcription, RNA Polymerize, closed promoter complex, open promoter complex, chain initiation,elongation, termination including factors.
2. RNAprocessing(capping,splitting &polyadenylation)reversetranscription.
3. Translation (initiation, elongation, termination factors, post translational modifications), regulatory sequences (cis acting elements)
4. Regulation of Gene expression in Prokaryotes and Eukaryotes: Jacob monad model, Operon model, Positive and negative regulation.

Unit–III:

1. Basic concepts of genetic engineering. Restriction Endo nucleases, DNA ligase's, Homo polymer tailing.
2. Cloningvectors:Plasmids(p^{BR322},p^{UC},Ti),cosmids,Phagmids(p^{BluescriPtIIKS}), yeastPlasmids,
3. Blottingtechniques:Southern,NorthernandWestern
4. GenomiclibrariesandC-DNA libraries

Unit–IV:

1. PCRtechniqueanditsapplications,Molecular markers:RFLPS,RAPD.
2. GeneTransferMethods:Directgenetransfer-Microprojectilegun,Microinjection, Electroporation&Lipofection methods.
3. Indirectgenetransfermethod-Agro bacteriummediatedgenetictransformationmethod.
4. Applicationsofr-DNAtechnologyinagriculture andmedicine

References:

1. GeneticsEngineering - Mitra
2. Plant Biotechnology - Chawla
3. MolecularBiology - S. RamReddy
4. MolecularBiology - Prifelder
5. MicrobialGenetics - GlickandPanster
6. AtextbookofBiotechnology - U.Satyanarayana
7. Cell&MolecularBiology - PK.Gupta

SEMESTER-IV

Practical Paper – IV (MOLECULARBIOLOGY&R-DNATECH)

1. Isolation of plasmid DNA
2. Restriction digestion of DNA
3. Competent cell preparation
4. Transformation and selection of transformants
5. Separation of DNA fragments by agarose electrophoresis

II. MOLECULARBIOLOGY PROBLEMS

1. Transcription
2. Restriction mapping
3. Genetic code

III. SPOTTING

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|---|--------------------|---------------------------------|
| 1. Operon model | 2. Electroporation | 3. Ti Plasmid. |
| 4. pBR322 | 5. pUC | 6. pBluescript KSI ⁺ |
| 7. PCR | 8. cDNA | 9. Genomic library |
| 10. Restriction enzymes generating sticky ends. | | |
| 11. Restriction enzymes generating blunt ends | | |
| 12. Microprojectile gun. | 13. MicroInjection | 14. Southern blotting |

IV. RECORD

V. VIVAVOCE

SEMESTER– IV

CourseType:SEC–IIA BIOINFORMATICS

UNIT-I Introduction to computers: Overview of Computer Organization and historical perspective. Computer applications in various fields of science and management. Introduction to hardware and software components of a computer. Introduction to operating systems like windows, UNIX (User level description)

UNIT-II Biological Databases: Introduction to bioinformatics, Important biological databases, nucleic acid sequences databases, genbank, EMBL, DDBJ, protein sequences, SWISSPROT, Tr-EMBL, PIR, Structural databases: PDB, pfam, CATH, scop.

UNIT-III Sequence alignments – concepts of alignment, methods and types of alignment. BLAST, FASTA, CLUSTAL. Definitions of proteomics, genomics, DNA microarrays, pharmacogenomics

Unit-IV **Bioinformatics applications:** Applications of bioinformatics, analysis of genomes, (HGP, Arabidopsis etc..) genomics, proteomics, molecular modelling, DNA microarrays.

Practical:

1. Navigating and getting familiarization with NCBI
2. Retrieving protein and DNA sequences using ENTREZ at NCBI
3. Navigating EBI
4. Retrieving protein and DNA sequences using SRS at EBI
5. Navigating PDB and downloading a PDB file
6. Navigating BLAST (both nucleotide BLAST & Protein BLAST)
7. Multiple sequence alignment – CLUSTAL Omega
8. Visualization tools like swigspdbviewer, rasmol

Semester-V
Animal, Plant Biotechnology and Immunology

UNIT-I: Introduction to Animal Cell Culture

1. Different types of instruments, culture vessels used in the animal cell culture. Media- Natural and Artificial.
2. Physiochemical properties of media. Cell cultures- Primary and Secondary. Methods for detection of cancer cell lines.
3. Hybridoma technology- Production of Monoclonal antibodies and applications.

Unit-II: Animal Biotechnology

1. Manipulation of Reproduction- IVF-technology, Artificial Insemination, Intra Cytoplasm Semen Insemination.
2. Production of transgenic animals. Stem cells- Types and applications.
3. Gene therapy- Ex vivo and In vivo gene therapies.

Unit-III: Plant Biotechnology

1. Plant tissue culture: Introduction, media (MS media), Organogenesis (direct and indirect), callus induction and cell suspension culture,
2. Plant growth regulators and their role in vitro morphogenesis, Micropropagation of plants via Meristem and Nodal cultures,
3. Somatic Hybridization: Protoplast isolation, fusion, selection and regeneration, applications. Difference between somatic hybrids and cybrids. Production of transgenic plants and their Applications.

UNIT-IV: Immunology

1. Cells of immune system; T-cell independent B-cell activation, T-Cell dependent B-cell activation, Antigen presentation Phagocytosis.
2. Types of immunity Innate and adaptive immunity, Antigen, antibody structure, functions and classification of immunoglobulins.
3. Antigen and Antibody interactions.

Practical syllabus for Animal, Plant Biotechnology and Immunology

I. Animal Biotechnology Experiments

1. Introduction to Animal cell culture
2. Different types of instruments and culture vessels
3. Media types- Natural and Artificial
4. Media types- Natural and Artificial
5. Physicochemical properties of media
6. Cell cultures- Primary and Secondary cell cultures
7. Methods of cancer cell detection

II. Plant Biotechnology Experiments

8. Composition of MS-Media
9. Direct and Indirect Organogenesis
10. Callus induction and cell suspension culture
11. Role of plant growth regulators in vitro morphogenesis
12. Micropropagation and its applications
13. Somatic hybridization; Protoplast isolation, Protoplast fusion, selection.

III. SPOTTING

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|-------------------|----------------------|------------------|
| 1. Culturebottles | 2. Animalcell medium | 3. Co2Incubator |
| 4. Callus | 5. SomaticEmbryo | 6. Syntheticseed |
| 7. Laminarairflow | 8. Hybrid | 9. ELISA |

IV. RECORD

V. VIVAVOCE

SEMESTER– VI

INDUSTRIAL BIOTECHNOLOGY

UNIT-I (Introduction to Industrial Biotechnology)

1. Principles of fermentation technology. Types of fermentations – Aerobic, Anaerobic, surface, submerged, solid state, batch, continuous and multiple or dual fermentations
2. Types of fermentors – lab, pilot and large-scale fermenters.
3. Characteristics of a fermenter. Design of a fermenter and its parts. Short account on up stream and down stream processing.

UNIT-II (Industrial Biotechnology)

1. Industrial production of fermented foods – Bread.
2. Industrial production of enzymes – amylases, protease and their uses. Immobilization of enzymes and cells.
3. Industrial production of ethanol, citric acid, wine

UNIT-III (Medical Biotechnology)

1. Industrial production of antibiotics – streptomycin, penicillin
2. Production of Vit B₁₂, edible vaccines, recombinant insulin
3. Gene therapy and its applications.

UNIT-IV (IPR)

1. Intellectual property rights IPR. Its importance
2. Patent concept. Products which can be patented. Patent application. Patent protection. Types – design, trademark, copyright etc.,
3. Biosafety and biopiracy

MSc. Biotechnology (Semester-I)

CORE-I: CELL BIOLOGY

UNIT-I

1. Ultrastructure of prokaryotic and eukaryotic cells
2. Cellular organelles, structural organization and function of endoplasmic reticulum, Golgi apparatus, peroxisomes, lysosomes, nucleus and vacuoles
3. Structure and function of mitochondria and chloroplast
4. Structure and function of cytoplasm and cytoskeleton (microtubules, microfilaments and intermediate filaments)

UNIT-II

1. Biomembranes—chemical composition and molecular model of cell membranes.
2. Extracellular matrix and environment.
3. Secretory and endocytotic pathway (Vesicular traffic)
4. Transport across the membrane, active and passive transport, ionophores, ion-transporting ATPases, Membrane channels, ABC – transporters.

UNIT-III

1. Chromosome morphology and structure, organisation, heterochromatin and euchromatin.
2. Chromatid models, nucleosomes and solenoid model, special model.
3. Cell cycle phases, checkpoints and regulation.
4. Cell to cell adhesion, cell junctions, cell signalling, communication between and inside the cells

UNIT-IV

1. Cell proliferation in development and differentiation
2. Animal cells, excitable cells. Muscular cells—slow and fast muscles, muscular contraction (physical and chemical)
3. Malignant cells—cancer, oncogenes, apoptosis

4. Stem cells and their renewal (blood-cell formation as an example) – Totipotent and pluripotent cell

Recommend Books:

1. The Cell – Geoffrey, M. Cooper
2. Molecular Biology of the Cell (3e) – Bruce Alberts et al (Garland Publ.)
3. Molecular Cell Biology – Lodish, Berk et al (W.H. Freeman Publ.)
4. Cell and Molecular Biology – E.D.P. De Robertis Jr (Lippincott Williams & Wilkins Publ.)
5. Cell Biology – Neal O. Thorpe
6. Biochemistry – David Voet & Judith Voet

Practical Syllabus for Cell Biology

Experiments

1. Cytological preparation of mitosis by squash method
2. Identification of meiotic division by squash method
3. Micrometry
4. Calibration of ocular micrometer for different objectives of microscope
5. Measurement of microorganisms by the use of an ocular micrometer
6. Statistical analysis
7. Isolation of genomic D.N.A. of plant material

Spotting

1. Mitochondrial genome
2. Chloroplast genome
3. Pachytene
4. Anaphase
5. Metaphase
6. Telophase

CORE-II: GENETICS AND BIODIVERSITY

UNIT-I

1. Introduction to genetics: Mendel's principles, gene interaction and modified ratios
2. Multiple alleles, polygenic and extra-chromosomal inheritance (plasmids, mitochondria, chloroplast and maternal inheritance).
3. Sex-linked, sex-limited and sex-influenced inheritance.
4. Population genetics, Hardy-Weinberg law, factors influencing the equilibrium.

UNIT-II

1. Linkage and crossing over, genetic mapping, recombination in yeast and *Neurospora*, cytological evidence of crossing over in maize and *Drosophila*; crossing-over frequency and map distances. Holliday recombination-model.
2. Recombination in bacteria – conjugation, transformation, transduction; recombination and gene mapping.
3. Genetics of phages, Gene fine-structure, concept of cistron, muton, recon, *Ri* locus
4. Mutation, mutagenesis: Physical and chemical mutagenesis, types of mutations, AMES test for mutagenesis, transposons.

UNIT-III

1. Classification of living organisms: characters of important major groups of flora and fauna
Plant and Animal biodiversity.
2. Levels of biodiversity: Genetic and species diversity in plants and animals, Megabiodiversity centers or hot spots, Ecosystem biodiversity: natural and artificial ecosystem; terrestrial (forest, grassland, desert) and aquatic (fresh water, estuarine and marine ecosystem) biomes.
3. Impacts of civilization, scientific developments, human activity (agriculture, mining, industry), natural calamities, population explosion, monocultures, alien species, pests and environmental pollution on biodiversity. Effects of loss of biodiversity and environment consequences. Global climate change and protection of ozone layer.
4. Uses of plant and animal biodiversity.

UNIT-IV

1. Value of biodiversity.
2. Intellectual property rights (IPR): patent, trade secrets, copyrights, trade marks, plant-variety protection (PVP), biopiracy, biosafety guidelines and regulations, Bioethical issues.
3. *Ex situ* and *in situ* conservation of biodiversity – endangered, endemic, vulnerable, rare plants and animals, Red Data Book, Chipko movement.
4. Sustainable management of biodiversity: Afforestation and plantations to ameliorate soil and air environment; Organic farming and permaculture to save agrobiodiversity and biodiversity of organisms useful for agriculture.

Recommend Books:

GENETICS

1. Principles of Genetics – E.J. Gardner and D.P. Snustad
2. Genetics – M. W. Strickbarger
3. Principles of Genetics by E.W. Sinnott, L.C. Donn & T.D.
4. Biology of Genes – Louis Levine
5. Elements of Genetics – P. Singh

BIODIVERSITY

1. Biotechnology: Fundamentals and Applications – Purohith
2. Elements of Biotechnology – P.K. Gupta
3. Environmental Science – A.S. Chauhan
4. Biological Organisation – V. Ahluwalia
5. A Text Book of Environmental Sciences – Purohith, Shammi & Agarwal
6. Environmental Studies – R.C. Desai
7. Text Book of Environmental Studies for undergraduate courses – Erach Bharucha

Practical Syllabus for Genetics & Biodiversity

I. Genetics

1. Introduction
2. Terminology in Genetics
3. Gene Interaction (Problems)
4. Linkage and Crossing over (2-point and 3-point)
5. Problems on Chromosomal aberrations
6. Variations in Chromosome Number

II. Biodiversity Uses of Biodiversity-Plants

1. Capsicum Annum
2. Trigonella foenum graecum
3. Curcuma longa
4. Piper nigrum
5. Zingiber officinale
6. Ocimum tenuiflorum
7. Ficus benghalensis
8. Nyctanthes arbor-tristis
9. Carica papaya
10. Lawsonia inermis

Uses of Biodiversity-Animals

1. Naja naja
2. Crab
3. Salamander
4. Locust

5. Tortoise
6. Bat
7. Hedgehog
8. Sycon
9. Sunspider
10. Ophiothrix

Critically Endangered Flora and Fauna

- 1. Dicerolbicornis**
- 2. Panthertigris**
- 3. Pantherauncia**
- 4. Orangutan**
- 5. Africanwilddogs**
- 6. Indian Elephant**
- 7. GreatIndian Bustard**
- 8. Lotuscorniculatus**
- 9. Cycusbeddomei**
- 10. Rauvulfiaserpentina**

CORE –III:MICROBIOLOGY

UNIT-I

1. Discovery of microorganisms, germ theory of diseases, major contributions in the field of microbiology.
2. Characteristics of important groups of bacteria (Archea and Eubacteria), algae, fungi and protozoa.
3. Economic importance of useful and harmful microorganisms.
4. Prokaryotic cell-wall and its synthesis, peptidoglycan structure, gram-positive and gram-negative cell-walls, cell-surface structure and functions of polymeric components in outer membranes and acidic polymers in gram-negative bacteria.

UNIT-II

1. Microbial growth, generation time and growth kinetics, measurement of growth, factors affecting growth, chemostat, turbidostat, balanced and unbalanced growth.
2. Nutritional types of bacteria, phototrophs, chemotrophs, autotrophs, organotrophs, diazotrophs, methylotrophs.
3. Nutrition and substrate relationship in fungi; hemitrophs, symbionts, necrotrophs, biotrophs.
4. Bacterial reproduction, endospore formation, reproduction methods in fungi, heterothallism, heterokaryosis, parasexual cycle

UNIT-III

1. General properties and structure of viruses and virus-related agents: Virioids and prions, bacteriophages.
2. Nomenclature and classification of viruses.
3. Reproduction in virus, replication of RNA- and DNA- Viruses.
4. Transmission of viruses, management of viruses.

UNIT-IV

1. Control of microorganisms, growth inhibition and killing, sterilization and disinfection (moist and dry heat, radiation and filtration). Factors affecting sterilization and disinfection.
2. Chemical disinfectants, characteristics, evaluation and mode of action of antimicrobial agents, classes of disinfectants – phenol and phenolics, alcohol, halogens (Cl,

chloramines, Br, I., tincture of iodine, iodophores), Biosurfactants, alkylating agents

(formaldehyde, glutaraldehyde, B-propiolactone and ethylene dioxide). Heavy metals (Hg-, Ag-, Cu-containing compounds).

3. QC of food and pharmaceuticals, cleaning and sanitation, cleanrooms, sterility tests, bioburden and microbial quality.
4. Microbiological verification of water systems, Potable water.

Recommend Books:

1. Microbiology- Pelzar, M.J. Chan ECS and Krieg, NRTata McGraw Hill Publ.
2. Biology of Microorganisms- Brock, Prentice Hall Publ.
3. General Microbiology- Prescott and Dunn
4. Bergey's Manual of Systematic Bacteriology (2c)
5. Microbial Physiology- Moat A.G. and T.W. Foster Wiley Eastern Publ.
6. Virology- S. Ram Reddy & S.M. Reddy
7. Introductory Mycology (4e) Alexopoulos et al
8. General Microbiology- R.A. Atlas
9. General Microbiology- Stainer et al
10. Microbial Physiology- S. Ram Reddy
11. An Introduction of Mycology- Mehrotra R.S. and Aneja K.R.

Practical syllabus for Microbiology

I. Microbiology Techniques (major)

1. Preparation of Media

- a) Preparation of Nutrient Agar Media
- b) Preparation of Nutrient Broth media
- c) Preparation of Sabourauds media (fungal media)

2. Simple staining method for Bacteria
3. Gram staining technique
4. Growth curve of microbes
5. Colony purification – Streak culture

II. Isolation techniques (minor)

6. Isolation of Microbes from Water
7. Isolation of Microbes from Air
8. Isolation of Microbes from Soil by serial dilution plate techniques
9. Antibiotic sensitivity of the Microbes

Spotting

1. Aspergillus
2. Penicillium
3. Yeast
4. Nostoc
5. Spirulina
6. Spirillum
7. Bacillus
8. Cocci
9. Vesicular and Arbuscular Mycorrhizae (VAM)

CORE-IV-BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES

UNIT-I

1. Buffer and measurement of pH, viscosity, diffusion, osmosis, and Donnan effect – biological applications.
2. Spectroscopic techniques. Principles of spectroscopy: Laws governing light absorption (Beer-Lambert's Law). Instrumentation and biological applications of UV and visible spectrophotometer, Mass spectroscopy,
3. Flame photometry, atomic-absorption spectrophotometry, Basic principles of IR and NMR spectroscopy.
4. Radioisotope techniques; types of isotopes. Nature and type of radioactivity, Decay units, detection and measurement of radioactivity (GM and Scintillation). Biological uses of radioisotopes.

UNIT-II

1. Principles, methods and biological applications of paper chromatography – circular, ascending and descending
2. Thin-layer chromatography (TLC), Gas-liquid chromatography (GLC),
3. Filtration and Purification techniques: Ion-exchange chromatography, affinity chromatography, gel-Filtration chromatography, gel matrices-sephadex, acrylamide, agarose gels.
4. High-performance liquid-chromatography (HPLC), HPLC coupled Mass spectroscopy,

UNIT-III

1. Electrophoretic process, Types of Electrophoresis, Ion movement in electric field
2. Supporting media - Starch, Paper, Agarose. Acrylamide Polyacrylamide gel-electrophoresis-slab, disc, native and SDS,
3. Gradient gel-electrophoresis, pulse-field electrophoresis.
4. Isoelectric focusing, Two-dimensional gel electrophoresis, Immunoelectrophoresis, high-voltage electrophoresis.

UNIT-IV

1. Basic principles of centrifugation; preparative centrifugation-differential, rate-zonal, isopycnic and equilibrium isodensity centrifugation
2. Analytical ultracentrifugation and its applications, purity of biomolecules and detection of conformation change in macromolecules.
3. Microscopy: principles and working of light and phase-contrast, fluorescent, scanning and transmission electron-microscopy, Cryo electron microscopy.
4. Flow Cytometry and their applications.

Recommended Books:-

1. Principles of Biochemistry—A.L. Lehninger (CBS Publishers).
2. Biochemistry—Lubert Stryer (5th Edition).
3. Principles of Biochemistry-General aspects-Smith et al. (8th edition).
4. Harper's Biochemistry—Murray et al. (Lange).
5. Text Book of Biochemistry—West et al., 1966 (Mac Millan).
6. Biochemistry (2nd Edition)- David Voet & J.G. Voet.
7. Outlines of Biochemistry- E.E. Cohn & P.K. Stump (Wiley Eastern Lt.).
8. Biochemistry- Zubay.
9. Text Book of Biochemistry and Clinical correlation- Thomas M. Devlin (John Wiley).
10. Biochemistry- C.K. Mathews & K.E. Van Holde (1995, 2nd Edt.) (Benjamins/Cummings).
11. Principles of Biochemistry (3rd Edt.)- A.L. Lehninger, David L. Nelson & Michael C. Cox..
12. Biochemistry (4th Edt.)- L. Stryer.
13. Biochemistry— Zubay.
14. Biophysical Chemistry- Upadhyay & Upadhyay.
15. Practical Biochemistry (4th Edition)- Keith Wilson & John Walker (Cambridge Editions).
16. Biochemistry- Plummer

PRACTICALS

BIOPHYSICAL & BIOCHEMICAL TECHNIQUES

1. Measurement of PH
2. Preparation of Buffers
3. Determination of Viscosity by Viscometer
4. Determination of DNA purity by UV spectrophotometer
5. Isolation of DNA

6. Estimation of Isolated DNA from any source
7. Estimation of Proteins. Separation of Proteins by Electrophoresis

8. Separation of Nucleic acids by Agarose electrophoresis
9. Separation of Proteins by SDS-PAGE
10. Elution of samples from Gel
11. Separation of Carbohydrates by Paper Chromatography
12. Separation of Amino acids by Paper Chromatography
13. Separation of Lipids by Thin Layer Chromatography
14. Demonstration Column Chromatography
15. Demonstration HPLC and GC
16. Verification of Lambert-Beers Law by UV-VIS Spectrophotometer
17. Membrane separation-Dialysis

SPOTTINGS

1. PHmeter
2. Viscometer
3. Centrifuge
4. Dialysis
5. Spectrophotometer
6. Agarose electrophoresis
7. SDS-PAGE
8. Greiger Muller counter
9. Immunoelectrophoresis
10. HPLC
11. GC

M.Sc. Biotechnology (Semester-II)

CORE-I-CELL AND TISSUE CULTURE TECHNOLOGY

UNIT-I

1. Introduction of plant-cell, tissue and organ culture
2. Different types of tissue culture media and composition
3. Initiation of callus, caullogenesis, rhizogenesis
4. Cyto-differentiation *in vitro* and role of nutrients and plant growth regulators in plant cell and tissue culture

UNIT-II

1. Micro-propagation including production of virus-free plants and clonal propagation
2. Somatic embryogenesis and synseed technology
3. Somaclonal variations and role in crop improvement and embryo rescue
4. Androgenic haploidy (pollen & anther culture) and its importance in crop improvement

UNIT-III

1. Principles and techniques of animal cell and tissue culture, sources of different types of animal cells
2. Animal cell-culture media, maintenance of animal cell-cultures, properties of cell lines, vaccines production.
3. Hybridoma technology; production steps of Monoclonal antibodies, applications and importance
4. Measurement of cell death; Apoptosis and cell proliferation assay.

UNIT-IV

1. Protoplast studies-isolation, culture, fusion and selection of hybrid cells, somatic hybrids, cybrids and applications
2. Cell-line selection: Induction and selection of mutants-drought and disease resistance
3. Cell-suspension cultures, production of secondary metabolites.
4. Cryopreservation and conservation of germplasm

Recommended Books:

1. Plant biotechnology - Chawla
2. Cell and tissue culture methods - H.D.Kumar
3. Methods in Plant tissue culture - Razdan
4. Revolution in Biotechnology - Mark JL
5. Plant genetic engineering - Dodds J.H.
6. Principles of plant biotechnology's An introduction to genetic engineering in plants – Mantal, S.H. Mathews J., Micke R.A.
7. Biotechnology: Fundamentals and Applications - Purohith

Practical syllabus :

1. Preparation of MS medium
2. Sterilization and Inoculation of explants
3. Initiation and induction of callus formation from leaf explants
4. Anther culture
5. Synthetic seed preparation
6. Preparation of cell suspension culture
7. Preparation of Animal cell culture media
8. Preparation of reagents

9. Trypsinization

CORE-II: BIOCHEMISTRY

UNIT– I

- a) Principles of bioenergetics, laws of thermodynamics, enthalpy, entropy, concept of free energy, high energy compounds, ATP – Cycle, coupled reactions, Oxidation Reduction reactions.
- b) Types of phosphorylations; arrangement of electron carriers in prokaryotes, eucaryotes and chemiosmotic hypothesis. Uncouplers of electron transport chain.
- c) Classification and nomenclature of enzymes, specificity, factors influencing enzyme activity. Michaelis constant and its significance, enzyme kinetics, determination of K_m , V_{max} , and L-B plots, regulation of enzyme activity: activators and inhibitors, feedback inhibition and isoenzymes.

UNIT– II

- a) **Carbohydrates:** definition of monosaccharides, structure of carbohydrates, Stereoisomerism, oligosaccharides.
- b) **Amino acids and proteins:** amino acids, essential amino acids, nonprotein amino acids, peptide bond, solubility, denaturation, functional diversity, Primary, Secondary, Tertiary, Quaternary (Hb), structures of proteins, and sequencing of polypeptides.
- c) **Lipids:** Definition and classification of lipids, fatty acids and essential fatty acids. Triacylglycerols, sterols cholesterol and prostaglandins.

UNIT– III

- a) **Metabolic pathways:** Glycolysis, pentose phosphate pathway, ED pathway, glyoxylate and citric acid cycles, gluconeogenesis.
- b) **Metabolism of Lipids:** biosynthesis, oxidative pathways (β -oxidation)
- c) Amino acids biochemical transformation of amino acids deamination, decarboxylation, transamination, desulphydration; transdeamination and urea cycle.
- d) Structure of Nucleotides, Nucleosides and Nitrogen bases. Biosynthesis degradation and regulation of Pyrimidine nucleotides. Biosynthesis, degradation and regulation of purine nucleotides and associated disorders of Pyrimidine and purine nucleotides.

UNIT– IV

- a) Structure of Nucleotides, Nucleosides and Nitrogen bases.
- b) Biosynthesis, degradation and regulation of Pyrimidine nucleotides.
- c) Biosynthesis, degradation and regulation of purine nucleotides and associated disorders of Pyrimidine and purine nucleotides.

Recommended Books:-

1. Principles of Biochemistry - A.L. Lehninger (CBS Publishers)
2. Biochemistry - Lubert Stryer (5th Edition)
3. Harper's Biochemistry - Murray et al. (Lange)
4. Text Book of Biochemistry - West et al., 1966 (MacMillan)
5. Biochemistry (2nd Edn) - David Voet and J.G. Voet
6. Outlines of Biochemistry - E.E. Cohn and P.K. Stump (Wiley Eastern Ltd.)
7. Biochemistry - Zubay
Text Book of Biochemistry and Clinical correlation – Thomas M. Devlin (John Wiley)
Biochemistry – C.K. Mathews and K.E. Van Holde (1995, 2nd Edt) (Benjamins/Cummings)
Principles of Biochemistry (3rd Edt) – A.L. Lehninger, David L. Nelson & Michael C. Cox
Biochemistry (4th Edt) - L. Stryer
1. Understanding Enzymes (1985) – Trevor Palmer (John Wiley)
2. Fundamentals of Enzymology (3rd Edt) - Nicholas C. Price & Lewis Stevens
3. Enzymes Biochemistry, Biotechnology, Clinical Chemistry – Trevor Palmer
4. Enzymes - Dixon and Web
5. Enzymology - Boyer

PRACTICALS

I. Quantitative analysis of carbohydrates

1. Iodine test
2. Fehling's test
3. Benedict's test
4. Barfoed's test
5. Seliwanoff's test
6. Bial's test
7. Mucic acid test
8. Test for sucrose
9. Osazone test

II. Quantitative analysis for Carbohydrates

1. Identification of Fructose
2. Identification of Maltose
3. Identification of cellulose
4. Identification of Lactose
5. Identification of Sucrose

III. Quantitative analysis for Amino acids

1. Identification of Proline
2. Identification of Tryptophan
3. Identification of Tyrosine

IV. Titrometry

1. Estimation of saponification of Oils

V. Qualitative analysis

1. Estimation of reducing sugar by DNS method
2. Estimation of Protein by Biuret method
3. Estimation of Protein by Lowry method

VI. Spotting

1. Spindle model of ATP synthetase
2. Lock & key model of enzyme active site
3. Aminoglycosides
4. Peptide bonds
5. Haemoglobin
6. Cholesterol
7. Prostaglandins
8. Nucleosides
9. TCA cycle
10. Nucleotide associated disorders

CORE-III:MOLECULARBIOLOGY

Unit-I

- a) Prokaryotic and eukaryotic chromosome structure, chromatin structure.
- b) DNA replication: General Principles, Enzymology – Helicases, topoisomerases, DNA Polymerases, reverse transcriptase and their mechanism rolling circle, unidirectional, bidirectional, DNA synthesis by reverse transcription; inhibitor of DNA replication blocking precursor synthesis, nucleotide polymerization altering DNA structure.
- c) DNA damage and repair: Types of DNA damaged – deamination, oxidative damage, alkylation, pyrimidine dimers; repair pathways methyl directed mismatch repairs, short patch repair, excision repair recombination repair, SOS system.

Unit-II

1. Structural features of rRNA, t RNA and m RNA, MicroRNAs and their relation of function, transcription general principles, basic apparatus, RNA polymerases, mechanism of transcription, promoters, enhancers and other regulatory sequences, inhibition of transcription.
2. Post-transcriptional controls: Transcriptional attenuation, methylation cutting and trimming of r RNA, capping polyadenylation and splicing of m RNA, cutting and modification of t RNA, degradation system, catalytic RNA, group I and group II intron splicing Rnase P.

Unit-III

1. Protein synthesis (translation): basic features of genetic code, wobble concept; prokaryotic and eukaryotic ribosomal associations, Mechanism of translation initiation, elongation and termination, factors that control above steps, inhibitors of protein synthesis.
2. Post translational modification of proteins: protein folding, Protein targeting, signal hypothesis. In vitro transcription and translation systems.

Unit-IV

- a) Molecular analysis of genes – concept of gene – classical and neoclassical; Molecular definition of gene – gene fine structure with reference to r II locus in *phages*.
- b) Regulation of gene expression – Operon concept, catabolite repression, positive and negative regulation, inducers and corepressors, *lac* operon, *trp* operon, *ara* operon and *gal* operon in yeasts.

- c) Global regulatory responses: heat shock response, stringent response and regulation by small molecules such as ppGpp and cAMP, of rRNA synthesis.

Recommended books

1. Brown, T.A. 1999 Gene Cloning. 3rd edition. Chapman and Hall Publications, USA.
2. Burrell, M.M. 1993. Enzymes of Molecular Biology, Humana Press.
3. Chirikjian, J.G. 1995 Biotechnology—Theory and Techniques, Vol. II, Jones and Bartlett Publishers.
4. Gerhardt, P. Murray, R.G., Wood, W.A., and Krieg, N.R. 1994 Methods for General and Molecular Bacteriology, ASM Press, Washington D.C.
5. Glick, B.R. and Pasternak, J.J. 1998 Molecular Biotechnology—Principles and Applications of Recombinant DNA, ASM Press, Washington D.C.
6. Lewin, B. 2008 Genes IX. Oxford University Press, Oxford.
7. Murray Moo 1992 Plant Biotechnology. Young, Pergamon Press.
8. Ratledge, C. and Kristiansen, B. 2001 Basic Biotechnology, II Edition, Cambridge University Press.
9. Winnacker, E.L. 1987 From Genes to Clones: Introduction to Gene Technology. VCH Publications, Federal Republic of Germany.
10. Antony, J.F., Griffiths, Gilbert, W.M., Lewontin, R.C. and Miller, J.H. 2002 Modern genetic analysis, Integrating Genes and Genomes, 2nd edition, WH Freeman and Company, New York.
11. Blackburn, G.M. and Gait, M.J. 1996 Nucleic acids in chemistry and biology. Oxford University Press.
12. Molecular Biology of cell. Albert *et al.*, 4th Edition Garland Publishing Inc.
13. George M. Malacinski, David Freifelder. 1998 Essentials of Molecular Biology. Jones and Bartlett Publishers.
14. Maloy, S.R., Cronan, J.R. Freifelder, D. 1994 Microbial Genetics, Jones and Bartlett Publishers.
15. Macinski, G.M. and Freifelder, D. 1998 Essentials of Molecular Biology, 3rd Edition, John and Bartlett Publishers.
16. Sir John Kendrew 1994 The Encyclopedia of Molecular Biology. Blackwell Science Ltd
17. Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A.M. 1998 Molecular Biology of the Gene, 4th edition, Benjamin/Cummings publishing company.
18. Freifelder, D. 1997 Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
19. Freifelder, D. 1990 Microbial Genetics. Narosa Publishing House, New Delhi.
20. Snyder, L. and Champness, W. 1997 Molecular Genetics of Bacteria. ASM press, USA.
21. Maloy, S.R., Cronan, J.E. and Freifelder, D. 1994 Microbial Genetics, Jones and Bartlett Publishers, London.
22. Turner, P.C., McLennan, A.G., Bates, A.D. and White, M.R.H. 1998 Instant Notes in Molecular Biology, Viva Books Pvt., Ltd., New Delhi.

MOLECULARBIOLOGY-Practicals

1. EstimationofDNA&RNA
2. DeterminationofpurityofDNA
3. U.V.Survivalcurve
4. IsolationofDNA fromsheepliver
5. Isolationofauxotrophicnurtantsbyreplicaplastingmethod
6. IsolationofPlasmid DNA
7. Preparationofcompetentcells
8. IsolationofDNAbyMICROPREPmethod
9. Southern&Westernblotting
10. ProblemsrelatedtoMolecularBiology

Spotting

- a) ADNA
- b) ZDNA
- c) Nucleosomes
- d) Topoisomerases
- e) RNA Polymerase
- f) RNA Splicing
- g) DNAPolymerase
- h) tRNAModel
- i) EukaryoticRibosomes
- j) PolyRibosome
- k) ReplicaPlating
- l) Galoperon-yeast
- m) Translation

CORE-IV-MICROBIALANDINDUSTRIALBIOTECHNOLOGY

UNIT– I

1. Isolation, primary and secondary screening of industrially important Microorganisms.
2. Strain development of industrially-useful microbes
3. Preservation of industrial microorganisms.
4. Immobilization technology for cells and enzymes and its applications.

UNIT– II

1. Industrial production of amino acids: glutamic acid, lysine; organic acids: lactic acid, acetic acid and gluconic acid.
2. Industrial production of antibiotics: penicillin, streptomycin, tetracycline.
3. Industrial production of solvents: ethanol, butanol, acetone. Production of beverages: wine, beer,
4. Industrial production of vitamins: A, B complex (B₂, B₁₂ Riboflavin) and C

UNIT– III

1. Industrial production of enzymes: proteases, amylases, lipase, phytases.
2. Production of human growth hormone and α - and β -interferons.
3. Scope, utility and methodology of biotransformation of steroids and nonsteroids
4. Production of single-cell proteins (bacterial, yeast, fungal and algal)

UNIT– IV

1. Industrial production and preservation of foods. Dairy products – cheeses, coloured butter milk, cultured cream, yogurt, acidophilous milk and Idly.
2. Yeast and yeast products: brewer's yeast, baker's yeast, food and fodder yeast, bread making and baked foods.
3. Edible mushrooms and their cultivation.
4. Food-process technology: thermal processing, microwave heating, thermal inactivation of microorganisms, freezing and thawing, evaporation, dehydration, drying -tunnel, tray, spray, drum, freeze, distillation.

Unit-I

- a) History of immunology, introduction to Immune system and its importance, structure. Composition and functions of cells, organs of Immune system.
- b) Antigens–Antibodies: Antigens structure, properties types, Iso, Allo, Haptens, Adjuvants, Immunoglobulin, structure, types, properties & biological functions.

Unit-II

Molecular Immunology

- a) Genes of the immune system MHC, HLA typing, transplantation, immune suppressive agents, immune aspects of tumors,
- b) Theories of Antibodies production generation of Antibodies diversity. Production of Monoclonal Antibodies and their applications, production of various vaccines and their action, adverse reactions to vaccines.

Unit-III

Clinical Immunology

- a) Complement system: components, complement activation, Pathways, regulation of complement system, biological consequences of complement activation, deficiency disorders of complement system, complement fixation test,
- b) Hypersensitivity reactions: Type I, II, III, IV
- c) Autoimmune diseases: immunodeficiency

Unit-IV

Applied Immunology

- a) Immunity: Innate, Acquired, Humoral, cell mediated, blood groups, blood transfusions and Rh-incompatibility
- b) Antigen antibody interactions: Agglutination, Precipitation, Flocculation, Immunodiffusion, Immunoelectrophoresis, Immunofluorescence, RIA, ELISA, Phagocytosis, Opsonization, Neutralization.

Recommended Books

1. Bellanti, J.A. 1985 Immunology III Ed.
2. Coleman, R.M. Lambard, M.F. and Siccard, 1992 Fundamental of Immunology II Ed.
3. Kuby, J. 2004 Immunology VI Ed. W.H. Freeman and Company New York.
4. Poul, W.E. 1990 Fundamental of Immunology II Ed. Ravar Press, New York.
5. Riot, M. Ivan 1998 Essential Immunology VII Ed. ELBS and Blackwell Scientific Pub. England.
6. Tizarrd, I.R. 2004 Immunology an Introduction II Ed. Thomson Asia Pvt. Ltd
7. Ross, G.D. Immunology of the complement System
8. Riott, J.M. Brostoff, J. Jand Male D.K. 1996 Immunology IV Ed. CVMosby Pub. St. Loius.
9. Johnstone, A. and R. Thrope Immuno Chemistry.
10. Weir, Hand Book of experimental Immunology Voll, II
11. Unani and Benacerraf, Text Book of Immunology.
12. Stiter, Terrand Parlow Basic and Clinical Immunology
13. Tom Parker, M. Lesline, H. Collier, 1990 Principles of Bacteriology, Virology and Immunity. VII Ed.
14. Chapel, H. and Halbey, 1986 Essentials of clinical Immunology ELBS London.
15. Donald M. Weir, John Steward, 1993 Immunology VII Ed. ELBS, London.
16. Hue Davis, 1997 Introductory Immunology Champman and Hall Publisher.
17. Peter, J. Delves, Ivan M. Roit Ed 1998 Encyclopedia of Immunology II Ed. Acad, Press.
18. Ridklad, M. Aydl, 1995 Immunology II Ed. Baltimore, Hangkang, NMSPub.
19. Janeway, C. 2004 Immunology VI Ed, Garland Science. New Yark.

Semester-III

Paper – I

IMMUNOLOGY PRACTICALS

1. Enumeration of RBC, WBC
2. Differentiating counting of WBC
3. Isolation of Lymphocytes
4. Identification of blood groups & Rh typing
5. Identification of *Salmonella* Antibodies
6. Identification of Incomplete Antibodies
7. Identification of Autoantigens
8. Identification of Rapid plasma regain
9. Identification of surface Ag of Hepatitis B
10. Identification of hcg Ag by Immunochromotography
11. Identification of hcg Ag by ELISA

12. Preparation of immunogenic wells
13. Single immunodiffusion
14. Double immunodiffusion
15. Separation of serum immunoglobulins by immunoelectrophoresis
16. Isolation of Lymphocytes

Semester – III ELECTIVE INTERDISCIPLINARY

Unit-I

BIOINFORMATICS

Introduction to Computers: Overview of computer organization and historical perspective computer application in various fields of science and management, Data representation: Number systems, character representation codes, binary, hex, octal codes and their inter conversions. Binary arithmetic floating point arithmetic, signed and unsigned numbers. Data storage: primary and secondary storage. Introduction to various computer devices such as keyboard, mouse, printers, disk files, floppies etc. concept of computing, operating systems such as windows NT, UNIX etc. (only brief user level description). Introduction to organization and architecture of mainframe, mini and micro systems. Introduction to E- mail, ftp, login and other network services, world wide web, MS- Office.

Unit-II

BIOLOGICAL DATABASES: Basic concepts of databases, bioinformatics & importance of databases, integration of databases and its need. DNA databases, protein sequencing databases, functional motifs databases, protein structure databases. Websites pertaining to these databases. Database querying, keyword searching, search machines, complex matches.

Unit-III

SEQUENCE ANALYSIS: Concepts of DNA protein sequence alignment and their importance, sequence alignments and alignment programs. Comparative sequence analysis: Pair wise sequence alignment, multiple sequence alignments, methods like BLAST, FASTA. Tools like CLUSTAL. Scoring schemes and substitution matrices like PAM, BLOSUM. Dynamic programming.

Unit-IV

MOLECULAR MODELING: Proteomics and genomics. Functional and structural proteomics. Genomics studies. Determination of structure of proteins, predicting protein structure – secondary structure, 3D structure, and domain structure – DNA binding domains. Molecular modeling: Comparative modeling. Methods of protein modeling, Microarray technology, human genome project and applications, Pharmacogenomics.

Recommended books

1. Primrose SB. Principles of Genome Analysis: a guide to mapping and sequencing DNA from different organisms. 2nd Ed. 1988. Blackwell Science: Oxford. ISBN 0-632- 04983-9
2. Genome Mapping: A practical approach. Dear P(Editor). 1st Ed. 2000. Oxford University Press :Oxford, New York.
3. Developing Bioinformatics Skills. Alfonso Valencia and Blaschke. L (2005) Oreille's Publication.
4. Bioinformatics sequence, structure and data banks ed. By Des Higgins Willie Taylor. (2006)

Semester – II
PRACTICAL – II
BIOINFORMATICS

1. Recognition of a sequence (DNA, RNA, Protein)
2. Drafting a computer program to carry out the same task in answering this question.
3. Inferring the complementary sequence for a given nucleotide sequence.
4. Navigating NCBI
5. Discuss the different internal links provided in the NCBI site
6. Navigating BLAST
7. Navigate ENTREZ browser of NCBI and note the various search utilities it can provide such as literature, sequence links etc.
8. Navigate ENTREZ browser of NCBI for information on:
 - a) Diabetes and the genes associated with it
 - b) Recent information on vaccines.
9. Sequence retrieval from NCBI & EMBL
10. Use GOOGLE, and visit the Pathways database to obtain information on conversion of glucose to pyruvate.
11. Identify orthologues, paralogues for a given sequence and build a phylogenetic relationship
12. In silico restriction digestion of a given sequence.

Semester III Paper III

FERMENTATION AND BIOPROCESS ENGINEERING

UNIT-I

1. History of fermentation technology. General requirements of fermentation process.
2. Basic design and construction of fermenter and bioreactor, parts and accessories.
3. Types of bioreactors – Batch fermenter, continuous-stirred-tank fermenter. tower, airlift, fed -batch reactor, fluidized-bed, enzyme bioreactor, photo bioreactor, enzyme bioreactor.
4. Advantage and disadvantages of construction type of bioreactor.

UNIT-II

1. Medium requirements for fermentation process, media optimization.
2. Sterilization methods of media and fermenter. Main parameters to be monitored and controlled during fermentation.
3. Solid-state and submerged fermentation.
4. Aerobic and anaerobic fermentations.

UNIT-III

1. Basic principles in Bioprocess.
2. Upstream unit operations involved in bioprocess.
3. Generalised process-flow-sheets.
4. Transport phenomenon in bioprocess-mass transfer, mass transfer coefficient, heat transfer, heat transfer coefficient.

UNIT-IV

1. Isolation of fermentation product: distillation, solvent extraction, adsorption, ultra filtration, precipitation.
2. Recovery of fermentation products – removal of insoluble, centrifugation, sedimentation,

flocculation, electro -precipitation, (grinding, homogenization, leaching)

3. Purification of fermentation product: chromatography, crystallization, desiccation, spray drying, adhesive spray dryers, drum dryers, freeze dryers.
4. Product formulation and Fermentation economics.

PRACTICALS

1. Ammonium salt precipitation
2. Dialysis
3. Wine production and characterization
4. Determination of Ethanol concentration in aqueous solution

Semester-III Paper- IV

PLANT AND AGRICULTURAL BIOTECHNOLOGY

UNIT-I

1. Plants as bioreactors
2. Molecular pharming.
3. Plant antibodies.
4. Edible vaccines.

UNIT-II

1. Production of organic manures and Production of Bio fertilizers- N_2 fixers and genes involved.
2. Phosphate solubilizers: PGPR and mycorrhizae.
3. Common diseases of crop plants.
4. Molecular aspects of resistance and susceptibility: Defense mechanism in plants; Host-parasite interaction.

UNIT-III

1. Role of selectable markers and reporter genes in genetic transformation. Marker-free transformation.
2. Selection of transformants and regeneration of transgenic plants.

3. Terminator technology
4. Antisense RNA technology, RNAi, Genome editing technology.

UNIT-IV

11. Genetic engineering of crop plants for resistance to abiotic stress (drought, salt, herbicide, temperature) and biotic stresses (viral, bacterial, fungal, and insect)- Bt genes, chitinase and glucanase genes.
12. Metabolic Engineering: Control mechanisms and manipulation of phenyl Propanoid pathway, shikimate pathway to aromatic amino acids; Pyridoxyl phosphate-mediated transformations in alkaloid biosynthesis.
13. Engineering for nutritional qualities: plant-protein composition and improved oil-storage in seeds of cereals, pulses and oil seeds.
14. Chloroplast Engineering and advantages of chloroplast transformation.

PRACTICALS

Major

1. Production of Vermicompost
2. In vitro culture of Bluegreen Algae
3. In vitro culture of Endophytic Mycorrhizae
4. Biolistic transformation of Rice

Minor

1. In vitro culture of Rhizobium species
2. Histochemical staining of genetically transformed callus
3. Map of cry3a gene construct on Ti plasmid
4. Determination of Reserpine in callus tissue of Rauwolfia serpentina

INTELLECTUAL PROPERTY RIGHTS (IPR)

Unit – I

a) Introduction to Intellectual Property:

Historical Perspective, Different Types of IP, Importance of protecting IP.

b) Copyrights

Introduction, How to obtain, Differences from Patents.

c) Trade Marks

Introduction, How to obtain, Different types of marks – Collective marks, certification marks, service marks, Trade names, etc.

Differences from Designs.

d) Patents

Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India.

Unit II

a) Geographical Indications

Definition, rules for registration, prevention of illegal exploitation, importance to India.

b) Industrial Designs:

Definition, How to obtain, features, International design registration.

c) Layout design of integrated circuits

Circuit Boards, Integrated Chips, Importance for electronic industry.

d) Trade Secrets

Introduction and Historical Perspectives, Scope of Protection, Risks involved and legal aspects of Trade Secret Protection.

Unit – III

Different International Agreements

a) World Trade Organization (WTO):

i) General Agreement on Tariffs & Trade (GATT), Trade Related Intellectual Property Rights (TRIPS) agreement

ii) General Agreement on Trade Related Services (GATS)

iii) Madrid Protocol

iv) Berne Convention

v) Budapest Treaty

b) Paris Convention WIPO and TRIPS, IPR and Plant Breeders Rights, IPR and

Biodiversity

UnitIV:

IP Infringement issue and enforcement – Role of Judiciary, Role of law enforcement agencies – Police, Customs etc. Economic Value of Intellectual Property – Intangible assets and their valuation, Intellectual Property in the Indian Context – Various laws in India Licensing and technology transfer.

Reference Books:

1. N.K.Acharya: *Textbook on intellectual property rights*, Asia Law House (2001).
2. Manjula Guru & M.B.Rao, *Understanding Trips: Managing Knowledge in Developing Countries*, Sage Publications (2003).
3. P.Ganguli, *Intellectual Property Rights: Unleashing the Knowledge Economy*, Tata McGraw-Hill (2001).
4. Arthur Raphael Miller, Micheal H. Davis; *Intellectual Property: Patents, Trademarks and Copyright in a Nutshell*, West Group Publishers (2000).
5. Jayashree Watal, *Intellectual property rights in the WTO and developing countries*, Oxford University Press, Oxford.

**SEMESTER – III
OPEN ELECTIVE –
III**

TOURISM AND HOSPITALITY MANAGEMENT

UNIT-I:

Definitions & Abbreviations – Concept of Tourism - Introduction to Tourism – Nature, Scope and Significance - Components and Constituents of Tourism Industry – Elements of Tourism - Types of Tourism – Present Trends in Domestic and Global.

UNIT-II:

Definition, size and scope of Hotel Industry, Principles and concepts of Hotel and its objectives, organization, departments and classification of Hotels, star categorization, types of rooms and types of plan

UNIT-III:

Travel and Transport - Basics of Travel Motivation - Social Significance of Travel - Modes of Travel - Tourist Preferences - Road Travel - Rail Travel – Indian Railways - Waterways – Civil Aviation Industry in India - Itinerary Planning and Development – Special interest Tours.

UNIT-IV:

Push and Pull Theory - Demand and Supply in Tourism - World Tourism Organisations (UNWTO, PATA, IATA) - Tourism Organisations of India (MoT, ITDC, TAAI, IATO, TSTDC) – Current India Tourism Promotional Campaigns and Schemes.

Suggested Readings:

1. Angelo, Andrew, *An Introduction to Hospitality Today*, ELBS, 2002.
2. Anand, M.M.: *Tourism and Hotel Industry in India*, Prentice Hall, New Delhi, 1976.
3. Gray, W. and Ligouri, S.C.: *Hotel and Hotel Management for Hotels*, Pub. Williams & Heinemann, London.
4. Negi Jagmohan, *Introduction to Hotels & Tourism*, Orient Longman, 2006
5. Stephen S. Hall, Stephen S., *Ethics in Hospitality Management*, Educational Institute of the American Hotel & Motel Associate, 1992
6. Pymer, Robert A.: *Introduction to Hotel and Restaurant Management*, Hunt Pub. Co., Iowa, 1984.

SEMESTER – III

OPEN ELECTIVE – V

e-COMMERCE

UNIT – I

Introduction to E-Commerce – Categories of E-Commerce – Economic forces and electronic commerce – E-Commerce opportunities

UNIT – II

Internet and World Wide Web – Intranet and Extranet – Internet connection options. Creating an Effective web presence – Technology ECRM Brands and web.

UNIT – III

Business to Business purchasing, logistics and support activities – Online Auctions and related business – Legal Environment of E-Commerce – Ethical issues.

UNIT – IV

Web Servers software and hardware – Communication channel security – Payment cards – Electronic Cash – Electronic Wallets – Stored value cards.

Suggested Readings

1. Schneider, E-Commerce, Thomson Publishing.
2. Albert Napier H, Rivers Nollie, Wagner W Stuart and Napier JB (2008)
3. Murthy CSV (2009) E-Commerce – Concepts, Models, Strategies, Parag Diwan and Sunil Sharma (2005) E-Commerce, New Delhi, Excel Books

SEMESTER – III
OPEN ELECTIVE – V
HUMAN RIGHTS

UNIT-I

Definition of Human Rights - Nature, Content, Legitimacy and Priority - Theories on Human Rights - Historical Development of Human Rights.

UNIT-II

International Human Rights - Prescription and Enforcement upto World War II - Human Rights and the U.N .O. - Universal Declaration of Human Rights - International Covenant on Civil and Political Rights - International Covenant on Economic, Social and Cultural Rights and Optional Protocol.

UNIT-III

Human Rights Declarations - U.N. Human Rights Declarations - U.N. Human Commissioner.

UNIT-IV

Amnesty International - Human Rights and Helsinki Process - Regional Developments - European Human Rights System - African Human Rights System - International Human Rights in Domestic courts.

UNIT-V

Contemporary Issues on Human Rights: Children's Rights - Women's Rights - Dalit's Rights
- Bonded Labour and Wages - Refugees - Capital Punishment. Fundamental Rights in the Indian Constitution - Directive Principles of State Policy - Fundamental Duties - National Human Rights Commission.

Books for Reference:

1. International Bill of Human Rights, Amnesty International Publication, 1988.
2. Human Rights, Questions and Answers, UNESCO, 1982
3. Maurice Cranston - What is Human Rights
4. Desai, A.R. - Violation of Democratic Rights in India
5. Pandey - Constitutional Law.
6. Timm, R.W. - Working for Justice and Human Rights

**SEMESTER –
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NEII**

ANIMALANDMEDICALBIOTECHNOLOGY

UNIT-I

1. Manipulationofreproductioninanimalsandhumans.
2. Superovulation,artificialinseminationand*invitro*fertilization(IVF),Intra cytoplasm semen insemination (ICSI).
3. Transgenicanimals:mice,cattle,sheepandfish.
4. Animalasbioreactorsand molecularfarming.

UNIT-II

1. Geneticsusceptibility,geneticload,prenataldiagnosisandgeneticcounseling.
2. *Exvivo*and*invivo*methodsofgenetherapy,genesilencingandgeneediting.
3. Genetargetingprospects.
4. Methods of drug delivery, Drug design, drug-protein, protein-protein, protein-DNA interactions. Nanotechnology in drug delivery.

UNIT-III

1. Hostdefensesagainstpathogens:componentsofhost-surfacedefenses:skin, mucosa; defense systems of eye, mouth and respiratory tract.
2. Componentsofsystemicdefense:tissuesandblood.
3. Virulenceandvirulencefactors.
4. Modulationofimmunerresponsebyvaccinesandotherimmunomodulatorsand their structure and functions.

UNIT-IV

1. Animalcloning;ethicalandsocialimplications;stem-cellapplications.
2. Humangenomesequences.
3. Geneticdisorders:Monogenicandmultifactor disorders(cardiovascularandneurological diseases).
4. Endocrine functions: pituitary (somatostatin), pancreas (insulin, glucagon), thyroid (thyroxine, calciton

PRACTICALS

1. Preparation of Tissue Culture Medium (Balanced salts solution)
2. Sterilization of media
3. Preparation of single cell suspension from mice spleen
4. Preparation of chick embryo fibroblast cell culture
5. Cell counting and cell viability
6. Trypsinization of monolayer and subculturing
7. Isolation of microorganism from skin (Human) and staining
8. Isolation of microorganism from mouth and determination of dental carrier susceptibility
9. Acid fast staining for Mycobacterium tuberculosis
10. DOT-ELISA

Spotting

1. CO₂ incubator
2. Inverted microscope
3. Hemocytometer
4. Membrane filters
5. Roux bottle
6. Roller bottle
7. Diphtheria
8. Phagocytosis
9. Down syndrome
10. Turner syndrome
11. In vitro fertilization
12. Embryo transfer
13. Knockout mouse
14. Amniocentesis
15. Transgenic sheep

Semester –
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CONCEPTSOFCLINICALRESEARCH

Unit – I

Clinical Trails

Types of Clinical Trails, Clinical Trial Data –sets, Clinical Trial Variables, Statistics FDA and Drug Approval Process, Clinical Trial Study Designs, ICH –GCP, Guidelines, FDA Regulation and Guidance, Clinical Data Interchange Standards Consortium (CDISC) Clinical Trail Colleagues, Guiding Principles for Statistical Programmer

Unit–II

ConceptsofBio-statsRelatedtoSAS

Getting Started Using SAS Software : The SAS Language, SAS Data –Sets, Creating HTML Output, SAS Data Libraries, Using SAS System Options

GettingDataintoSAS:ReadingFileswiththeimportWizard,SelectedIn-formats,Reading Delimited Files with the DATA step, Reading Delimited Files with IMPORT Procedure

Working with Data: Using SAS Function, Using IF-THEN Statements, Simplifying Programs with Arrays

Unit–III

Sorting, Printing and Summarizing Your Data: Using SAS Procedures, Sorting Your Data with PROC SORT, Printing Your Data with PROC PRINT, Creating Your Own Formats Using PROC Format, SummarizingYour Data Using PROCMEANS, Writing Summary Statistics to a SAS Data- set, Counting Your Data with Proc Freq, Produci9ng Tabular Reports with Proc TABULATE, Producing Simple Output with PROC REPORT.

UsingBasicStatisticalProcedures:ExaminingCorrelationswithPROCCORR,UsingPROC

REG for Simple Regression Analysis, Reading the Output of PROC REG, Using PROC ANOVA for One-Way Analysis of Variance.

ExportingData:WritingFilesUsingExportWizard,WritingDelimitedandHTMLFilesUsing ODS

Modifying and Combining SAS Data-sets: Modifying a Data-Set Using the SET Statements, Combining Data-Sets Using a One-to-One Match Merge, Using SAS Data –Set Options, Charging Observations to Variable Using PROC Transpose.

Unit-IV

SAS Graphs: G-Charts, G-Plots

Debugging SAS Programs : Fixing Programs That Don't Work, Note: Lost Card, The DATA Step Debugger, SAS Truncates a Character Variable, SAS Stops in the Middle of a job, SAS Runs out of Memory or Disk Space.

Advance SAS

Writing Flexible Code with the SAS Macro Facility

Macro Concepts, Creating Modular Code with Macros, Adding Parameters to Macros, Writing Date- Driven Program with CALL SYMPUT

Enhancing Your Output with ODS: Using ODS Statements to Create HTML Output, Using ODS Statements to Create RTF Output, Using ODS Statements to Create PRINTER Output, Customizing Titles and Footnotes, Customizing PROC Print Output with the STYLE =Option,

Customizing PROC REPORT Output with the STYLE=Option, Customizing PROC TABULATE Output with the STYLE=Option.

References

1. The little SAS Book: v Lora D. Delwiche, Susan J. Slaughter
2. SAS Black Ron Cody, Stephen McDaniel
3. SAS Pharmaceutical Industry, Jock Shostak FDA Publications
4. CDISC (Clinical Data Interchange Standards Consortium), FDA publications.

CONCEPTS OF CLINICAL RESEARCH-Practical

BASE SAS LABS

Complete SAS Environment with practical SAS

CLINICAL TRIAL LAB TOPICS

- a) Preparing and classifying Clinical Trial Data
- b) Importing Data
- c) Transforming Data and Creating Analysis Data-Sets
- d) Creating Tables and Listings
- e) Creating Clinical Trial Graphs
- f) Performing Common Analysis and Obtaining Statistics
- g) Exporting Data

Semester-IV
Paper-III

ENVIRONMENTAL BIOTECHNOLOGY

UNIT-I

1. Biomonitoring of the aquatic environment & – biological indicators, biosensors – pollution indices (Odum, Nygaard, Palmer) and pollution control.
2. Waste-water treatment through aerobic microorganisms – biological filters, aeration tanks, biological ponds, irrigation fields (biofilms).
3. Waste-water treatment through anaerobic microorganisms – septic tanks, imhof's tank, upflow anaerobic sludge blanket (UASB), anaerobic filters, anaerobic attachment film expanded bed (AAFEB), anaerobic rotating biological contractor.
4. Recovery of useful products from sewage and industrial wastes.

UNIT-II

1. Decomposition of organic matter and litter by soil microorganisms.
2. Bioremediation of polluted soils/sites – degradation of xenobiotics pesticides, plastics and biodegradable plastics. Genetically-Engineered Microorganisms (GEMs) in bioremediation – their construction, release, survival, environmental clean up, applications, biosafety and risk assessment.
3. Bioleaching and biomining of copper and uranium (*ex situ* and *in situ* hole-to-hole leaching). Biodesulphurisation of coal.
4. Solid-waste treatment; hazardous, biomedical and municipal waste management; vermicompost.

UNIT-III

1. Air sampling techniques – The impactors: slit sampler, cascade, hirst trap, Anderson sampler, rotorod, vertical cylinder trap, burkard trap. The impingers: porton and pre-impingers.
2. Nomenclature of atmospheric layers, microbes as source and sink of atmospheric pollutants. Immediate and delayed type of hypersensitivity.

3. Emission-control technology – typical cyclones, industrial fabric-filters, electrostatic precipitators, liquid scrubbers, gravity-settling chambers.
4. Air sanitation – control of air-borne pathogens – irradiation, chemical disinfection, dust control.

UNIT-IV

1. Lignocellulosic material as bioenergy source-biodelignification–role of lignolytic and xylanolytic enzymes, separation of cellulose – biobleaching and bio-pulping.
2. Bioethanol as alternate/renewable energy source–bioethanol vs. food crisis, advantages and disadvantages.
3. Biogas (Methane)–biogas plant design, construction, process, microbiology and production. Methane vs. green-house effect.
4. Hydrogen-production process from biomass; thermal gasification, pyrolysis to reverse global warming.

Reference Books:

1. Alexander M. Soil Microbiology
2. Anil Prakash (ed). Fungi in Biotechnology
3. Atlas and Batra, Microbial Ecology
4. Benjamin Cunnings Microbial Ecology
5. Burns R. and J. H. Slater, Experimental Microbial Ecology
6. Gabriel Bitton Wastewater Microbiology
7. Gray T. R. G. & S. T. Williams, Soil Microorganisms
8. Gregory P. H. The Microbiology of Atmosphere
9. Lautit M. W. & C. M. Eds. Keuin Microbial Ecology Proc.
10. Lynch J. M. The Rhizosphere
11. Lynch J. M. and N. J. Poole Microbial Ecology: A conceptual approach
12. Michael S. Switzenbaury (Ed) Anaerobic Treatment of Sewage
13. Mishra R. R. Soil Microbiology
14. Odum E. P. Fundamentals of Ecology
15. Omenn G. S. & M. Alexander Genetic control of Environmental Pollutants
16. Ralph Mitchell Environmental Microbiology
17. Microbiology of Extreme Environments. Edited by Clive Edward. Open University Press. Milton Keynes.
18. Microbiology of Extreme Environments and its potential for Biotechnology. Edited by M. S. Da Copta, J. C. Durate, R. A. D. Williams. Elsevier Applied Science, London
19. Extreme Environments Mechanism of Microbial Adaptation. Edited by Milton R. Heinrich. Academic Press

Environmental Biotechnology Practical

1. Determination of Biochemical Oxygen Demand (BOD) of sewage water
2. Determination of Chemical Oxygen Demand (COD) of industrial wastewater
3. Bacteriological examination of water using multiple tube fermentation test; presumptive confirmed and microbial – contaminated aquatic systems
4. Estimation of gross primary production net primary production and respiratory consumption in microbial contaminated aquatic systems.
5. Estimation of phosphates, sulphates and nitrates (eutrophication factors) in autotrophic and heterotrophic aquatic habitats.
6. Disinfection of potable water by chlorine (bleaching powder method) – determination of chlorine demand and residual chlorine.
7. Estimation of soil organic matter and soil organic carbon (SOC) by Walkley and Black method
8. Enumeration for soil bacteria, fungi and actinomycetes by standard Agar plate method
9. Biodegradation of lignin and assay of lignolytic enzymes (lignin peroxidase and laccase)
10. Biodegradability of lignocelluloses by white rot fungi.
11. Biosorption of chromium by microorganisms
12. Decolourization and degradation of dye effluents by immobilized microbial cells
13. Biodesulphurization of coal by *Thiobacillus ferrooxidans*
14. Air sampling by petri plate method, gravity slide method and Tilak air sampler
15. Air pollution tolerance index (APTI) in infected and healthy plants
16. Delignification of wood/rayon/paper pulp by solid state fermentation (SSF)

Spotters

- a) Aeco flora Agar plate
- b) Dye effluent treatment
- c) Humus
- d) Biobleached rayon pulp
- e) Desulphurised coal
- f) Bacteria isolated from Extreme environment
- g) Tilak air samples
- h) Imhoff tanks
- i) Biosensors
- j) Trickling filters
- k) Air samples

Semester–IV Paper - IV

GENETICENGINEERING

UNIT–I

1. Genecloningprocessesandstepsinvolvedingenecloning.
2. Enzymesusedingeneticengineering, restrictionendonucleases, exonucleases, DNA-modifying enzymes.
3. ligases–linkers, adaptors, TerminalTransferases.
4. Cloningvectors: plasmids, cosmids, phagemids, shuttlevectors, viralvectors.

UNIT–II

1. Identificationofclonedgenesbyhybridizationtechniques:(Southern,Northern, Western and their applications).
2. cDNALibraries:Constructionandscreening.
3. GenomicLibraries:Constructionandscreening.

UNIT–III

1. PCR technology:Essential Requirements of PCR , Mechanism of PCR,. Types of PCR, PCR applications.
2. Molecularmarkers:RFLP,RAPD,AFLP,SSRandtheirapplications.
3. DNAfinger-printing,DNAfoot-printingandtheirapplications.

UNIT–IV

1. Genetransfermethods(DirectandIndirect)
2. ApplicationsofrDNA–TechnologyinAgriculturewithreferencetoGM-cropsand foods (Golden rice, Flavr-Savr, Flowercolors).
3. Applicationsofr-DNAtechnologyinmedicine(r-Hormones,r-Vaccines,r-Interferons).

Recommended Books

1. Brown, T.A. 1999 Gene Cloning. 3rd edition. Chapman and Hall Publications, USA.
2. Burrell, M.M. 1993. Enzymes of Molecular Biology, Humana Press.
3. Chirikjian, J.G. 1995 Biotechnology—Theory and Techniques, Vol. II, Jones and Bartlett Publishers.
4. Gerhardt, P. Murray, R.G., Wood, W.A., and Kreig, N.R. 1994 Methods for
5. General and Molecular Bacteriology, ASM Press, Washington D.C.
6. Glick, B.R. and Pasternak, J.J. 1998 Molecular Biotechnology—Principles and Applications of Recombinant DNA, ASM Press, Washington D.C.
7. Lewin, B. 2008 Genes IX. Oxford University Press, Oxford.
8. Murray Moo 1992 Plant Biotechnology. Young, Pergamon Press.
9. Ratledge, C. and Kristiansen, B. 2001 Basic Biotechnology, II Edition, Cambridge University Press.
10. Winnacker, E.L. 1987 From genes to Clones: Introduction to Gene technology. V C H Publications, Federal Republic of Germany.
11. Antony, J.F., Griffiths, Gilbert, W.M., Lewontin, R.C. and Miller, J.H. 2002 Modern genetic analysis,
12. Integrating Genes and Genomes, 2nd edition, WH Freeman and Company, New York.
13. Blackburn, G.M. and Gait, M.J. 1996 Nucleic acids in chemistry and biology. Oxford University Press.
14. Molecular Biology of cell. Albert *et al.*, 4th Edition Garland Publishing Inc.
15. George M. Malacinski, David Freifelder. 1998 Essentials of Molecular Biology. Jones and Bartlett
16. Publishers.
17. Maloy, S.R., Cronan, J.R. Freifelder, D. 1994 Microbial Genetics, Jones and Bartlett Publishers.
18. Macinski, G.M. and Freifelder, D. 1998 Essentials of Molecular Biology, 3rd Edition, John and Bartlett Publishers.
19. Sir John Kendrew 1994 The Encyclopedia of Molecular Biology. Blackwell Science Ltd
20. Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A.M. 1998 Molecular Biology of the Gene, 4th edition, Benjamin/Cummings publishing company.
21. Freifelder, D. 1997 Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
22. Freifelder, D. 1990 Microbial Genetics. Narosa Publishing House, New Delhi.
23. Snyder, L. and Champness, W. 1997 Molecular Genetics of Bacteria. ASM press, USA.
24. Maloy, S.R., Cronan, J.E. and Freifelder, D. 1994 Microbial Genetics, Jones and Bartlett Publishers, London.

25. Turner, P.C., McLennan, A.G., Bates, A.D. and White, M.R.H. 1998 Instant Notes in Molecular Biology, Viva Books Pvt., Ltd., New Delhi.
26. Twynan, R.M. 2003 Advanced Molecular Biology. Viva Books Pvt. Ltd. New Delhi.
27. Ram Reddy S, Venkateshwarlu K and Krishna Reddy V 2007 A Text Book of Molecular Biotechnology Himalaya Publishers Hyderabad
28. Old, R.W. and Primrose, S.B. 1994 Principles of Gene Manipulation, Blackwell Science Publication.

*Practical
GENETIC ENGINEERING*

1. Isolation of genomic DNA
2. Isolation of RNA
3. Isolation of plasmid DNA
4. Restriction digestion of plasmid DNA and physical-map construction
5. Competent-cell preparation, transformation and selection
6. Gene cloning
7. PCR amplification
8. Recovery of DNA fragments from gel
9. SDS-PAGE
10. Gene-transfer methods (Agrobacterium-mediated gene transfer)

Spotting.

1. Staggered ends
2. Blunt ends
3. Plasmids
4. Cosmid
5. cDNA Library
6. Gene gun
7. PCR
8. Bt-Cotton
9. Transgenic rice
10. FlavrSavr

SEMESTER – IV

OPEN ELECTIVE – I

BIOSAFETY AND BIOPIRACY

Unit I

Biosafety: Introduction; biosafety issues in Science; Biological Safety Cabinets & their types; Primary Containment for Biohazards; Biosafety Levels of Specific Microorganisms

Unit II

Biosafety Guidelines: Biosafety guidelines and regulations (National and International); GMOs/LMOs - Concerns and Challenges

Unit III

Role of Institutional Biosafety Committees (IBSC), RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs.

Unit IV

Guidelines for using radioisotopes in laboratories and precautions. Biopiracy, Famous Case i biopiracy The Neem Tree, Basmati. Convention on Biological Diversity.

Suggested Reading

1. Bare Act, 2007. Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., New Delhi.
2. Kankanala C (2007). Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd. New Delhi.
3. Mittal, D.P. (1999). Indian Patents Law, Taxmann, Allied Services (p) Ltd.
4. Singh K K (2015). Biotechnology and Intellectual Property Rights: Legal and Social Implications, Springer India.
5. Goel D & Prashar S (2013). IPR, Biosafety and Bioethics. Pearson

6. SenthilKumarSadhasivamandMohammedJaabir,M.S.2008.IPR,Biosafetyand biotechnology Management. Jasen Publications, Tiruchirappalli, India

LINE TICKETING

Unit I

GroundStaff

- a) Roleofgroundstaff
- b) Securitymeasures
- c) Check-ininvolved
- d) Differenttypesofaircrafts

UnitII

Callcenter&CustomerSupport

- a) SoftSkills&Accent
- b) Empathy statements

UnitIII

TicketingManagement

- a) Differenttypesofsoftware
- b) BoardingPass
- c) Differentclassesinticket
- d) PNRgeneration

UnitIV

AirhostessTraining

- a) Grooming
- b) EmergencyExits
- c) Rolesofthe crew

NANOTECHNOLOGY

Unit I*Nanotechnology-Concepts and Techniques*

- a) Basic definition – origin – fundamental concepts- longer to smaller (a material perspective); simple to complex (a molecular perspective)
- b) Chemical precipitation and co-precipitation; Metal nano crystals by reduction, Solgel synthesis- Micro emulsions or reverse micelles, micelle formation- Chemical Reduction-Emulsions, and dendrimers - Solvothermal synthesis- Thermolysis routes, Microwave heating synthesis- Sonochemical synthesis- Electrochemical synthesis- Photochemical synthesis.

Unit II

- a) Characterization of nanoparticles – UV-VIS, SEM, FTIR, NMR, XRD, Passive nanostructures, active nanostructures.
- b) Green synthesis of silver nanoparticles – polysaccharide method, Tollens method, Irradiation method, Biological method, Poloxometalates method. Mechanism of antimicrobial action of nanoparticles – AgNps as a new generation of antimicrobials.

*Unit III***Nanotechnology–Applications**

- a) Environmental treatments: Air disinfection, water disinfection, groundwater and biological waste water disinfection, surface disinfection, Bioremediation. Nano membranes, nano filters, Environment sensing. Emerging opportunities for microbial control and integrated urban water management
- b) Biomedical and pharmaceutical: Nanoparticles in bone substitutes and dentistry – Implants and Prosthesis - Reconstructive Intervention and Surgery – Nano robotics in Surgery– Photodynamic Therapy– Nano sensors in Diagnosis- Drug delivery– Therapeutic applications.

*Unit IV**Applications*

- a) Agriculture and food technology: Nanotechnology in Agriculture - Precision farming, Smart delivery system – Insecticides using nanotechnology – Potential of nano- fertilizers – Nanotechnology in Food industry - Packaging, Food processing - Food safety and biosecurity – Contaminant detection – Smart packaging.
- b) Textiles and cosmetics: Nano fibre production - Electrospinning – Controlling morphologies of nano fibers – Polymer nanofibers - Nylon-6 nano composites from

polymerization - Nano-filled polypropylene fibers -Bionics– Swim-suits with shark- skin-
effect, Soil repellence, Lotus effect- Nanofinishing in textiles Lightweight

bulletproof vests and shirts, Waterproof and Germ proof, Cleaner kids clothes, Wired and Ready to wear. Cosmetics – Formulation of Gels, Shampoos, Hair- conditioners, Sun-screen dispersions for UV protection using Titanium oxide – Color cosmetics.

SEMESTER – IV OPEN ELECTIVE – IV

HEALTH CARE MANAGEMENT

Unit I:

Concepts of Health and Diseases:

Concepts of Health – Definition and dimensions of Health – Indicators of Health – Concept of disease and Disease Causation – Concept of Disease Control – Levels of Prevention – Common Diseases – Principles and Practices of Epidemiology.

Unit II:

Evolution of Health Care services:

Health Care, Meaning and scope – Overview of Health Care delivery in India and abroad – current trends in health Care delivery and the present scenario – Levels of health Care – Government health services – Developments in public sector health Care delivery systems

Unit III:

Hospital Administration:

Development of Hospitals – Classification of hospitals – Functions of a hospital – Hospital organization and role of hospital administration / administrator.

Unit IV:

Health Care Policies and Environment:

Demographic trends in India – Family Planning/ Welfare Concepts – National Family Planning Program and Population Control – National Health Policy 2002 – Rural Health Policy – Hazardous materials handling in hospitals.

References

G.E. Alan Dever Epidemiology in Health Services Management, Aspen Publication, Maryland, 1984.

J.W. Stephen & T. Paul Interdiction to Health Services, Delmar, New York, 1988 K.K. Anand Hospital Management, Vikas Publishing, New Delhi, 1996.

Oxford University Oxford textbook of public health, Vol.3.

A. V. Srinivasan(ed.) Managing A Modern Hospital, Response Books, New Delhi. 2000.

SEMESTER – IV OPENELECTIVE–V
FUNDAMENTALS OF ELECTRONICS

Unit I

Semiconductors: Introduction to semiconductors (Intrinsic & Extrinsic)

Construction, working and V-I characteristics of PN Junction diode. Application of PN junction diode half wave and Full wave Rectifiers, Construction, working and characteristics of Zener diode. Application of Zener diode. Simple regulated Power supply.

Unit II

Bipolar junction transistor: PNP and NPN transistor configuration, CE configuration characteristics. Common emitter amplifier RC coupled amplifier.

Unit III

Digital electronics: logic gates, universal gates, Boolean algebra. Half adder, Full adder, Half & Full subtractor, semiconductor memories (RAM & ROM).

Unit IV

Microprocessors: Evolution to Microprocessors, Block diagram of Microprocessors, 8-bit, 16-bit and 32-bit Microprocessors,

Reference books

2. Modern digital electronics – R.P Jain TMH
3. Fundamental of digital circuits – A. Anandkumar .PHI
4. Principles of electronics – V.K Metha and Rohithmenta Schand & co
5. Digital principles and circuits – Agarwal HPH
6. Electronics devices and circuits – Salivahanan, Sureshkumar, Vallavraj TMH
7. Fundamental of microprocessors and microcontrollers – B. Ram
8. Introduction to microprocessor – Adhitya P malhur TMH

PROGRAM/COURSES OUTCOME

Course out come of M.Sc Biotechnology

The outcomes of an MSc in Biotechnology can vary depending on the specific program and institution. However, here are some common outcomes you might expect:

Advanced Knowledge: Graduates should have a deep understanding of the principles, theories, and applications of biotechnology, including molecular biology, genetic engineering, bioinformatics, and bioprocess engineering.

Laboratory Skills: Students typically gain hands-on experience in various laboratory techniques, including DNA sequencing, protein purification, cell culture, and bioinformatics analysis.

Critical Thinking: Graduates are trained to critically evaluate scientific literature, design experiments, and interpret data effectively.

Problem-Solving Skills: They develop the ability to identify and address challenges in biotechnological research and industry, such as optimizing bioprocesses, developing new therapies, or improving agricultural practices.

Communication Skills: Effective communication is crucial in biotechnology, whether it's presenting research findings, writing scientific papers, or collaborating with colleagues. Graduates should be adept at communicating complex scientific concepts to both technical and non-technical audiences.

Ethical Awareness: Biotechnology often raises ethical and societal issues, such as those related to genetically modified organisms (GMOs), cloning, and stem cell research. Graduates should have an understanding of these issues and be able to navigate them responsibly.

Career Opportunities: With their specialized knowledge and skills, MSc biotechnology graduates are well-equipped for careers in various sectors, including pharmaceuticals, healthcare, agriculture, environmental science, and biotechnology research.

Further Education: Some graduates may choose to pursue further education, such as a Ph.D., to deepen their expertise or pursue academic research careers.

Overall, the MSc in Biotechnology equips graduates with a solid foundation in both theoretical knowledge and practical skills, preparing them for diverse and challenging roles in the rapidly evolving field of biotechnology.

Course out come for integrated MSc in Biotechnology

An integrated MSc in Biotechnology typically combines undergraduate and postgraduate studies into a single program, spanning a duration of around five years. Here are some expected outcomes of such a program:

1. **Comprehensive Understanding:** Integrated MSc programs provide a thorough understanding of biotechnology from foundational to advanced levels, covering topics such as molecular biology, genetics, bioinformatics, microbiology, and bioprocess engineering.

2. **Early Specialization:** Students can specialize in specific areas of biotechnology early in their academic journey, allowing for in-depth exploration and skill development in their chosen fields of interest.

3. **Advanced Laboratory Skills:** Through a combination of coursework and practical training, students acquire advanced laboratory skills essential for biotechnological research and development, including DNA manipulation, protein expression, genetic engineering, and bioinformatics analysis.

4. **Interdisciplinary Approach:** Integrated programs often integrate knowledge from multiple disciplines such as biology, chemistry, physics, and engineering, fostering interdisciplinary thinking and problem-solving abilities.

5. **Research Experience:** Students are typically involved in research projects throughout the program, gaining hands-on experience in experimental design, data analysis, and scientific communication under the guidance of faculty members.

6. **Industry-Relevant Training:** The curriculum is designed to align with the needs of the biotechnology industry, ensuring that graduates are equipped with the practical skills and knowledge required to excel in various roles within biotech companies.

7. **Soft Skills Development:** In addition to technical skills, integrated MSc programs often focus on developing soft skills such as critical thinking, communication, teamwork, and leadership, which are essential for success in both academia and industry.

8. **Career Readiness:** Upon completion of the program, graduates are well-prepared to pursue careers in diverse sectors including pharmaceuticals, healthcare, agriculture, environmental science, biotechnology research, and academia. They may also choose to pursue further education through doctoral programs or specialized certifications.

Overall, an integrated MSc in Biotechnology equips students with a comprehensive skill set, preparing them for rewarding careers in the dynamic and rapidly evolving field of biotechnology.

Out come of Bachelor of Science (BSc) in Biotechnology

The outcomes of a Bachelor of Science (BSc) in Biotechnology program typically include:

1. **Foundational Knowledge:** Graduates have a solid understanding of the fundamental principles of biology, chemistry, genetics, and biotechnology. They are familiar with key concepts such as cell biology, molecular biology, microbiology, biochemistry, and genetics.
2. **Laboratory Skills:** Students acquire hands-on experience in laboratory techniques commonly used in biotechnology research and industry, including DNA extraction, PCR (Polymerase Chain Reaction), gel electrophoresis, cell culture, and basic bioinformatics analysis.
3. **Critical Thinking:** Graduates develop critical thinking and problem-solving skills, enabling them to analyze biological problems, design experiments, and interpret data effectively.
4. **Communication Skills:** They learn to communicate scientific ideas and findings clearly and effectively, both orally and in writing. This includes writing laboratory reports, presenting research findings, and participating in scientific discussions.
5. **Ethical Awareness:** Biotechnology raises various ethical, social, and environmental considerations. Graduates understand the ethical implications of biotechnological advancements and are able to navigate these issues responsibly.
6. **Teamwork and Collaboration:** Many biotechnology projects require collaboration between scientists from different disciplines. Students learn to work effectively in interdisciplinary teams, fostering teamwork and collaboration skills.
7. **Industry Exposure:** Some programs incorporate industry internships or projects, providing students with exposure to the practical applications of biotechnology in industry settings. This can help students gain valuable hands-on experience and industry connections.
8. **Preparation for Further Education or Employment:** Graduates are well-prepared to pursue further education in graduate programs (such as MSc or Ph.D. programs) or enter the workforce in entry-level positions in biotechnology-related industries, research laboratories, healthcare, agriculture, environmental science, or government agencies.

Overall, a BSc in Biotechnology equips students with a strong foundation in biological sciences and biotechnological techniques, preparing them for a variety of career paths in the dynamic field of biotechnology.

HOD/BOS/CHAIRPERSON

**Dr. V. Srilekha is the Head and Chair person for Department of
Biotechnology**

BOS MEMBERS

Sl. No	NAME	DESIGNATION	ADDRESS
1	Dr. V. Srilekha	Chairman	Assistant Professor&HoD Dept. of Biotechnology, Chaitanya (Deemed to be University), Warangal.
2	Prof. A. Roja Rani	Subject Expert	Professor Dept. of Genetics Osmania University Hyderabad, TS.
3	Prof. D. Rama Raju	Subject Expert	Associate Professor Department of Biotechnology, NIT, Hanumakonda.
4	Prof. T. Christopher	Member	Senior Professor Dept. of Biotechnology, Chaitanya (Deemed to be University), Warangal.
5	Prof. V.Rajender	Member	Professor Dept. of Biotechnology, Chaitanya (Deemed to be University), Warangal.
6	Prof. T. Muralikrishna	Member	Professor Dept. of Biotechnology, Chaitanya (Deemed to be University), Warangal.
7	Prof. B.S. Anuradha	Member	Professor Dept. of Microbiology, Chaitanya (Deemed to be University), Warangal.
8	Prof. S. Suma	Member	Professor Dept. of Biochemistry, Chaitanya (Deemed to be University), Warangal.
9	Dr. Ch. Sathvika	Member	Associate Professor Dept. of Biotechnology, Chaitanya (Deemed to be University), Warangal.

DRC

S. No.	Name	Designation
1.	Dr.V.Srilekha,Head& BoS	Chairman
2.	Prof.T.Christopher	Member
3.	Prof.V.Rajender	Member
4.	Prof.T.Murali Krishna	Member
5.	Dr.V.Sathvika	Member

**LIST OF TEACHING
and
NON TEACHING
STAFF**

List of the staff members of Department

S. No	Name of the Faculty	Designation Qualification	Area of Specialization
1	Mrs. V. Srilekha	Associate Professor. M.Sc. Ph.D, Head. And BOS Chair person.	Genetics, Immunology, Industrial Biotechnology.
2	Prof. T. Christopher	Senior Professor	Cell biology
3	Dr. Rajender Vadluri	Professor B.Ed., M.Sc., Ph.D., SET-TS.	Molecular Biology, Instrumentaion – techniques & Genetic Engineering.
4	Dr. T. Murali Krishna	Professor, M.Sc., M.Phil., Ph.D	Animal Biotechnology, Cell and tissue culture & Fermentation Technology.
5	Mrs. G. Deepika	Assistant Professor. M.Sc.	Cell Biology and Genetics
8	Mrs. D. Bhagya Laxmi	Assistant Professor M.Sc.,	Plant Biotechnology, Animal Biotechnology, Industrial Biotechnology
<u>SUPPORTING STAFF</u>			
S.No	Name of the staff	Designation	
1	Mrs. V. ShashiRekha	Lab Assistant	
2	Mrs. Radhika	Lab Assistant	

FACILITIES

This Department has been provided with Different facilities like

1. A lab for conduction of Molecular Biology experiments
2. A lab for conduction of Microbiology experiments
3. A lab for conduction of pharmaceutical biotechnolgy experiments
4. A lab for conduction of Plant Tissue culture experiments
5. A lab for conduction of Biochemical estimation experiments
6. A digital class room for post graduate students
7. Room for Teaching staff
8. A room storage of chemicals and other items

SEMINARS/CONFERENCES/WORKSHOP'S/FDP'S

PUBLICATIONS

BOOKS

Dr. Srilekha, V. and Gudikandula, K., 2023. Antioxidant potential of carotenoids derived from marine bacteria and their applications. In *Marine Antioxidants* (pp. 311-315). Academic Press.

Dr. V. Rajender Published book entitled" Mutagenesis and Molecular Characterization of Some Mutants in *Capsicum, annum L*" with ISBN 978-93-95118-98-9, by Integrated publications, New Delhi. 110085.

ARTICLES

Prof. RAJENDER VADLURI

1. Gade Pavan Kumar, K. Bramarambica, Y. Vijay Kumar, P. ChandraSekhar, Swapna Mittapalli, **Rajender Vadluri**(2023) Organophosphorous Based Pesticide Degrading Bacterial Screening from Agriculture Soils of Telangana Region, Journal of Advanced Zoology, 44(S-5), 2400-2404. ISSN.0253-7214 (IF-0.6).
2. Swapna Mittapalli, Thriven Dumpati, Gade Pavan Kumar, Sadhu Suman Kalyan, Potta Jyothi, **Rajender Vadluri**(2023) *Agrobacterium* mediated genetctransformationof Ground nut (*Arachis hypogaea L.*) Cultivar ICGV – 15311 embryo axis explants for Defensin gene against fungal resistance, Journal of Advanced Zoology, 44(S-5), 2430-2434. ISSN.0253-7214 (IF-0.6).
3. Gade Pavan Kumar, K. Bramarambica, P. Chandrasekhar, Y. Vijay Kumar, Swapna M, **Rajender Vadluri**(2023) Comparative Optimization studies of various parameters towards Chlorantraniliprole degradation by gram positive Pdb, Journal of Advanced Zoology, 44(S-5), 2435-2440. ISSN.0253-7214 (IF-0.6).
4. Swapna Mittapalli, Thriven Dumpati, Gade Pavan Kumar, Vaishnavi Anumula, Prathap Pasula, Suman Kalyan Sadhu, **Rajender Vadluri**(2023) *In vitro* regeneration and GUS Expression studies in Groundnut (*Arachis hypogaea L*) Variety ICGV 15311, Journal of Advanced Zoology, 44(S-5), 2405-2411. ISSN.0253-7214 (IF-0.6).
5. Swapna Mittapalli, Sumankalyan Sadhu, Jyothi Potta, Arpitha Madadi, Nishath Anjum, **Rajender Vadluri** (2023) An efficient Invitro regeneration studies of

commercially important groundnut (*Arachis hypogaea* L) Cultivars ICGV 15311, ICGV 15287, ICGV13074, European Journal of Pharmaceutical and Medical Research., 10(9).ISSN.2394-3211 (IF-1.8).

6. SrilekhaKonakanchi, **Rajender Vadluri**, Kireety Sharma Anumula, Narashimulu, Devender Banothu, Thupurani Murali Krishna (2023) Antiproliferative, molecular docking and bioavailability studies of diarylheptanoids isolated from stem bark of *Garuga pinnata* Rox B. 3 Biotech., 13:208. ISSN No.2190-5738 (IF-2.8).

Prof. T.Muralikrishna

PUBLICATIONS

SrilekhaKonakanchi, Kireety Sharma Anumula ,Narashimulu K , **Thupurani Murali Krishna**. Studies On 3/7 Caspase Activity And Apoptosis Induction By Diarylheptanoids Isolated From *Garuga Pinnata* Roxb Journal of Advanced Zoology Volume 44 Issue S-5 Year 2023 Page 3260:3268

Srilekha Konakanchi Rajender Vadluri, Kireety Sharma Anumula ,Narashimulu Devendar Banothu,**Thupurani Murali Krishna**.Antiproliferative, molecular docking, and bioavailability studies of diarylheptanoids isolated from stem bark of *Garuga pinnata*Rox B. 3 Biotech (2023) 13:208.

Praveen Kumar G, Thupurani Murali Krishna. Bacteriostatic Effect Of Coumarin 2-(3,4-Dihydroxyphenyl)-3,5,7-Trihydroxy4H-Chromen-4-One Isolated From The Root Extract Of *Strychnos nux vomica*. Journal of Advanced Zoology Volume 44 Issue S-5Year 2023 Page 01:05

Praveen Kumar G , **Thupurani Murali Krishna** Anti Biofilm Activity and Time-Kill Study Of Silver Nanoparticles Of *Strychnos nux vomica* Root Ethyl Acetate Extract Against Clinically Resistant Staphylococcus Mutants Journal of Advanced Zoology Volume 44 Issue S-5Year 2023 Page 01:07.

Prasanna Kumar TP, **Thupurani Murali Krishna**. Effect of Fermentation Parameters for the Mass Cultivation of *Trichoderma viride* via Submerged and Solid-State Fermentation Studies On Cellulase ProductionJournal of Advanced Zoology Volume 44 Issue S-5Year 2023 Page 3285:3292.

Prasanna Kumar TP , **Thupurani Murali Krishna**.Determination of Nitrogen (N), Phosphorous (P), Potassium (K), pH and Electrical Conductivity of Jeevamrutham Samples Collected from

Different Places of Telangana and Andhra Pradesh Journal of Advanced Zoology Volume 44 Issue S-5 Year 2023 Page 3275:3284.

Marojua ,RajuVadlakondaa , **Murali Krishna T** , Bhasker Pittala & Kumaraswamy Gullapelli Synthesis of new imidazopyridine based 1,2,3-triazoles: Evaluation of antibacterial, antibiofilm and time kill studies Indian Journal of Chemistry Vol.62, February, 2023, pp. 139-146.

NagavelliRamu, **ThupuraniMurali Krishna**, Venkatarathnam,Nasipireddy, RavikumarKapavarapu, and Sirassu Narsimha Fused Imidazo[2,1-b][1,2,3]triazolo[4,5-d][1,3]thiazines: One-Pot Synthesis, Antibiofilm, Bactericidal Effects, and *in silico* Studies Chemistry select 2023, 8, e202300777 (1 of 9)

DR.V.SRILEKHA

PUBLICATIONS

Srilekha, V., Krishna, G., Seshasrinivas, V. and Charya, M.A.S., 2017. Antibacterial and anti-inflammatory activities of marine *Brevibacterium* sp. Research in pharmaceutical sciences, 12(4), pp.283-289.

Srilekha, V., Krishna, G., Srinivas, V.S. and Charya, M.A.S., 2017. Antimicrobial evaluation of bioactive pigment from *Salinicoccus* sp. isolated from Nellore sea coast. Int. J. Biotechnol. Biochem, 13, pp.211-217.

Srilekha, V., Krishna, G., Seshasrinivas, V. and Singaracharya, M.A., 2018. Evaluation of wound healing and anti-inflammatory activity of a Marine yellow Pigmented bacterium, *Micrococcus* sp.

Krishna, G., **Srilekha, V.**, Charya, M.S., Serea, E.S.A. and Shalan, A.E., 2021. Biogenic synthesis and cytotoxic effects of silver nanoparticles mediated by white rot fungi. *Heliyon*, 7(3).

Srilekha, V., Krishna, G., Sreelatha, B., Jagadeesh Kumar, E. and Rajeshwari, K.V.N., 2023. Prodigiosin: a fascinating and the most versatile bioactive pigment with diverse applications. *Systems Microbiology and Biomanufacturing*, pp.1-11.

Srilekha, V., Krishna, G., Sreelatha, B., Jagadeesh Kumar, E. and Rajeshwari, K.V.N., 2024. Prodigiosin: a fascinating and the most versatile bioactive pigment with diverse applications. *Systems Microbiology and Biomanufacturing*, 4(1), pp.66-76.

Rajeshwari K.V.N.,Srilatha B.,**Srilekha Reddy V.** and Shyam Prasad G.Nonsteroidal antiinflammatory drugs as potential inhibitorss of tankyrase-2 for colon cancer prevention *Research Journal of Biotechnology*,Vol. 18 (9) September (2023).

A.Veena. **V.Srilekha.**, B.S.Anuradha.Isolation, Screening and optimization of Amylase producing Yeast.*ZKGInternational*.Vol (8), 2023

DEPARTMENT JOURNAL

**List of the Scientific journals and Magazines Presently available in college
Library**

S.No	Name of the Journal	Number
1	Indian Journals of Clinical Biochemistry	Half yearly
2	Bioinformatics Trends	Half yearly
3	Asian Journal of Miobiology	Quarterly
4	Indian Journal of Biotechnology	Quarterly
5	Indian Science Abstracts	Quarterly
6	Journal of Bioscience	Quarterly
7	Journal of Envirmental Biology	Quarterly
8	Journal of Mycology& Plant Pathology	Quarterly
9	Nature Envirment& Pollution Technology	Quarterly
10	Indian Journal of Microbiology	Semi-monthly
11	Current Literature on Science of Science	Bi- Monthly
12	Current Science	Monthly

13	Indian Journal of Experimental Biology	Monthly
14	Resonance	Monthly
15	Indian Journal of Biochemistry & Biophysics	Fort Nightly
16	Down to Earth	Fort Nightly
Magazines		
1	Scientific American	Monthly
2	Science Reporter	Monthly
3	Biology Today	Monthly
4	Health Screen	Monthly

patents

PATENTS PUBLISHED BY DR. V. RAJENDER

1. Published patent on “A Method for Invitro generation of root nodules from groundnuts”.
Application Number-202341063275. Date: 20/09/2023.
2. Published patent on “An Efficient and Rapid Regeneration of Callus from Roots and Root Hair of Indian Maize”. **Application Number-202341033823**. Date: 13/05/2023.

Application Details	
APPLICATION NUMBER	202341033823
APPLICATION TYPE	ORDINARY APPLICATION
DATE OF FILING	13/05/2023
APPLICANT NAME	1. Dr. Beemagani Sreelatha 2. Dr. Vadluri Rajender 3. Dr. SadhuSuman Kalyan 4. Potta Jyothi 5. Dr. V. Sudeeka 6. K. Venkata Naga Rajeshwari 7. Mittapalli Swapna 8. A. Veena 9. P. Neeraja 10. T. Shiva Chander
TITLE OF INVENTION	AN EFFICIENT AND RAPID REGENERATION OF CALLUS FROM ROOTS AND ROOT HAIR OF INDIAN MAIZE
FIELD OF INVENTION	BIOTECHNOLOGY
E-MAIL (As Per Record)	vishubathini@gmail.com
ADDITIONAL EMAIL (As Per Record)	
E-MAIL (UPDATED Online)	
PRIORITY DATE	
REQUEST FOR EXAMINATION DATE	-
PUBLICATION DATE (U/S 11A)	16/06/2023

Application Details	
APPLICATION NUMBER	202341063275
APPLICATION TYPE	ORDINARY APPLICATION
DATE OF FILING	20/09/2023
APPLICANT NAME	1. Dr. Rajender Vadluri 2. Dr. Beemagani Sreelatha 3. Dr. SadhuSuman Kalyan 4. Swapna Mittapalli 5. Potta Jyothi 6. Dr. Gudepu Renuka 7. Deepika Guduru 8. Marapaka Yasudha 9. Bhagath Yerram
TITLE OF INVENTION	A METHOD FOR IN-VITRO GENERATION OF ROOT NODULES FROM GROUND NUTS
FIELD OF INVENTION	BIOTECHNOLOGY

PATENT FILINGBY DR. T. MURALI KRISHNA

ISOLATION OF COMPOUNDS FROM EXTRACTS OF *ERYCIBE PANICULATA* LEAF AND THEIR ANTIBACTERIAL ACTIVITY Docket Number: 37706 Reference Number: 202341027536 Indian Patent Filing

PATENT GRANT (DR. T. MURALI KRISHNA)

German Patent Grant A System for extraction and Characterization of bio active compound from *Dendrothaeafalacata* haustorium Reference Number: 2023062718131300DE.

PATENTS PUBLISHED BY DR. V. SRILEKHA

1. Published patent on “An Efficient and Rapid Regeneration of Callus from Roots and Root Hair of Indian Maize”. **Application Number-202341033823**. Date: 13/05/2023.



Office of the Controller General of Patents, Designs & Trade Marks
Department of Industrial Policy & Promotion,
Ministry of Commerce & Industry,
Government of India

INTELLECTUAL PROPERTY INDIA
www.ipindia.gov.in

Application Details	
APPLICATION NUMBER	202341033823
APPLICATION TYPE	ORDINARY APPLICATION
DATE OF FILING	13/05/2023
APPLICANT NAME	1. Dr. Beemagani Sreelatha 2. Dr. Vadluri Rajender 3. Dr. Sadhu Suman Kalyan 4. Potta Jyothi 5. Dr. V. Srilekha 6. K. Venkata Naga Rajeshwari 7. Mittapalli Swagna 8. A. Veena 9. P. Neeraja 10. T. Shiva Chander
TITLE OF INVENTION	AN EFFICIENT AND RAPID REGENERATION OF CALLUS FROM ROOTS AND ROOT HAIR OF INDIAN MAIZE
FIELD OF INVENTION	BIOTECHNOLOGY
E-MAIL (As Per Record)	bslathabathini@gmail.com
ADDITIONAL EMAIL (As Per Record)	
E-MAIL (UPDATED Online)	
PRIORITY DATE	
REQUEST FOR EXAMINATION DATE	--
PUBLICATION DATE (S/S 11A)	16/06/2023

LAB EQUIPMENT

List of Equipment in the Department of Biotechnology

S.No	Name of the Equipment	Number
1	Autoclave	03
2	Balance	01
3	BOD incubator	01
4	Refrigerated Centrifuge	02
5	Cyclomixer	02
6	Colny counter	01
7	Paper Chromatography Chamber	01
8	Digital Balance	01
9	Deep Freezer	01
10	Dry Bath	01
11	Electrophoresis Apparatus	06
12	ELISA reader	01
13	Bench Top Fermenter	01
14	Gel documentation	01
15	Heamocytometer	06
16	Hot plate	02
17	Hot air oven	01
18	Ice breaking mechine	01
19	Incubator	02
20	Laminar Air Flow	03

21	Micro pipettes	09
22	Magnetic stirrer	02
23	Compound Microscopes	08
24	Microoven	01
25	Microcentrifuge	01
26	Orbital Shaking Incubator	01
27	PH meter	01
28	Rotar centrifuge	01
29	PCR	01
30	Refrigerator	02
31	Inverted Microscope	01

RESEARCH SCHOLARS

Total number of research scholars in the Department are 27 among which 5 scholars have been submitted;

Scholars with Fellowship :01

(Single girl child fellowship)

Scholars without Fellowship: 26

Research scholars awarded: 0

COURSES INTAKE

ACHIEVEMENTS

Faculty Achievements

Dr. V. Srilekha, HoD & BoS Chair Person, and **Prof. V. Rajender**, Department of Biotechnology, attended SERB Sponsored **Genome Editing Workshop Genome editing** at **BITS Pilani**, Hyderabad campus held on November 17th & 18th -2023.



Dr. V. Srilekha, Dept. of Biotechnology Attended one day National seminar on 'Winning strategies for women professionals in higher education -Reflections towards capacity building' on November 25th, 2023.



Dr. V. Srilekha, HoD& BoS Chairperson, Department of Biotechnology received Chaitanyam award for Best Book Chapter publication entitled “Antioxidant potential of carotenoids derived from marine bacteria and their applications” in Marine Antioxidants Book, published in Elsevier.



Prof. T. Muralikrishna, Department of Biotechnology, received Chaitanyam award for German patent grant on “A System for extraction and Characterization of bioactive compound from *Dendrothaeafalacata* haustorium”.



Dr. V. Srilekha, HoD& BoS Chairperson, Department of Biotechnology, received a certificate of appreciation for reviewing a manuscript in Journal of Advances in Microbiology.



Ph. D. Thesis Submission:

1. Gade Pavan Kumar, Submitted his thesis entitled “**Screening and Molecular Characterization of Pesticide Degrading Bacteria from Agriculture Soil in Telangana Region**”, under the supervision of **Prof. V. Rajender**.
2. Swapna Mittapalli, Submitted her thesis entitled “**Studies on Genetic Transformation of Defensin Gene Against Fungal Pathogen in Groundnut (*Arachis hypogaea* L.)**”, under the supervision of **Prof. V. Rajender**.



Ph. D. Thesis Submission:

1. Mr.TP.Prasanna Kumar, Mr.G.Praveenkumar Submitted his thesis entitled “**Microbial profiling of jeevamrutham and optimization studies of fermentation parameters for the mass production of biofertilizers**”, under the supervision of **Prof. T. Murali krishna**.
2. Mr.G.Praveenkumar, Submitted his thesis entitled “**Isolation and characterization of bio active compounds from *Strychnos nux-vomica***”, under the supervision of **Prof. T. Murali krishna**.
3. Mrs.K.Srilekha, Submitted her thesis entitled “***In vitro* determination of**

Anticanceractivities of diarylheptanoidsderivedfrom *Garuga pinnata*ROX B” under the supervision of **Prof. T. Murali krishna**.



1. Students of UG & PG Biotechnology 2nd & final year visited CCMB on 26th September, 2023.



2. Conducted Pre Submission Seminar (PSS) of 1st Batch Ph.D Students G. Pavan Kumar, M. Swapna, P.Prasanna Kumar, G. Praveen Kumar & K. Srilekha, on 30th September & 19th October, 2023.

3. Conducted Research Design Seminar (RDS) for 3rd Batch Ph.D Students- B. Akhila, B. Vamshi, M. Supriya, I. Jayasri & Ch. Anush Sai, on 30th December, 2023 & 11th January, 2024.



4. As a part of the community service, students of PG Biotechnology IV Semester and visited a Government school at Thirumalagiri near Parkal.



Student Achievements

Ms.K. Akhila student of M.Sc 5 years Integrated Biotechnology IX semester.

Interaction with H'ble Lok Sabha Speaker, Shri Om Birla on 14th April 2023, at Parliament house during National Youth Parliament. She is a winner of state level youth Utsav and was selected for National level youth Utsav at New Delhi.



1. Winner of the State level Yuva Utsav December 28-29 2023 and Selected for the National Level Yuva Utsav at New Delhi.



2. Represented CDU at National Youth Festival Karnataka from 12- 18 January 2023.



P. Uday, student of M. Sc 5 years Integrated Biotechnology, IX semester.

1. Participated and awarded best poster presentation at Maharashtra national level art exhibition on Feb 24th, 2023.



2. Participated and won SAMRIDDHI – 2023 1st prize pencil art, 1st prize Face painting at Chaitanya (Deemed to be University), Hanamkonda.



3. Participated and received 1st Prize on National Science Day 2023, Organized by SAMSKRUTHI Foundation, held on 25th March, 2023 at CKM College Warangal.

K. Supriya, Student of M. Sc 5 years Integrated Biotechnology IX semester.

She was selected for Summer Research Fellowship Program, by Indian Science of Academies, Selected to perform project at Aligarh Muslim University, Aligarh, Uttarpradesh.

Project title::NEMATODE ASSOCIATIONS WITH TERRESTRIAL MOLLUSCS from: 10/07/2023 To: 5/09/2023.



Indian Academy of Sciences, Bangalore
Indian National Science Academy, New Delhi
The National Academy of Sciences India, Prayagraj

SCIENCE ACADEMIES

SUMMER RESEARCH FELLOWSHIP PROGRAM

P.O. No. 6005, C.V. Raman Avenue, Sadashivpet, Bengaluru 560 075
Telephone: (080) 2299 1207, 2299 1232, 2299 1221, Fax: (080) 2361 6004
E-mail: jshankar@ias.ac.in Website: www.ias.ac.in

Date: 14 April 2023

Dear Sir/Ms/Madam,

This has reference to your application for/INSTITUTIONAL SUMMER RESEARCH FELLOWSHIP for 2023. We are happy to offer you a Fellowship to work for one month during the summer (July - August 2023) subject to verification of your work as stated by you in the application with the working address. You will be working with Prof. Qasim Fakhori, Algori School of Chemistry, Algori University, Algori-376005, India.

We have tried to be as practical as we can in a guide allocation in your case of interest. Where that has not been possible, you will work with the assigned guide in a related area that will be determined by the guide, and report about the experience with the attached system. We will not be able to make any change in this regard.

This Fellowship is subject to the following terms:

- The duration of the Fellowship is eight weeks (8 weeks) including holidays and General Holidays, and is not extendable. If you do not work for the entire period, you will not be granted the Fellowship amount and the conditions that it entails, except for the amount.
- You will be provided with a room and board allowance in Algori, Algori and India.
- If you are NOT an INDIAN CITIZEN (including OCI/PIO), you will be paid a Fellowship of 12,000/- per month towards your Fellowship, including your transport expenses. Those who are citizens of INDIA/NEPAL/NETHERLANDS will be covered by a separate agreement. The details of which will be sent later.
- Your local correspondence, please contact your guide who can help you. The Academy office will not be able to help you in this regard.

Please also go through carefully & comply with all the instructions given in the attached sheet.

You are advised to get in touch with Prof. Fakhori immediately to work out the exact period of your visit. In the meantime, please communicate with Mrs. M. S. Muralidhar, Co-ordinator, Summer Research Program, your acceptance of this Fellowship. We would need a signed report from you upon your arrival, and a list of report of your work at the end of the month on the your Fellowship for the time period you are granted. After the expiry of the final report, we shall release the remaining amount due to you along with your travel fare.

We urge you to convey your acceptance of this Fellowship within 7 days to both your office and guide and get approval given at the bottom of the attached sheet by entering the Form of Acceptance granted to you. Once it is done you will be granted the Fellowship. This should be returned to the Academy immediately (both by email and in the form of Acceptance sheet printed @ 100 copies) so that the Fellowship can be released to your guide as per working file.

With best wishes,

Yours sincerely,

Professor P. K. Jha
Chair, Summer Research Education Panel, IAS

* It is recommended that you Summer Research Fellowship (SRF) be awarded to a person who has completed a minimum of one year of service. The Academy will not provide any extension period. Therefore, it is up to you to plan the duration of service accordingly.

COLLABORATIONS

Collaboration 1

Kakatiya government PG college ,Warangal has duly signed on memorandum of understanding with Chaitanya(Deemed to be University) on 7th march,2022

Collaboration II

Telangana social welfare residential degree college for women,Warangaleast has duly signed on memorandum of understanding with Chaitanya(Deemed to be University) on 17th march,2023.

CONTACT INFORMATION

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