

BHAVAN'S VIVEKANANDA COLLEGE OF SCIENCE, HUMANITIES AND COMMERCE

Accredited with 'A' Grade by NAAC

Affiliated to Osmania University, Hyderabad

Autonomous College *Wef 2020-21*

SEMESTER - I

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	Environmental Studies/Computer Skills	AECC-1	2		2	2		2
	English	CC-1A	4		4	4		4
	Second Language	CC-2A	4		4	4		4
	Optional 1	DSC-1A	4	2	6	4	1	5
BT 133	Optional 2- Cell Biology and Genetics	DSC-2A	4	2	6	4	1	5
	Optional 3	DSC-3A	4	2	6	4	1	5
					28			25

SEMESTER - II

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	Environmental Studies/Computer Skills	AECC-2	2		2	2		2
	English	CC-1B	4		4	4		4
	Second Language	CC-2B	4		4	4		4
	Optional 1	DSC-1B	4	2	6	4	1	5
BT 233	Optional 2 - Biological Chemistry and Microbiology	DSC-2B	4	2	6	4	1	5
	Optional 3	DSC-3B	4	2	6	4	1	5
					28			25

SEMESTER - III

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1C	3		3	3		3
	Second Language	CC-2C	3		3	3		3
	Optional 1	DSC-1C	4	2	6	4	1	5
BT 333	Optional 2- Molecular Biology and Recombinant DNA Technology	DSC-2C	4	2	6	4	1	5
	Optional 3	DSC-3C	4	2	6	4	1	5
SE 333	Integrated Pest Management	SEC-1	2		2	2		2
		SEC-2	2		2	2		2
					28			25

SEMESTER - IV

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1D	3		3	3		3
	Second Language	CC-2D	3		3	3		3
	Optional 1	DSC-1D	4	2	6	4	1	5
BT 433	Optional 2 - Bioinformatics and Biostatistics	DSC-2D	4	2	6	4	1	5
	Optional 3	DSC-3D	4	2	6	4	1	5
SE 433	Food Preservation and Adultration	SEC-3	2		2	2		2
		SEC-4	2		2	2		2
					28			25

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**BHAVAN'S VIVEKANANDA COLLEGE OF SCIENCE, HUMANITIES AND
COMMERCE, SAINIKPURI, SECUNDERABAD.**

Autonomous College

Affiliated to Osmania University, Hyderabad.

(Accredited with 'A' grade by NAAC)

Department of Genetics, Biotechnology and Botany

Subject: Biotechnology (Optional)

(B Sc. Life Sciences)

Semester -I CBCS

Paper I - Theory

Title-Cell Biology and Genetics

Effective from 2020-21 onwards

Credits: 4

Paper Code: BT 133

No of Hours: 60

Objectives:

- To introduce the basic concepts of cell biology and cell division.
- To learn Mendelian and non- Mendelian genetics like Co-dominance, Incomplete Dominance and Epistasis.
- The fundamentals of Linkage, recombination and gene mapping introduced to the students to help them develop a liking for genetics.
- They are also taught about Sex determination and diseases linked to X chromosomes which facilitates them to go for courses like genetic counselling and contribution in building up of healthy nation.

Unit I: Cell Structure and Function

16 hours.

1. Cells as basic units of living organisms- Bacterial, Fungal, Plant and Animal cells. (2)
2. Ultra structure of Prokaryotic cell (cell wall, cell membrane, plasmids, Nucleoid) (1)
3. Ultra structure of eukaryotic cell (Cell wall, cell membrane, Nucleus, Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi complex, vacuoles). (5)
4. Fluid mosaic model, Sandwich model, Cell membrane permeability (3)
5. Structure of chromosome- morphology, components of chromosomes (histones and non-histones), Packing of DNA into chromatin, nucleosome and higher order organization (3)
- 6.) Specialised chromosomes (Polytene and Lampbrush). (2)

Unit II: Cell Division and Cell cycle

14 hours

1. Bacterial cell division (2)
2. Eukaryotic cell cycle -- phases (2)
3. Mitosis-Stages (spindle assembly) -- Significance (2)
4. Meiosis- Stages (synaptonemal complex) -- Significance (4)
5. Senescence and necrosis (2)
6. Apoptosis (2)


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Unit III: Principles and mechanism of inheritance

15 hours

1. Mendel's experiments – Factors contributing to success of Mendel's experiments (1)
2. Law of segregation – Monohybrid ratio; Law of Independent assortment – Dihybrid Ratio, Trihybrid Ratio (2)
3. Deviation from Mendel's Laws – Partial and complete dominance (eg: Flower color in *Mirabilis jalapa*), co-dominance (eg: MN Blood groups), Non allelic interactions-types of epistasis, modification of dihybrid ratios (4)
4. Penetrance and expressivity (eg: Polydactyly), Pleiotropism, phenocopy- microcephaly, cleft lip. Multiple allelism (ABO blood groups) (4)
5. Genes and environment – Temperature (*Drosophila shibire* mutant), Nutritional (*Neurospora*), Effect on human genes (PKU, Pattern baldness) (1)
6. X-Y chromosomes- sex determination in *Drosophila*, Man, X-linked inheritance- hemophilia and color blindness; X- inactivation. (3)


Unit IV: Linkage, Recombination and extension to Mendel's laws

15 hours

1. Linkage and recombination- cytological proof of crossing, phases of linkage, recombination frequency, gene mapping and map distance. (4)
2. Non- Mendelian inheritance- Maternal effect (*Shell coiling in snail*), Variegation in leaves of *Mirabilis jalapa* (4)
3. Cytoplasmic male sterility in maize. (1)
4. Mitochondrial inheritance in human and poky in *Neurospora crassa* (3)
5. Chloroplast inheritance in *Chlamydomonas* (2)
6. Hardy- Weinberg Equilibrium (1)

Outcomes:

- Understanding of cell structure and function opens new insights into basic research like using them as experimental material students to learn
- A clear understanding of cell cycle and cell regulation makes their use in production of cell lines
- An exposure to Mendelian and non Mendelian genetics makes students understand the pattern of inheritance of genes, and take up research activities related to inheritance
- Knowledge gained on linkage and recombination helps students to solve problems based on them and construct linkage maps
- A basic exposure to Hardy-Weinberg Equilibrium motivates students to do apply the law in basic research contributing to the scientific growth.


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Biotechnology
I Year B.Sc Syllabus
Semester –I CBCS
Paper I- Practicals
Title- Cell biology and Genetics

Credits: 1

Paper Code: BT 133 P

20 hrs (2 hrs/ week)

Objective: To introduce the students to use Microscope and prepare cell smear to study mitosis, meiosis and salivary glands. Exposure to students to do problems on genetics

1. Microscopic observation of cells: bacterial, fungal, plant and animal cell.
2. Preparation of different stages of Mitosis (garlic root tips).
3. Preparation of different stages of Meiosis (grasshopper testis)
4. Preparation of Polytene chromosomes from drosophila salivary gland
5. Problems on monohybrid and Dihybrid ratio in *Drosophila*/maize.
6. Problems on co-dominance, Epistasis, two-point and three point test cross, gene mapping.
7. Statistical applications of Hardy-Weinberg Equilibrium.

Outcome: Students expertise in solving problems and excel in using Microscope very well which facilitates them to pick up jobs pertaining to both fields

Spotters

1. Prokaryotic Cell (Bacteria),
2. Mitochondria,
3. Chloroplast,
4. Polytene Chromosomes
5. Test Cross,
6. Blood Grouping,
7. Hemophilia Pedigree
8. Crossing Over
9. Synaptonemal Complex,
10. Nucleosome Model.

REFERENCE BOOKS

1. Cell & Molecular Biology. E. D. De Robertis & E. M. F De Robertis, Waverly publication
2. An introduction to Genetic Analysis by Anthony, J.F. J.A. Miller, D.T. Suzuki, R.C. Richard Lewontin, W.M-Gilbert, W.H. Freeman publication
3. Principles of Genetics by E. J. Gardner and D. P. Snusted. John Wiley & Sons, New York

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4. The science of Genetics, by A. G. Atherly J. R. Girton, J. F. McDonald, Saundern College publication
5. Principles of Genetics by R. H. Tamarin McGrawhill
6. Theory & problems in Genetics by Stansfield, Schaum out line series McGrawhill
7. Molecular Cell Biology Lodish, H., Baltimore, D; fesk, A., Zipursky S. L., Matsudaride, P. and Darnel. American Scientific Books. W. H. Freeman, New York
8. The cell: A molecular approach. Geoffrey M Cooper, Robert E Hausman, ASM press
9. Cell and Molecular Biology, Concepts and Experiments – Gerald Karp, John Wiley & Sons, Inc.
10. Cell Biology And Genetics by P. K. GUPTA


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Department of Genetics, Biotechnology and Botany
Subject: Biotechnology (Optional)
(BSc. Life Sciences)
Semester -II CBCS
Paper II - Theory**

**Title-Biological chemistry and Microbiology
Effective from 2020-21 onwards**

Credits: 4

Paper Code: BT 233

No of Hours: 60

Objectives:

- The concepts of biochemistry are introduced to the students like biomolecules, enzymes and Nucleic acids.
- Various metabolic pathways like glycolysis, citric acid cycle, gluconeogenesis, beta oxidation is explained in detail.
- To introduce to the concepts of genetic material (DNA / RNA), along with the structure of nucleic acids proposed by Watson and Crick.
- They are exposed to various types of microscopy
- A brief account of microbial pathogenesis especially of mycobacterium and Hepatitis is introduced to the students
- Different methods of physical and chemical sterilization are explained to obtain pure cultures.

Unit I: Biomolecules

16 hours

1. Carbohydrates- Importance, classification, structure and functions of monosaccharides (glucose and fructose), disaccharides (sucrose, lactose and maltose) and polysaccharides-Homo and heteropolysaccharides (starch, glycogen, inulin, hyaluronic acid and peptidoglycan). (4)
2. Amino acids- importance, classification, structure, physical and chemical properties of amino acids, peptide bond formation. (2)
3. Proteins- importance, structure of proteins- primary, secondary, tertiary and quaternary. (2)
4. Lipids- importance, classification-simple lipids (triacylglycerides and waxes), complex lipids (phospholipids and glycolipids), derived lipids (steroids, terpenes and carotenoids). (2)
5. Nucleic acids: structure and Chemistry of DNA (Watson and Crick Model) and RNA (t-RNA) structure and forms of DNA (A, B and Z) (3)
6. Enzymes – Importance, classification and nomenclature; Michaelis- Menton Equation, factors influencing the enzyme reactions; enzyme inhibition (competitive ,uncompetitive & mixed),co-enzymes (3)

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Unit II: Bioenergetics

14 hours

1. Glycolysis, Tricarboxylic Acid (TCA) Cycle. (3)
2. Electron Transport, Oxidative Phosphorylation (2)
3. Gluconeogenesis and its significance (2)
4. Transamination and Oxidative deamination reactions of amino acids (3)
5. B-oxidation of Fatty acids (2)
6. Glyoxalate cycle. (2)

Unit III: Fundamentals of microbiology

15 hours

1. Historical development of microbiology and contributors of microbiology (1)
2. Microscopy: Bright field microscopy, Dark field microscopy, Phase contrast microscopy, Fluorescent microscopy, Scanning and Transmission electron microscopy (4)
3. Outlines of Classification of microorganisms (2)
4. Structure and general characteristics of bacteria and virus (3)
5. Disease causing pathogens and symptoms (eg: Mycobacterium, Hepatitis) (2)
6. Structure and general characteristics of micro-algae and fungi (3)

Unit IV: Culture and identification of microorganisms

15 hours

1. Methods of sterilization-Physical and chemical methods (2)
2. Bacterial nutrition - types of bacteria, essential macro and micro nutrients and growth factors. (3)
3. Bacterial growth curve- batch and continuous cultures, synchronous cultures, measurement of bacterial growth - measurement of cell number and cell mass. (3)
4. Factors affecting bacterial growth (2)
5. Culturing of anaerobic bacteria and viruses (3)
6. Pure cultures and its characteristics (2)

Outcomes:

- Understanding of biochemistry develops in them an instinct to take up research in biochemistry or as biochemists in various labs across the world
- Knowledge acquired on various biochemical pathways opens great avenues for them to join for research in various labs across the country
- Pure culture isolation techniques help them look for rare isolates which can be of significance either at industrial level or bioremediation
- A brief account of microbial pathogenesis especially pertaining to diseases like mycobacterium and hepatitis is introduced to the students which help in preventing the pathogenicity of the disease thereby building a healthy nation.


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Biotechnology
I Year B.Sc Syllabus
Semester –II CBCS
Paper II- Practicals
Title–Biological Chemistry and Microbiology

Credits: 1
Paper Code: BT 233 P
20 hrs (2 hrs/ week)

Objective: Students are introduced to the various qualitative analysis of sugars, lipids and amino acids along with the estimation of sugars and proteins and chromatographic separation of amino acids. The students are introduced to microbial techniques of preparing media, isolation of bacteria and staining them.

1. Preparation of Normal, Molar and Molal solutions
2. Preparation of Buffers (Acidic, Neutral and Alkaline Buffers)
3. Qualitative tests of sugars, amino acids and lipids.
4. Estimation of total sugars by anthrone method.
5. Separation of amino acids by paper chromatography
6. Estimation of protein by Biuret method.
7. Sterilization methods
8. Preparation of microbiological media (Bacterial, algal and fungal)
9. Isolation of bacteria by streak, spread and pour plate methods
10. Isolation of bacteria from soil.
11. Simple staining and differential staining (gram staining).
12. Bacterial growth curve
13. Technique of micrometry (Ocular and stage)

Outcome: Expertise gained by students on qualitative and quantitative analysis of biomolecules helps them get research opportunities and jobs in various labs both at national and international level.

Spotters:

1. Osazone
2. Globular protein
3. Lock and key model
4. Competitive inhibition
5. RUBISCO
6. ATP synthase
7. Autoclave
8. Laminar air flow
9. Tyndallisation
10. Bacterial growth curve
11. Hot air oven
12. Serial dilution technique


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REFERENCE BOOKS

1. Lehninger Principles of Biochemistry By: David L. Nelson and Cox
2. Biochemistry By: Rex Montgomery
3. Harper's Biochemistry By: Robert K. Murray
4. Enzymes By: Trevor Palmer
5. Enzyme structure and mechanism By: AlanFersht
6. Principles of Biochemistry By: Donald J. Voet, Judith G. Voet, Charlotte W. Pratt
7. Analytical Biochemistry By: Cooper
8. Principles and techniques of Biochemistry and Molecular Biology Edited By: Keith Wilson and John Walker
9. Practical Biochemistry By: Plummer
10. Biology of Microorganisms by: Brock, T.D. and Madigan, M.T.
11. Microbiology by: Prescott, L.M., Harley, J.P. Klein, D.A.
12. Microbiology by: Pelczar, M.J, Chan, E.C.S., Ereig, N.R.
13. Microbiological applications by: Benson

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Department of Genetics, Biotechnology and Botany

Subject: Biotechnology (Optional)

(BSc. Life Sciences)

Semester –III CBCS

Paper III

Title–Molecular Biology and Recombinant DNA Technology

Effective from 2021-22 onwards

Paper Code: BT 333

No of Hours: 60

Credits 4

COURSE OBJECTIVE: To analyze genome organization and understand gene expression and regulation and incorporate recombinant DNA technology.

UNIT WISE COURSE OBJECTIVES

Cob 1: To analyze genome organization and understand DNA replication

Cob2: To understand Gene expression in Prokaryotes and Eukaryotes

Cob 3: To analyze Gene regulation in Prokaryotes and Eukaryotes

Cob 4: To familiarize with versatile tools used to formulate cloning strategies and recombinant DNA Technology. To appraise analysis and applications in DNA cloning

Unit 1- Genome Organization and DNA Replication

15 hours

- 1. DNA as the genetic material-Griffiths transformation experiment, Avery, Macleod and McCarty's experiment and Hershey and Chase –labelling experiment, RNA as genetic material-Tobacco Mosaic virus. (3)**
- 2. Organization of prokaryotic genome and eukaryotic nuclear genome. (2)**
- 3. Organization of Mitochondrial and chloroplast genome. (2)**
- 4. DNA Replication –enzymes involved in the replication of DNA, origin of replication fork. (3)**
- 5. Replication of prokaryotic genome and nuclear genome of eukaryotes. (3)**
- 6. Mutations –types of mutations, spontaneous mutations and induced mutations. (2)**

Unit 2: Gene expression in Prokaryotes and Eukaryotes

15 hours

- 1. Structure of prokaryotic gene, structure of eukaryotic gene, structure and functions of prokaryotic RNA –polymerase-subunits. (3)**
- 2. Transcriptional machinery in eukaryotes (RNA polymerase) and their structural and functional features. (2)**

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3. Genetic code-properties, deciphering of genetic code, wobble hypothesis. (2)
4. Transcription mechanism in prokaryotes-initiation, elongation and proof reading, termination (rho independent and rho dependent). (3)
5. Transcription in eukaryotes- initiation, elongation and termination factors. (2)
6. Translation mechanism-initiation, elongation and termination. (3)

Unit 3 - Gene regulation in Prokaryotes and Eukaryotes **15 hours**

1. Prokaryotic transcriptional regulation (inducible system)-operon concept, lac operon and glucose effect. (4)
2. Prokaryotic transcriptional regulation (repressible system) -tryptophan operon. (2)
3. Post transcriptional modification – capping, poly-adenylation. (2)
4. Splicing and alternate splicing. (2)
5. Post translational modifications -glycosylation, acetylation and ubiquitination. (3)
6. Gal regulation in yeast – mating type gene switching and epigenetic regulation (2)

Unit 4- Recombinant DNA technology **15 hours**

1. Enzymes used in molecular cloning restriction endonuclease, DNA ligases, polynucleotide kinase, klenow enzyme and DNA polymerase. (3)
2. Cloning vectors PBR 322, bacteriophage vectors, Cosmid, Phagemid, Shuttle vectors. (3)
3. Vectors for library preparation (lambda phage vectors, cosmids, BAC and YAC. (2)
4. Gene transfer techniques; physical chemical and biological methods. (2)
5. Selection of recombinant clones-colony hybridization and library screening. (2)
6. CRISPR- Introduction and Applications (1)
7. Application of recombinant DNA technologies-agriculture, diagnostics, industrial, pharmaceuticals and medicine. (2)

Outcomes:

By the end of this course students will be able to

BT333 CO 1: To understand and demonstrate the various levels of genomic organization and DNA replication.

BT333 CO 2: To relate and interpret gene expression in prokaryotes and Eukaryotes.

BT333 CO 3: To formulate new strategies applicable to state the function of various genes.

BT333 CO 4: To explain the concept, techniques and applications of Genetic Engineering and cloning

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Biotechnology
III Year B.Sc Syllabus
Semester - III CBCS
Paper III- Practicals

Title—Molecular Biology and Recombinant DNA Technology

Paper Code: BT 333 (P)
20 hrs (2 hrs/ week)

Objective:

Cob1. To introduce the students to practical concepts of rDNA technology and molecular biology like restriction digestion of DNA.

- 1.Isolation of DNA from bacterial cells.**
- 2.Isolation of Plasmid DNA**
- 3.Agarose electrophoresis of DNA**
- 4.Quantification of DNA by Spectrophotometer**
- 5.Separation of proteins by SDS-PAGE.**
- 6.Polymerase Chain reaction**
- 7.Restriction digestion of DNA**
- 8.Bacterial transformation and Transduction**

Outcome:

CO1: Expertise in Molecular biology and rDNA Technology

Spotters:


- 1. PCR**
- 2. RNA Polymerase**
- 3. Okazaki fragments**
- 4. Plasmid vector Map**
- 5. Prokaryotic gene**
- 6. Eukaryotic gene**
- 7. Splicing**
- 8. Post transcriptional modification**
- 9. Point mutations**
- 10. Lac operon**
- 11. Tryptophan operon**
- 12. Post translational modifications (PTMS)**


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Recommended Books

1. Molecular Biology of the Gene - By Watson, Hopkins, Goberts, Steitz and Weiner (Pearson Education)
2. Cell and Molecular Biology - By Robertis&Robertis, Publ: Waverly
3. Gene Structure & Expression - By J.D. Howkins, Publ: Cambridge
4. Test Book of Molecular Biology - By K.S.Sastry, G.Padmanabhan & C. Subramanyan, Publ: Macmillan India
5. Genes - By B. Lewin - Oxford Univ. Press
6. Molecular Biology & Biotechnol. - By H.D. Kumar, Publ: Vikas
7. Molecular Biotechnology - By G.R. Glick and J.J. Pasternak, Publ: Panima
8. Molecular Biology - By D. Freifelder, Publ: Narosa
9. Genes and Genomes - By Maxine Singer and Paul Berg
10. Cell and Molecular Biology - By S.C. Rastogi
11. Genome - T.A. Brown
12. Gene Cloning - T.A. Brown
13. Text Book of Biotechnology - By H.K. Das (Wiley Publications)
14. Genetic Engineering - By R. Williamson, Publ: Academic Pres4
15. Microbial Genetics - By S.R. Maloy, J.E. Cronan& D. Freifelder, Publ: Jones & Barlett
16. Principles of Gene Manipulation - By R.W. Old & S.B. Primrose, Publ: Blackwell
17. From Genes to Clones - By E.L. Winnacker, Publ: Panima, New Delhi
18. Methods for General & Molecular Bacteriology - By P. Gerhardt et al., Publ: ASM
19. Recombinant DNA - By J.D. Watson et al., Publ: Scikentific American Books
20. Genetic Engineering and Biotechnology - By V. Kumar Gera
21. Essentials of Biotechnology - By P.K. Gupta
22. Introduction to Applied Biology and Biotechnology - By K. Vaidyanath, K. Pratap Reddy and K. Satya Prasad
23. Gene Biotechnology - By Jogdand
24. Biotechnology, IPRs and Biodiversity - By M.B. Rao and Manjula Guru (Pearson Education)
25. Genetic Engineering - By Boylan (Pearson Education)
18. Basic Concepts of Biotechnology - By Irfan Ali Khan and Atiya Khanum (Ukaaz Publications)
19. Advances in Biotechnology - By Irfan Ali Khan and Atiya Khanum


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Department of Genetics, Biotechnology and Botany

Subject: Biotechnology (Optional)

(BSc. Life Sciences)

Semester –IV CBCS

Paper IV

Title–Bioinformatics and Biostatistics

Effective from 2021-22 onwards

Paper Code: BT 433

No of Hours: 60

Credits 4

COURSE OBJECTIVE: to analyze biological data digitally and to apply and interpret statistical methods correctly.

UNIT WISE COURSE OBJECTIVES

Cob 1: To uncover the wealth of biological information hidden in the mass of sequence, structure, literature and biological data.

Cob2: To organize, process and analyze biological data

Cob 3: To advance statistical science and its application to problems of human health and disease, with the ultimate goal of advancing statistics.

Cob 4: To Choose and apply appropriate statistical methods for analyzing one or two variables. Use technology to perform descriptive and inferential data analysis for one or two variables. Interpret statistical results correctly, effectively, and in context.

Unit 1 – Introduction to bioinformatics and biological databases 15hours

1. Bioinformatics definition, history, scope and applications. (4)
2. Bioinformatics tools and resources – Internet basics, role of internet, free online tools, downloadable free tools. (3)
3. Bioinformatics web portals –NCBI, EBI, ExPASy. (3)
4. Biological databases –DNA sequence databases (GenBank, ENA(EMBL)&DDBJ). (3)
5. Protein sequence databases (Swissprot& PROSITE). (2)

Unit 2- Sequence alignment 15hours

1. Basics of sequence alignment –match, mismatch, gaps, gap penalties, scoring alignment. (3)

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2. Types of sequence alignment –pairwise and multiple alignment, local and global alignment. (3)

3. Dot matrix comparison of sequences. (2)

4. scoring matrices-PAM and BLOSUM. (2)

5. Pairwise sequence similarity search by BLAST and FASTA. (2)

6. Concepts of Phylogeny – distance based (NJ method and character base (ML method) tree construction methods (3)

Unit 3- Descriptive Biostatistics and probability

15hours

1. Introduction to biostatistics, kinds of data and variables –based on nature (numerical –discrete and continuous: categorical – ordinal and nominal – based on source (primary and secondary data): sample size, sampling methods and sampling errors. (3)

2. Data tabulation and representation methods: graphical methods –stem and leaf plot, line diagram, bar graph, histogram, frequency polygon, frequency curves; diagrammatic method-pie diagram. (3)

3. Measures of central tendency- mean, median, mode; merits and demerits. (2)

4. Measures of dispersion -range, variance, standard deviation, standard error and coefficient of variation; merits and demerits. (2)

5. Concepts of probability-random experiments, events, probability of event, probability rules (addition and multiplication) use of permutations and combinations, random variables (discrete and continuous). (3)

6. Probability distributions: Binomial and Poisson distributions for discrete variables, Normal distribution for continuous variables. (2)

Unit 4 – Application of biostatistics

15hours

1. Hypothesis testing –steps in testing for statistical hypothesis, null and alternative hypothesis, level of significance-type 1 and type 2 errors. (3)

2. Test of significance for small samples –student's t-test (one sample and two samples). (2)

3. Test of significance for large samples –Z – test for means and proportions. (3)

4. Chi-square test and its applications- goodness of fit, test of independence. (2)

5. Analysis of variance (ANOVA) – one way analysis. (2)

6. Correlation – definition, simple and linear analysis, Karl Pearson's correlation coefficient. (3)

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Outcomes: Paper IV

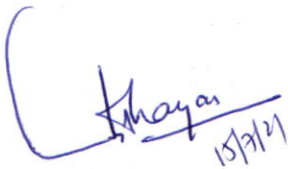
By the end of these course students will be able to

BT433 CO 1: Use bioinformatics tools to guide data analysis and interpretation

BT433 CO 2: Provide a basic outline of the processes used for sequence alignment

BT433 CO 3: Define the principal concepts about biostatistics. Recognize the definition of statistics, its subject and relation with the other sciences.

BT433 CO 4: To cater for graduates who wish to have better career prospects, to enhance their knowledge in new spheres of Biostatistics.



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Biotechnology
III Year B.Sc Syllabus
Semester –IV CBCS
Paper IV- Practicals
Title–Bioinformatics and Biostatistics

Paper Code: BT 433 (P)
20 hrs (2 hrs/ week)

Objectives:

Cob 1 students value the concepts of biostatistics along with hands on expertise in Bioinformatics.


1. OMICS-Basics
2. Exploring web portals NCBI, EBI & ExPASy
3. Literature search through Pubmed and Pubmed Central
4. Sequence retrieval from Genbank, ENA, Swissprot
5. Pairwise homology search by BLAST and FASTA
6. Calculation of mean, median, mode, standard deviation, variance, standard coefficient of variation
7. Construction of bar diagram, Pie diagram, Line diagram, Histogram
8. Problems on Hypothesis testing using Z- test, t-test and Chi- square test
9. Problems on probability and probability distributions


Outcomes:

CO1: Students expertise Biostatistics and also in analysis of biological data using bioinformatics tools.

Spotters:

1. Line diagram, Bar diagram and pie diagram.
2. Histogram, frequency polygon and frequency curve
3. Normal Probable curve.
4. GenBank
5. DDBJ
6. SWISS-PROT
7. PROSITE
8. PIR
9. BLAST
10. pairwise alignment.
11. Multiple sequence alignment
12. PAM, BLOSUM
13. Phylogentic Tree


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Recommended Books

1. **Bioinformatics and Bioprogramming in C** - By L.N. Chavali
2. **Introduction to Bioinformatics** - By V. Kothekar
3. **Introduction to Bioinformatics** - By Arthur M. Lesk
4. **Introduction to Bioinformatics** - By T.K. Attwood, D.J. Parry-Smith,
(Pearson Education)
5. **Discovering Genomics, Proteomics and Bioinformatics**- By A.M. Campbell and
L.J. Heyer (Pearson Education)
6. **Fundamental Concepts of Bioinformatics** - By Krane (Pearson Education)
7. **Fundamentals of Biostatistics** - By Khan and Khanum (Ukaaz Publications)
8. **Basic Concepts of Bioinformatics** - By Irfan Ali Khan and Atiya Khanum
(Ukaaz Publications)
9. **Biometry** - By Sokal and Rohlf W.H. Freeman
10. **Fundamentals of Biometry** - By L.N. Balaram (George Allen and Unwin
Ltd, London(1972)
11. **Biostatistics** - By N.T.J. Bailey
12. **Biostatistics- Manual of biostatistical methods for use in health, nutrition and
Anthropology** - By K. Visweshwar Rao (Jaypee Publications).


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Bhavan's Vivekananda College of Science, Humanities and Commerce, Sainikpuri

Autonomous College (Affiliated to Osmania University)

Accredited with "A" Grade by NAAC

Template for B Sc Programme under CBCS

Prescribed by TSCHE for implementation from 2022-23 onwards

BIOTECHNOLOGY

Semester 1

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	Environmental Studies	AECC-1	2		2	2		2
	English	CC-1A	4		4	4		4
	Second Language	CC-2A	4		4	4		4
BT133 / BT133 P	Optional 1 Cell Biology and Genetics	DSC-1A	4	3	7	4	1	5
	Optional 2	DSC-2A	4	3	7	4	1	5
	Optional 3	DSC-3A	4	3	7	4	1	5
					31			25

Semester 2

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	Computer Skills	AECC-2	2		2	2		2
	English	CC-1B	4		4	4		4
	Second Language	CC-2B	4		4	4		4
BT233 / BT233 P	Optional 1 Biological Chemistry and Microbiology	DSC-1B	4	3	7	4	1	5
	Optional 2	DSC-2B	4	3	7	4	1	5
	Optional 3	DSC-3B	4	3	7	4	1	5
					31			25

Semester 3

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1C	3		3	3		3
	Second Language	CC-2C	3		3	3		3
BT333 / BT333 P	Optional 1 Molecular Biology and Recombinant DNA technology	DSC-1C	4	3	7	4	1	5
	Optional 2	DSC-2C	4	3	7	4	1	5
	Optional 3	DSC-3C	4	3	7	4	1	5
	Skill Enhancement Course-1 Communication Skills	SEC-1	2		2	2		2
SE333	Skill Enhancement Course-2 Integrated Pest Management	SEC-2	2		2	2		2
					31			25

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Semester 4								
Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1D	3		3	3		3
	Second Language	CC-2D	3		3	3		3
BT433 / BT433 P	Optional 1 - Bioinformatics and Biostatistics	DSC-1D	4	3	7	4	1	5
	Optional 2	DSC-2D	4	3	7	4	1	5
	Optional 3	DSC-3D	4	3	7	4	1	5
	Skill Enhancement Course-3 Universal Human Values	SEC-3	2		2	2		2
SE433	Skill Enhancement Course-4 Food Preservation and Adulteration	SEC-4	2		2	2		2
					31			25

Semester 5

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1E	3		3	3		3
	Second Language	CC-2E	3		3	3		3
BT 533 A/ BT533 A P BT533B / BT533B P	Optional 1- A/B A. Plant Biotechnology (or) B. Medical Biotechnology ✓	DSE-1E	4	3	7	4	1	5
	Optional 2	DSE-2E	4	3	7	4	1	5
	Optional 3	DSE-3E	4	3	7	4	1	5
GE533	Generic Elective -Basics in Biotechnology	GE-1	4		4	4		4
					31			25

Semester 6

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1F	3		3	3		3
	Second Language	CC-2F	3		3	3		3
BT633 A/ BT633A P BT633B / BT633B P	Optional 1- A/B A. Animal Biotechnology (or) B. Environmental Biotechnology	DSE-1F	4	3	7	4	1	5
	Optional 2	DSE-2F	4	3	7	4	1	5
	Optional 3	DSE-3F	4	3	7	4	1	5
BT633_O	Optional paper/Project IPR, Biosafety and Entrepreneurship		4		4	4		4
					31			25

Total Credits = 150

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COMMERCE, SAINIKPURI, SECUNDERABAD.**

Autonomous College

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(Accredited with 'A' grade by NAAC)

Department of Genetics and Biotechnology

Subject: Biotechnology (DSE)

(BSc. Life Sciences)

Semester -V CBCS

Paper VA - Theory

Title-Plant Biotechnology

Effective from 2022-23 onwards

Paper Code: BT 533A

No of Hours: 60 (4hrs/wk)

Credits: 4

COURSE OBJECTIVES:

To analyze the basic concepts of Plant tissue culture and transgenic plants along with its applications.

UNIT WISE COURSE OBJECTIVES

Cob1: To discuss the basics of plant tissue culture, media preparation and techniques involved in callus cultures, suspension cultures, organogenesis and somatic embryogenesis.

Cob2: To identify the different techniques involved in plant tissue culture and interpret its applications.

Cob3: To differentiate the methods involved in production of transgenic plants.

Cob4: To appraise the achievements of transgenic plants and its emergence as bioreactors for edible vaccines, antibody production.

Unit 1: Fundamentals of Plant Tissue Culture

15 Hours

1.1: Introduction to Plant tissue culture ,totipotency of plant cells(dedifferentiation,redifferentiation and regeneration).

(3)

1.2: Nutritional requirements for plant tissue culture, nutrient media-macronutrients and micronutrients, media additives (carbon source,vitamins, amino acids); types of media.

(3)

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- 1.3: Plant growth regulators-auxins, cytokinins and gibberellins. (2)
- 1.4: Preparation of media, sterilization, selection & surface sterilization of explant, inoculation of callus cultures and cell suspension cultures. (3)
- 1.5: Induction of callus cultures and cell suspension cultures. (3)
- 1.6: Organogenesis and somatic embryogenesis. (2)

Unit 2: Application of plant Tissue culture **15 Hours**

- 2.1: Meristem culture, micropropagation and their applications. (2)
- 2.2: Encapsulation and production of synthetic seeds and their applications. (2)
- 2.3: Cell suspension cultures (batch and continuous cultures) and application. (2)
- 2.4: Protoplast isolation, culture and fusion- development of somatic hybrids & cybrids and their applications. (3)
- 2.5: Somaclonal variation and its applications. (2)
- 2.6: Anther and pollen culture for production of haploids & their applications. (2)
- 2.7: Cryopreservation - conservation of plant germplasm. (2)

Unit 3: Production of Transgenic Plants **15 Hours**

- 3.1: Direct gene transfer techniques - physical methods: microinjection, particle bombardment (gene gun) and electroporation & Chemical methods. (3)
- 3.2: Molecular mechanism of Agrobacterium infection and features of Ti plasmid. (2)
- 3.3: Agrobacterium mediated gene transfer using binary and co-integrate vectors. (3)
- 3.4: Viral vectors for gene transfer into plants. (2)
- 3.5: Selection of transgenic plants using reporter and selection marker genes. (3)
- 3.6: Genome editing - CRISPR CAS 9 Technology. (2)

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Unit 4: Applications of Transgenic Plants

15 hours

- 4.1: Herbicide resistance in transgenic plants- glyphosate tolerance. (2)
- 4.2: Insect resistance transgenic plants: Bt cotton, proteinase inhibitors, lectins. (3)
- 4.3: Virus , bacterial and fungal resistant transgenic plants. (3)
- 4.4: Abiotic stress tolerance : drought , heat and salinity stress tolerant plants. (2)
- 4.5: Transgenic plants with enhanced nutritional value vitamin A, oil, amino acids. (2)
- 4.6: Transgenic plants as bioreactors:edible vaccines,antibody production, biodegradable plastics. (3)

OUTCOMES

By the end of this course, students will be able

CO1: To understand the principles and techniques of plant tissue culture.

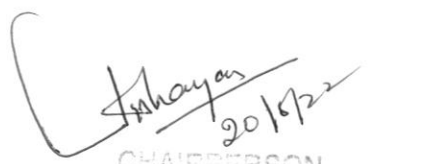
CO2: To appraise the achievements of plant tissue culture techniques and their benefit to society .

CO3: To determine the different methods involved in gene transfer techniques and CRISPR CAS 9 Technology.

CO4:To describe the uses of evolving transgenic plants for the resistance to herbicides, insects,virus,bacteria fungi and abiotic stress.They will also be able to determine its role in enhanced nutritional value and as bioreactors.



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Biotechnology
III Year B.Sc Syllabus
Semester -V; CBCS
Paper VA- Practicals
Title- Plant Biotechnology

Paper Code: BT 533A P
45 hrs (3 hrs/ week)
Credit:1

Objective: To demonstrate the basic procedures used in plant tissue cultures.

1. Preparation of media for plant tissue culture.
2. Sterilization methods of explants (seed, leaf, internode & root) and inoculation.
3. Establishment of callus culture - from carrot/rice.
4. Preparation of synthetic seeds.
5. Meristem culture.
6. Cell suspension cultures.
7. Protoplast isolation and culture.
8. Agrobacterium mediated transformation.

Outcomes: Students expertise in media preparation, sterilization methods, different culture techniques, synthetic seeds preparation.

SPOTTERS

1. Callus cultures
2. Sterilization techniques autoclave and hot air oven
3. Somatic embryo
4. Synthetic seeds
5. Meristem culture
6. Plant regeneration
7. Cell suspension cultures
8. Isolation of Protoplast
9. Particle bombardment (gene gun)
10. Binary or co-integrate vectors
11. Gus gene expression in transgenic plants tissue


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12. Golden Rice

Recommended books

1. Plant Tissue culture and its Biotechnological Application by W.Barz, E. Reinhard, M.H.Zenk.
2. Plant Tissue Culture by Akio Fujiwara
3. Frontiers of Plant Tissue Culture by Trevor A. Thorpe
4. In vitro Haploid Production in Higher Plants by S.Mohan Jain, S.K Sopory, R.E. Veilleux
5. Plant Tissue Culture : Theory and Practice by S.S Bhojwan and Razdan
6. Plant Cell, Tissue and Organ culture , Applied and Fundamental Aspects by Y.P.S Bajaj and A.Reinhard


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(Accredited with 'A' grade by NAAC)

Department of Genetics and Biotechnology

Subject: Biotechnology (DSE)

(BSc. Life Sciences)

Semester -V CBCS

Paper V - Theory

Title-Medical Biotechnology

Effective from 2022-23 onwards

Paper Code: BT 533B

No of Hours: 60 (4hrs/wk)

Credits: 4

COURSE OBJECTIVE: To analyze the concepts of Inheritance of Human diseases, its genetic basis and to interpret the techniques for its diagnosis and therapeutic approaches.

UNIT WISE COURSE OBJECTIVES

Cob1: To understand the inheritance of human diseases and karyotyping including chromosomal staining.

Cob2: To analyze the genetic basis of Human disorders.

Cob3: To examine the techniques for diagnosis of human diseases.

Cob4: To interpret the Therapeutic approaches for human diseases.

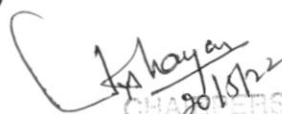
Unit 1: Inheritance of human diseases and karyotyping	15 Hours
1.1: Inheritance patterns- pedigree analysis of autosomal traits	(3)
1.2: Inheritance patterns – pedigree analysis of allosomal traits	(3)
1.3: Factors affecting pedigree pattern – penetrance, expressivity	(2)
1.4: Genetic heterogeneity-allele and locus heterogeneity	(2)
1.5: karyotyping of Human chromosomes	(2)
1.6: Chromosomal staining – G.Q, R and C banding techniques.	(3)

Unit 2: Genetic basis of Human disorders **15 Hours**

2.1: Chromosomal disorders caused due to structural chromosomal abnormalities (deletions, duplications, translocations and inversions) **(3)**

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- 2.2: Chromosomal disorders caused due to numerical chromosomal abnormalities (euploidy, aneuploidy, autosomal and allosomal) (3)
- 2.3: Monogenic disorders (autosomal and X- linked diseases) (2)
- 2.4: Mitochondrial diseases-LHON, MERRF (2)
- 2.5: Multifunctional disorders – diabetes and hypertension (2)
- 2.6: Cancer – types of cancer, genetic basis of cancer (Oncogenes, tumor suppressor genes) (2)
- 2.7: Introduction to communicable and non communicable diseases (1)

Unit 3: Techniques for diagnosis of human diseases. 15 Hours

- 3.1: Prenatal; diagnosis -invasive techniques -amniocentesis, chorionic villi sampling (3)
- 3.2: Diagnosis using enzyme markers -Guthrie test (phenylketonuria) (2)
- 3.3: Diagnosis using monoclonal antibodies-ELISA (HIV) (2)
- 3.4: DNA /RNA based diagnosis-HBV (3)
- 3.5: PCR based genotyping techniques for diagnosis-RFLP (MTHFR C677T mutation) (3)
- 3.6: Chip bases diagnosis and applications- colon cancer (2)

Unit 4: Therapeutic approaches for human diseases 15 Hours

- 4.1: Recombinant proteins-human growth hormone, insulin (2)
- 4.2: Gene therapy -ex vivo and in vivo gene therapy (2)
- 4.3: Stem cells -potency definitions; embryonic and adult stem cells (2)
- 4.4: Applications of stem cell-based therapies and regenerative medicine (3)
- 4.5: Vaccines, different Types and their Applications -(herpes simplex virus, Cholera Vaccine, Covid) (3)
- 4.6: Industrial production and Applications of monoclonal antibodies (3)

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OUTCOMES

By the end of this course, students will be able

CO1: To compare the pedigree analysis of autosomal and allosomal traits and the theory behind karyotyping and chromosomal staining of human chromosomes.

CO2: To distinguish chromosomal disorders, monogenic disorders, multi-functional disorders, mitochondrial disease and cancer.

CO3: To recognize the principles and applications involved in the techniques involved in the diagnosis of human diseases like Phenylketonuria, HIV, colon cancer.

CO4: To formulate therapeutic approaches for human diseases which involves recombinant proteins, gene therapy, stem cells, DNA based vaccines, monoclonal antibodies.



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Biotechnology
III Year B.Sc Syllabus
Semester -V; CBCS
Paper V- Practicals
Title- Medical Biotechnology

Paper Code: BT 533B P
45 hrs (3 hrs/ week)
Credit:1

Objective: To demonstrate the role of karyotyping in identification of chromosomal disorders, to help students to identify the mode of inheritance by pedigree analysis, DOT ELISA and Chromosome banding.


- 1.karyotyping of normal human chromosome set
- 2.Karyotyping of autosomal abnormality (Down's syndrome)
3. karyotyping of allosomal abnormality (Klinefelter syndrome)
- 4.Chromosome banding -G Banding
- 5.Human pedigree analysis of autosomal disorder
6. Human pedigree analysis of allosomal disorder
- 7.Estimation of C-reactive protein
- 8.DOT ELISA

Outcome: Students evaluate karyotyping procedures, Chromosome banding, different modes of inheritance of traits, and expertise in DOT ELISA

SPOTTERS:

- 1.Identify the karyotype (Down's syndrome)
2. Identify the karyotype (Klinefelter syndrome)
3. Chromosomal banding techniques)
- 4.Identify the inheritance pattern of pedigree (autosomal disorder)
- 5.Identify the inheritance pattern of pedigree (allosomal disorder)
6. Prenatal diagnosis – invasive technique


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7. Prenatal diagnosis- noninvasive techniques
8. Identify the type of gene therapy -ex vivo in vivo
9. Recombinant vaccine
10. ELISA technique
11. Identify the SNP genotype of different samples after performing PCR-RFLP
12. Count the viable cells on Neubauer chamber (hemocytometer)

Recommended Books

1. Medical Biotechnology by Pratibha Nallari. V Venugopalrao- Oxford Press
2. Introduction to Human Molecular Genetics by JJ Pasternak- John Wiley Publishers.
3. Human Molecular Genetics by Tom Strachen and AP Read Bios Scientific Publishers
4. Human Genetics Molecular Evolution by McConkey
5. Recombinant DNA Technology by AEH Emery
6. Principles and Practice of Medical Genetics - 1 II III Volumes by AEH Emery
7. Molecular Biotechnology by Glick and Pasternak



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Department of Genetics and Biotechnology

Subject: Biotechnology

(BSc. Life Sciences)

Semester -V CBCS

Paper V - Generic Elective

Title-Basics in Biotechnology.

Effective from 2022-23 onwards

Paper Code: GE 533

No of Hours: 60 (4hrs/wk)

Credits: 4

COURSE OBJECTIVES

To analyze the concepts of Basic biotechnology with reference to Agricultural, Microbial and Industrial, animal and medical sectors including computer applications .

UNIT WISE COURSE OBJECTIVES

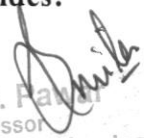
Cob1 :To distinguish the different techniques involved in agricultural biotechnology along with its applications .

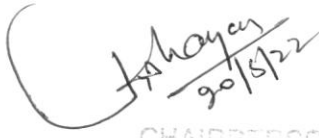
Cob2:To interpret the methods involved to characterize and preserve microorganisms, its strain improvement and development along with its application.

Cob3:To discuss the concepts involved in Animal and Medical Biotechnology.

Cob4: To evaluate computer applications in Biotechnology.

Unit 1: Agricultural Biotechnology	15 Hours
1.1: Plant tissue culture- media, sterilization, culture types.	(3)
1.2: Micro-propagation, Synthetic seeds, Somatic hybrids and haploid plants.	(3)
1.3: Transgenic plants- direct & indirect methods of gene transfer.	(3)
1.4: Applications of transgenic plants- improving productivity & Nutritional quality.	(2)
1.5: Applications of transgenic plants-stress tolerant plants & molecular farming.	(2)
1.6: Biofertilizers and biopesticides.	(2)


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Unit 2: Microbial and Industrial Biotechnology **15 Hours**


- 2.1: Exploitation of micro-organism and their products. (2)
- 2.2: Isolation, screening and selection of microorganisms for industrial products. (3)
- 2.3: Preservation of microorganisms. (2)
- 2.4: Strain development and improvement, strategies of strain improvement selection and recombination. (2)
- 2.5: Production of recombinant DNA vaccine, amino acids, vitamins. (3)
- 2.6: Single cell protein, dairy products, penicillin and streptomycin production. (3)


Unit 3: Animal and Medical Biotechnology **15 Hours**

- 3.1: Cell culture technique and its applications. (3)
- 3.2: Animal breeding (Selective breeding and cross breeding) and its limitations. (3)
- 3.3: In vitro techniques in animal improvement: in vitro fertilization & microinjection. (2)
- 3.4: Genetically modified animals: transgenic & knock – outs. (3)
- 3.5: Mouse models of disease: cancer and diabetes. (2)
- 3.6: Biotechniques: gel electrophoresis and PCR. (2)

Unit 4: Computer applications in Biotechnology **15 Hours**

- 4.1: Scope of computer applications in Biotechnology. (2)
- 4.2: Biotechnology tools and resources -role of the internet, free online tools, downloadable free software. (3)
- 4.3: Biotechnology web portals- NCBI, EBI, ExpASY. (3)
- 4.4: Biological databases: Classification of databases – the primary (GenBank), secondary (PIR) databases. (3)
- 4.5: Sequence databases – DNA sequence databases (ENA & DDBJ). (2)
- 4.6: Protein sequence databases (Swissprot & PROSITE). (2)


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OUTCOMES

At the end of this course, students will be able

CO1: To interpret the different techniques involved in Plant tissue culture, Micropropagation , Gene transfer and the production of biofertilizers and biopesticides.


CO2: To evaluate the concepts and applications of Microbial and Industrial Biotechnology


CO3: To differentiate cell culture and animal breeding techniques, and also to value the role of mouse models of diseases and transgenic animals.

CO4: To identify the tools and resources of computer applications in Biotechnology. which will pave a way to acquire a comprehensive knowledge on different kinds of Web portals and databases.

Recommended books

- 1.Plant Tissue culture and its Biotechnological Application by W.Barz, E. Reinhard, M.H.Zenk.
2. Plant Cell, Tissue and Organ culture , Applied and Fundamental Aspects by Y.P.S Bajaj and A.Reinhard
3. Essentials of Biotechnology for Students by Satya N.Das
4. Text Book of Biotechnology by H.K Das (Wiley publication)
- 5.Biotechnology by H. J. Rehm and G. Reed VIH Publications, Germany
- 6.Biogas Technology by T. Nijaguna
7. Biotechnology by K.Trehan
8. Industrial Microbiology by L.E. Casida
9. Essentials of Biotechnology for Students by Satya N.Das


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Department of Genetics and Biotechnology

Subject: Biotechnology (DSE)

(BSc. Life Sciences)

Semester -VI CBCS

Paper VI - Theory

Title-Environmental Biotechnology

Effective from 2022-23 onwards

Paper Code: BT 633B

No of Hours: 60 (4hrs/wk)

Credits: 4

COURSE OBJECTIVES:

To acquire knowledge on pollution and sources and understand the importance of Biomass, Biofuels, Biofertilizers, Biopesticides and Bioremediation.

UNIT WISE COURSE OBJECTIVES

Cob1: To discuss the different types of pollution and its sources.

Cob2: To appraise the different sources of Biomass and Biofuels.

Cob3: To distinguish the different concepts and types of Biofertilizers and biopesticides.

Cob4: To analyze the different methods of bioremediation of environmental pollution.

Unit 1: ENVIRONMENTAL POLLUTION

15 Hours

1.1: Introduction to environment and pollution.

(2)

1.2: Types of pollution -air, water and soil pollutions.

(3)

1.3: Types of pollution-inorganic, organic and biotic.

(3)

1.4: Sources of pollution -domestic waste, agricultural waste, industrial effluents and municipal waste.

(3)

1.5 Greenhouse gases, global warming and climate change.

(2)

1.6: Measurement methods of environmental pollution -BOD & COD.

(2)

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Unit 2: Biomass and Biofuels **15 Hours**

- 2.1: Renewable and non- renewable energy resources. (2)
- 2.2: Fossil fuels energy source and their impact on environment. (3)
- 2.3: Biomass as source of energy (Bioenergy). (3)
- 2.4: Types of biomass -plant, animal and microbial biomass. (3)
- 2.5: Production of biofuels: bioethanol and biodiesel. (2)
- 2.6: Production of biohydrogen and biomethane. (2)

Unit 3: Biofertilizers and Biopesticides **15 hours**

- 3.1: Chemical fertilizers and their impact on environment (eutrophication). (3)
- 3.2: Concepts of biofertilizers. (2)
- 3.3: Types of biofertilizers – bacterial, fungal and algal fertilizers. (3)
- 3.4: Pesticides and their impact on environment. (2)
- 3.5: Concepts of biopesticides, types of biopesticides. (3)
- 3.6: Uses of biofertilizers and biopesticides. (2)

Unit 4: Bioremediation of Environmental Pollutants **15 hours**

- 4.1: Waste water treatment – sewage and industrial effluents (aerobic and anaerobic methods). (3)
- 4.2: Bioremediation -concepts and types (in-situ and ex-situ bioremediation). (3)
- 4.3: Bioremediation of toxic metal ions-biosorption and bioaccumulation. (3)
- 4.4: Composting of organic wastes. (2)
- 4.5: Microbial remediation of pesticides and xenobiotic compounds. (2)
- 4.6: Phytoremediation- concepts and applications. (2)

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OUTCOMES

By the end of this course students will be able to

CO1: To interpret the different types of Pollution and its sources ,its effect on the globe along with the measurement methods.

CO2: To evaluate the different types of biomass and biofuels used and its importance to the maintenance of the environment.

CO3: To explore the sources of energy that are eco-friendly like bio-fuels and biofertilizers and to motivate the students to pursue research in the same field for the betterment of the society.

CO4: To analyze the importance of bioremediation to the environment and to identify its methods.


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Biotechnology
III Year B.Sc Syllabus
Semester -VI; CBCS
Paper VI- Practicals
Title- Environmental Biotechnology

Paper Code: BT 633B P
45 hrs (3 hrs/ week)
Credit:1


Objective:To demonstrate the techniques involved to evaluate polluted water samples and to help students understand the microbial flora present in it.


1. Estimation of BOD in polluted water samples.
2. Estimation of COD in polluted water samples.
3. Estimation of total dissolved solid in wastewater samples.
4. Determination of quality of water sample (Coliform test).
5. Isolation of microorganisms from polluted soil/ industrial effluents.
6. Production of hydrogen or biogas.
7. Identification and characterization of bioremediation microorganisms.
8. Production of microbial biofertilizers.

Outcome: The students estimate BOD, COD of polluted water samples, isolate and characterize the microorganisms from different sources and analyze the techniques in the production of biofertilizers and biogas.

SPOTTERS:

1. Air/water /soil pollution
2. Municipal waste
3. Industrial effluents


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4. Algal blooms
5. Greenhouse effect
6. Plant biomass
7. waste water treatment plant
8. Organic composting
9. Biogas plant
10. Xenobiotic degrading bacteria
11. Phytoremediation
12. Microbial biofertilizers.

RECOMMENDED BOOKS

1. Text Book of Biotechnology by H.K Das (Wiley publication)
2. Biotechnology by H. J. Rehm and G. Reed VCH Publications, Germany
3. Biogas Technology by T. Nijaguna
4. Biotechnology by K. Trehan
5. Industrial Microbiology by L.E. Casida
6. Food Microbiology by P.K. Gupta
7. Essentials of Biotechnology for Students by Satya N. Das
8. Bioethics – Readings and Cases by B.A Brody and h.t Engelhardt. Jr. (Pearson education)
9. Biotechnology. IPRS and biodiversity by M.B. Rao and Manjula Guru (Pearson education)



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Department of Genetics and Biotechnology

Subject: Biotechnology (DSE)

(BSc. Life Sciences)

Semester -VI CBCS

Paper VI A- Theory

Title-Animal Biotechnology

Effective from 2022-23 onwards

Paper Code: BT 633A

No of Hours: 60(4hrs/wk)

Credits: 4

COURSE OBJECTIVES

To analyze the principles and applications of animal cell culture and to examine the techniques involved in the in vitro animal improvement, animal genetics and genetically modified organisms.

UNIT WISE COURSE OBJECTIVES

Cob1:To describe the principles and applications of animal cell culture techniques.

Cob2:To distinguish the methods pertaining to animal breeding, superovulation, in vitro fertilization,somatic cell nuclear transfer and their applications.

Cob3:To interpret molecular markers in animal genetics.

Cob4:To appraise the significance of genetically modified organisms and their applications in the field of disease biology and drug development.

Unit 1: Animal cell culture : principles and applications 15 hours

1.1: Cell culture technique: cell culture media,sterilization techniques. (2)

1.2:Characteristic features of cell lines and cell line maintenance. (2)

1.3: Methods of isolation and separation of various cell types and establishment of cell lines. (3)

1.4: Properties and types of stem cells, culturing of embryonic stem cells

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- and adult stem cells. (3)
- 1.5: Manipulation of cells : electroporation,transfection,transduction and microinjection. (3)
- 1.6: Application of cell culture : manufacturing , toxicity testing and tissue engineering. (2)

Unit 2: In vitro techniques in animal improvement 15 hours

- 2.1: Principles of animal breeding , selective breeding, cross breeding and their limitations. (3)
- 2.2:Superovulation , collection of semen and ova. (2)
- 2.3:In vitro maturation of oocytes, artificial insemination. (2)
- 2.4: In vitro fertilization, embryo collection and embryo sexing. (3)
- 2.5: Somatic cell nuclear transfer , cloning of animals (example: Dolly). (3)
- 2.6: Applications of in vitro techniques in animal improvement. (2)

Unit 3: Molecular markers in animal genetics 15 hours

- 3.1 Development in livestock genomes (Estimated Breeding Value-EBV). (3)
- 3.2: Molecular markers: types and characteristics. (3)
- 3.3: RFLP and RAPD. (3)
- 3.4: SNPs and their application in genotyping. (2)
- 3.5: Identification and isolation of desired genes of interest. (2)
- 3.6: Marker- assisted selection. (2)

Unit 4: Genetically modified organisms 15 hours

- 4.1: Animal models and their significance in scientific research. (3)
- 4.2: Mouse models for cancer. (2)
- 4.3: Generation of transgenic mouse. (2)
- 4.4: Generation of Gene knock-out mouse. (2)
- 4.5: Genetically modified mice as disease models. (3)
- 4.6: Applications of genetically modified animals in understanding disease biology and drug development. (3)

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OUTCOMES

By the end of this course students will be able to

CO1: To interpret the cell culture techniques ,cell lines characteristics, stem cell properties and methods of cell manipulation.

CO2: To evaluate the methods of in vitro techniques involved in animal improvement.

CO3: To identify the significance of molecular markers and their role in RAPD,RFLP and in animal genetics.

CO3: To value the role of genetically modified animals in scientific research.

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Biotechnology
III Year B.Sc Syllabus
Semester -VI; CBCS
Paper VIA- Practicals
Title- Animal Biotechnology

Paper Code: BT 633A P
45 hrs (3 hrs/ week)
Credit:1


Objectives: To demonstrate preparation and sterilization of animal culture media, cell counting, Culturing of suspension and adherent cells and preparation of metaphase chromosomes.

- 1.Preparation of animal cell culture media
- 2.Sterilization of cell culture media
- 3.Cell counting by microscopy
- 4.Isolation of cells from chicken liver
- 5.Establishment of primary cell culture: Liver/Spleen
- 6.Preparation of metaphase chromosomes
- 7.Culturing suspension cells
- 8.Culturing adherent cells

Outcomes:To expertise in preparing animal culture media,metaphase chromosomes,establishing the primary cell culture procedure which will pave a way for students to seek employability in research laboratories .

SPOTTERS

- 1.Microscope
- 2.CO2 incubator
- 3.Biosafety cabinet/Laminar air flow
- 4.Trypan blue stained cells
- 5.Cell culture flasks and dishes
- 6.Metaphase slide


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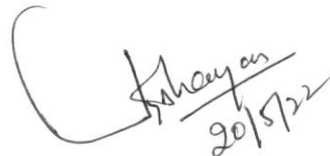
7. Autoclave
8. Centrifuge
9. Example of an RFLP
10. Microinjection into egg cells

Recommended Books

- 1 Text book of Animal Biotechnology by B Singh. The Energy and Resources Institute (teri)
- 2 Genetics for Animal Sciences by WH Freeman Van Vleck LD, Pollak EJ & Bltenacu EAB.1987
3. Cancer Cell Culture Methods and Protocols 731 (Methods in Molecular Biology) Humana; 2nd ed 2011 edition (28 April 2011).
4. Genetic Engineering by VK Agarwal and P.S. Varma. S. Chand & Company Ltd, 2009



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Department of Genetics and Biotechnology

Subject: Biotechnology

(BSc. Life Sciences)

Semester -VI CBCS

Paper VI - Optional paper

Title-IPR, Biosafety and Entrepreneurship

Effective from 2022-23 onwards

Paper Code: BT 633_O

No of Hours: 60(4hrs/wk)

Credits: 4

COURSE OBJECTIVES:

To introduce the basic concepts of ethics and safety that are essential for the different disciplines of science and procedures involved in the protection of intellectual property and related rights.

UNIT WISE COURSE OBJECTIVES:

Cob1: To introduce the basics of Intellectual property rights, copyrights, trademarks and patents.

Cob2: To understand the value and purpose of patents.

Cob3: To discuss the basics of laboratory management and safety.

Cob4: To appraise the fundamental concepts of Entrepreneurship.

Unit 1: Intellectual Property Rights


15 hours


1.1: Intellectual Property - meaning, nature. (2)

1.2: Significance and need of protection of intellectual property. (2)

1.3: Types of intellectual property rights: patent, trademarks, copyright, design registration, trade secret, geographical indicators, plant variety protection. (3)

1.4: Copyright : meaning, nature, historical evolution and significance. (2)


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1.5: Ownership of copyrights-rights of author and owners, trademarks. (3)

1.6: Plant varieties protection and plant breeding rights. (3)

Unit 2: Patents laws 15 hours

2.1: Patents-concepts of patents- historical overview of the patent law in India. (3)

2.2: Kinds of patents - procedure for obtaining patent in India and other countries. (3)

2.3: Patenting microbes and organisms- novelty ,International Depository Authorities(IDAs),submitting details of the deposit. (3)

2.4 Patenting genes-pros and cons, Bioethics: examples. (2)

2.5: Patenting markers and variants -examples. (2)

2.6: Product vs process patent - product life cycle and process design. (2)

Unit3: Laboratory management and safety 15 hours

3.1: Administration of laboratories, laboratory design, laboratory information management system. (3)

3.2: Laboratory safety-good laboratory practice (GLP), good manufacturing practices (GMP), biosafety levels. (2)

3.3: Basic principles of quality control (QC) and quality Assurance (QA). (2)

3.4: Handling of hazardous compounds - chemicals, solvents, poisons, isotopes,explosives and biological strains. (3)

3.5: Storage of hazardous material. (3)

3.6: Disposal of biological and radioisotope wastes. (2)

Unit 4: Entrepreneurship 15 hours

4.1: Concept, definition structure and theories of entrepreneurship. (3)

4.2: Types of start -ups with examples. (2)

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4.3: Types of entrepreneurship, environment , process of entrepreneurial development. (3)

4.4: Entrepreneurial culture, entrepreneurial leadership. (2)

4.5: Product planning and development - project management , search for business idea, concept of projects , project identification. (3)

4.6: Promoting bio-entrepreneurship. (3)

OUTCOMES

By the end of this course students will be able to

CO1: Distinguish and explain various forms of IPRs and analyze the rights and responsibilities of holders of Patent, Copyright, Trademark, design registration and trade secret.

CO2: To analyze the significance of patent laws and its role in innovation and economic performance.


CO3: To understand the legal framework of health and safety.

CO4: To demonstrate an ability to engage in critical thinking by analyzing situations and constructing and selecting viable solutions to solve problems.

Recommended Books

1. Law Relating to Intellectual Property Rights” by V K Ahuja.
2. Intellectual Property Rights” by Neeraj Pandey and Khushdeep Dharni.
3. Text Book of Intellectual Property Rights by N K Acharya.
4. Principles of Entrepreneurship development by prof.Dr.C.karthikeyan and Dr.P.Lalitha.
5. Patent Law principles and strategies by Jeffrey I. Auerbach, Ph.D., J.D.


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Department of Genetics and Biotechnology

Subject: Biotechnology (Optional)

(BSc. Life Sciences)

Semester -III CBCS Skill Enhancement

Course Title: Integrated Pest Management

Effective from 2021-22 onwards

Paper Code: SE333

No of Hours: 30

Credits: 2

Objectives: .

COB 1: Gain basic knowledge of various pests and Pest control strategies of IPM.

COB2 : Students understand the side effects of chemical pesticides.

UNIT 1: Theory

(15 hours)


1. Basic concepts of pest. (1)
2. Types of pest based on occurrence and nature of damage. (2)
3. Concept of Pest Management. (1)
4. Principles of insect pest management. (2)
5. Tools of Integrated pest management. (2)
6. Chemical pest management (Insecticides- Advantages and disadvantages). (2)
- 7, Role of soil nutrients in pest control. (1)
8. Biopesticides- success stories and limitations. (2)
9. Bioremediation of Industrial pollutants by insects. (2)


Unit II

15 hours

Project work/survey on

1. Collection and preservation of mature and immature insects.
2. Collection of information on chemical insecticides available in local markets.
3. Collection of information on Biopesticides available in local market.
4. Visit to IPM fields.
5. Neem Extract-Application to plants.


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Outcomes :

CO1 Students expertise in tackling the pests in an eco-friendly way

CO2 Students are motivated to go for biological pesticides and employ IPM strategies for pest control

Employability

Gain employability as quality control personnel in identifying the pests infesting the crop plants. Manage to incorporate IPM program in controlling the pest infestation

Break up for classes

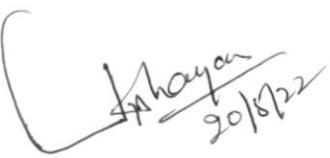
Survey and field work (10)

Analysis and compilation of Data (5)

Recommended Books

- 1.. Metcalf R L, Introduction to Insect pest management. 3'd Edition New York: A Wiley Interscience publication, c1994
2. Shagufta, Integrated Pest Management APH Publishing corporation, 2012
3. G. S. Dhaliwal and R Arora, Integrated pest management, Concepts and Approaches.
4. D, Prasad, Crop Protection: Management strategies.
5. Awasthi V B, Agricultural Insect Pests and their control'
6. Arora R, Theory and Practice of integrated Pest Management


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Department of Genetics and Biotechnology

Subject: Biotechnology (Optional)

(BSc. Life Sciences)

Semester -IV CBCS Skill Enhancement

Course Title: Food Preservation and adulteration

Effective from 2021-22 onwards

Paper Code: SE433

No of Hours: 30

Credits 2

Objectives:

COB 1: Students get an insight into the process of microbial degradation of food

COB 2: Students get the basic knowledge of the different types of food adulteration added to foods and evaluation of milk by MBRT

UNIT 1


(15 hours)

- 1.History of Food preservation -evolution of cooking process. (1)**
- 2.Food fermentation process and preservation process. (3)**
- 3.Food additives- Preservative,Antioxidants, supplements , emulsifiers and thickening agents. (4)**
- 4.Food additives -Taste and Flavour Enhancers (Sweeteners,Bleaching and Maturing agents, Colouring and Flavouring agents. (3)**
- 5.Food adulterants -Types of adulterants (Intentional and Incidental). (3)**
- 6.Health hazards and Risks. (1)**

Unit II

- 1.Report writing on "Food adulterants in coffee,Turmeric, Edible oils, Ghee,Honey ,Milk (4)**
- 2.Microbial Analysis of Foods (3)**
- 3.determination of quality of Milk by MBRT (6)**
- 4.Preparation of Fruit Squash/Mayonnaise (2)**


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Outcomes:


1. CO1: Students learn the basic methods of food preservation.
2. CO2: Students interpret the health risks with different adulterants present in food.


Employability

Gain employability as technical staff in identifying the key adulterants in various foods in the market. Gets employability as a quality control inspectors and controls food adulteration.

Recommended books

1. Hand book of Analysis and Quality control for fruits and Vegetable products by Ranganna S.
- 2, Food Microbiology by William G, Frazier
3. Fruit and Vegetable Preservation- Principles and Practice by Srivastava R. P
4. Food Science Experiments and Applications by Mohini Sethi.


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LIST OF EXAMINERS FOR BIOTECHNOLOGY 2022-2023

S.No	Sem	Name of the examiner	Designation	Institution	E mail ID& Mobile Number	Years of Experience
1.	Sem 1/2	Mrs. A. Jaya Madhuri	Lecturer, Department of Biotechnology	Loyola Academy, Degree and PG College.	madhuriadabala@gmail.com 9849442334	15 yrs
2.	Sem 1/2	Dr. S. Someswar Rao	Assistant Professor, Department of Genetics	Osmania University	drsomeswar@osmania.ac.in 7729822608	7 yrs
3.	Sem 1/2	Mrs Deepika	Lecturer, Department of Biotechnology	Nizam College, Basheerbagh, Hyd.	srkdeepika@yahoo.com 9866133047	11 yrs
4.	Sem 3/4	Dr. Sambashiva	Lecturer, Department of Biotechnology	Nizam College, Basheerbagh, Hyd.	8978282097	9 yrs
5.	Sem 3/4	Ms. Neelima	Lecturer, Department of Genetics and Biotechnology	University College for women, Koti	neelima.biotechnology@gmail.com 9491084029	10 yrs
6.	Sem 3/4	Mrs N. Kavitha	Lecture, Department of Biotechnology.	Sujatha Degree College for Women, Chapal Road,	nannutakavitha@gmial.com 9949987216	13 yrs
7.	Sem 5 & 6	Dr. S. Prashant	Assisstant Professor, Department of Genetics and Biotechnology	Osmania University	prashanthsingam@gmail.com 9849667490	7 yrs
8.	Sem 5 & 6	Dr. Maheshwari	Lecturer, Department of Genetics.	Koti Womens College	vijay.genetics@gmail.com 8125380624	2 yrs
9.	Sem 5 & 6	Mrs. Sugandhamala	Lecturer, Department of Biotechnology	St. Pious Degree College for Women.	suganthamala.a@gmail.com 8019194373	14 yrs
10.	Sem 5 & 6	Mrs. Saleah Afreen	Lecturer, Department of Genetics	University College for women, Koti	salehaafreen23@gmail.com 8686367530	6 yrs
11.	Sem 5 & 6	Dr. Padmalatha	HOD, Department of Biotechnology	St. Pious Degree College for Women.	padmalatha22@gmail.com 9490316663	23 yrs

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