



*Viswambhara Educational Society*

**VAAGDEVI DEGREE & P.G.COLLEGE**

**Kishanapura, Hanamkonda, T.S**


*(Approved by A.I.C.T.E., New Delhi, Affiliated to Kakatiya University & TSCHE)*



National Assessment & Accreditation Council

## DEPARTMENT OF B.SC BIOTECHNOLGY

1	B.SC	CORE-I
2	B.SC	BIOCHEMISTRY AND MICROBIOLOGY
3	B.SC	ENVIRONMENT BIOTECHNOLGY
4	B.SC	ANIMAL BIOTECNOLOGY

  
Dr A. Sheshachalam  
PRINCIPAL  
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Kishanapura, Hanamkonda

**SEMESTER-I**  
**CORE COURSE DCS -1**  
**THEORY-I**  
**CELL BIOLOGY AND GENETICS**

**1. Unit : Cell structure and Functions**

- 1.1. Cell as basic unit of living organisms-bacterial, fungal, plant and animal cells
- 1.2. Ultrastructure of prokaryotic cell (cell membrane and plasmids, Nucleoid)
- 1.3. Ultrastructure of eukaryotic cell (cell wall, cell membrane, nucleus, mitochondria, chloroplast, endoplasmic reticulum, Golgi apparatus, vacuoles)
- 1.4. Fluid mosaic model, Sandwich model, Cell membrane permeability
- 1.5. Structure of chromosome-morphology, components of chromosomes (histones and non-histones), specialized chromosomes (Polytene, Lampbrush)
- 1.6. Chromosomal aberrations- structural and numerical

**2. Unit : Cell Division and Cell cycle**

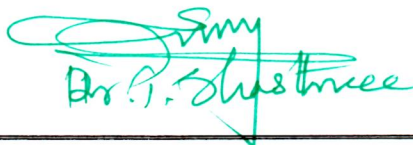
- 2.1. Bacterial cell division
- 2.2. Eukaryotic cell cycle –phases
- 2.3. Mitosis - Stages (spindle assembly)-significance
- 2.4. Meiosis- Stages (synaptonemal complex)-significance
- 2.5. Senescence and necrosis
- 2.6. Apoptosis

**3. Unit : Principles and mechanism of inheritance**

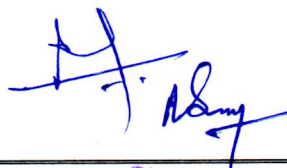
- 3.1. Mendel's experiments- factors contributing to success of Mendel's experiments
- 3.2. Law of segregation- Monohybrid Ratio; Law of independent assortment- Dihybrid Ratio, Trihybrid Ratio
- 3.3. Deviation from Mendel's laws- partial or incomplete dominance (eg: Flower Color in *Mirabilis jalapa*), Co-dominance (eg: MN Blood groups), Non allelic interactions-types of epistasis, modification of dihybrid ratios
- 3.4. Penetrance and Expressivity (eg: Polydactyly, Waardenburg syndrome), pleiotropism, phenocopy- microcephaly, cleft lip
- 3.5. Multiple allelism (eg: Coat color in Rabbits, eye color in *Drosophila* and ABO Blood groups)
- 3.6. X-Y chromosomes - Sex determination in *Drosophila*, Man, X-linked inheritance- Hemophilia and Color blindness; X-inactivation.

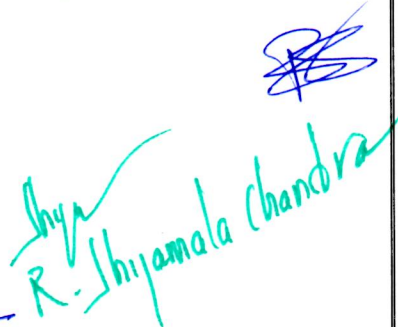
**4. Unit : Linkage, Recombination and Extension to Mendel's Laws**

- 4.1. Linkage and recombination- Cytological proof of crossing over, 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.
- 4.4. Mitochondrial inheritance in human and poky in *Neurospora crassa*
- 4.5. Chloroplast inheritance in *Chlamydomonas*
- 4.6. Hardy-Weinberg Equilibrium.

  
Dr. P. Shastri

  
4  
Dr. A.V. Rao

  
Chair Person

  
R. Shyamala Chandra

### CORE-I: PRACTICALS

1. Microscopic observation of cells: bacteria, fungi, plant and animal
2. Preparation of different stages of Mitosis (onion root tips)
3. Preparation of different stages of Meiosis (grasshopper testis)
4. Preparation of Polytene chromosome from *Drosophila* salivary gland
5. Monohybrid and dihybrid ratio in *Drosophila*
6. Monohybrid and dihybrid ratio in Maize
7. Problems on co-dominance, epistasis, two point and three point test cross, gene mapping.
8. Statistical applications of Hardy-Weinberg Equilibrium

### 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.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
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



**SEMESTER-II**  
**CORE COURSE DCS -2**  
**THEORY-II**  
**BIOLOGICAL CHEMISTRY AND MICROBIOLOGY**

**Unit 1: Biomolecules**

- 1.1. Carbohydrates- importance, classification; structure and functions of monosaccharides (glucose & fructose), disaccharides (sucrose, lactose & maltose) and polysaccharides (starch, glycogen & insulin)
- 1.2. Amino acids- importance, classification, structure, physical and chemical properties of amino acids; peptide bond formation
- 1.3. Proteins- importance, structure of proteins- primary, secondary, tertiary and quaternary
- 1.4. Lipids- importance, classification- simple lipids (triacylglycerides & waxes), complex lipids (phospholipids & glycolipids), derived lipids (steroids, terpenes & carotenoids)
- 1.5. Nucleic acids :structure and chemistry of DNA (Watson and crick) and RNA(TMV)  
Structure and forms of DNA (A, B and Z)
- 1.6. Enzymes- importance, classification and nomenclature; Michaelis-Menton Equation, factors influencing the enzyme reactions; enzyme inhibition (competitive, uncompetitive & mixed), co-enzymes

**Unit 2: Bioenergetics**

- 2.1 Glycolysis, Tricarboxylic Acid (TCA) Cycle,
- 2.2 Electron Transport, Oxidative Phosphorylation
- 2.3 Gluconeogenesis and its significance
- 2.4 Transamination and Oxidative deamination reactions of amino acids
- 2.5 B-Oxidation of Fatty acids
- 2.6 Glyoxalate cycle.

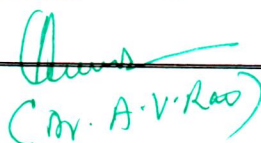
**Unit 3 : Fundamentals of Microbiology**

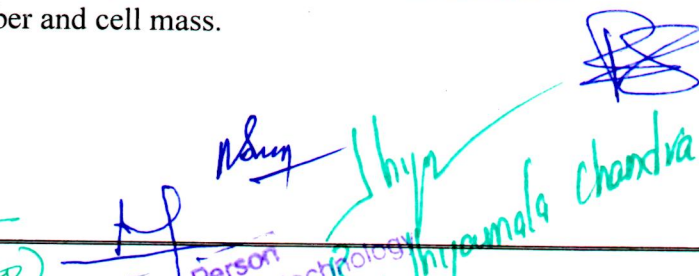
- 3.1 Historical development of microbiology and contributors of microbiology
- 3.2 Microscopy: Bright field microscopy, Dark field microscopy, Phase contrast microscopy, Flourescent microscopy, Scanning and Transmission electron microscopy
- 3.3 Outlines of classification of microorganisms
- 3.4 Structure and general characteristics of bacteria and virus
- 3.5 Disease causing pathogens and symptoms (Eg: *Mycobacterium*, *Hepatitis*)
- 3.6 Structure and general characteristics of micro-algae and fungi

**Unit 4: Culture and identification of microorganisms**

- 4.1 Methods of sterilization- physical and chemical methods
- 4.2 Bacterial nutrition nutritional types of bacteria, essential macro micro nutrients and growth factors.
- 4.3 Bacterial growth curve-batch and continuous cultures, synchronous cultures measurement of bacterial growth-measurement of cell number and cell mass.
- 4.4 Factors affecting bacterial growth
- 4.5 Culturing of anaerobic bacteria and viruses
- 4.6 Pure cultures and its characteristics

  
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R. Jayamala Chandra

## PRACTICALS

### BS306: BIOCHEMISTRY AND MICROBIOLOGY

1. Preparation of normal molar, molal solutions.
2. Preparation of buffers (acidic, basic ,neutral)
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 proteins by biuret method
7. Sterilization methods
8. Preparation of microbiological media (bacterial, algal & 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's staining)
12. Bacterial growth curve
13. Technique of micrometry(ocular and stage)

#### Spotters:

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

#### 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. Experimental Biochemistry: A Student Companion by: Sashidhar Beedu et al.
10. Practical Biochemistry By: Plummer
11. Biology of Microorganisms by: Brock, T.D. and Madigan, M.T.
12. Microbiology by: Prescott, L.M., Harley, J.P. Klein, D.A.
13. Microbiology by: Pelczar, M.J, Chan, E.C.S., Ereig, N.R.
14. Microbiological applications by: Benson



**Biotechnology**  
**B.Sc- II Year, Semester – III**  
**Core Course DSC-3**

**MOLECULAR BIOLOGY AND r-DNA TECHNOLOGY**

**UNIT-I**

- 1.1. Transcription in prokaryotes: Enzymatic Synthesis of RNA, Basic features of RNA synthesis, E.coli RNA polymerase, Classes of RNA molecules.
- 1.2. Transcription mechanism in prokaryotes – Promoter, initiation, elongation, proof reading and Rho dependent and Rho independent termination.
- 1.3. Transcription in Eukaryotes : Polymerases of eukaryotes, Promoters of eukaryotes.
- 1.4. Synthesis of hn RNA and post transcriptional modifications
- 1.5. The Genetic Code, properties of genetic code, Wobble hypothesis.
- 1.6. Translation mechanism in prokaryotes and eukaryotes.

**UNIT-II**

- 2.1. Regulation in Prokaryotes: General aspects of Regulation.
- 2.2. Transcription level regulation – positive, negative regulation.
- 2.3. Auto and co-ordinated regulation.
- 2.4. Operon concept – lac, trp, operons.
- 2.5. Translation regulation in Eukaryotic and prokaryotic organism.
- 2.6. Inhibitors of Protein synthesis – antibiotics and other inhibitors.

**UNIT-III**

- 3.1. Enzymes used in gene cloning: Restriction Endonucleases, Ligases, Phosphatases, Methylases, Kinases.
- 3.2. Cloning vehicles, plasmids, cosmids, phage vectors.
- 3.3. Construction of genomic and cDNA libraries.
- 3.4. Identification of cloned genes – Colony hybridisation.
- 3.5. Expression vectors: Bacterial vectors.
- 3.6. Yeast vectors.

**UNIT-IV**

- 4.1. Principle, Methodology and application of PCR technology.
- 4.2. Variations of PCR.
- 4.3. DNA fingerprinting technique and its application in forensic medicine.
- 4.4. Principles involved in blotting techniques - Southern, Northern and Western.
- 4.5. Genome sequencing: Sanger model of sequencing.
- 4.6. Applications of r-DNA technology in medicine.



  
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**Biotechnology**  
**B.Sc- II Year, Semester – IV**  
**Core Course DSC-4**

**BIostatistics and Bioinformatics**

**UNIT-I**

- 1.1.Introduction to biostatistics, History and applications.
- 1.2. Concept of sampling and sampling distributions.
- 1.3.Measures of Central tendency (Mean, Median, Mode)
- 1.4.Measures of deviation (Standard deviation, Variance and Co-efficient of variation)
- 1.5.Concept of Probability, basic laws and its application to Mendelian segregation.
- 1.6. Concept of Probability distribution, Binomial and Poisson distribution, Normal distribution and their applications in biology.

**UNIT-II**

- 2.1 Concept of Test of hypothesis: applications of t – test statistics to biological problems/  
Data – Chisquare statistics, applications in biology.
- 2.2. Simple Correlation and Regression.
- 2.3. Concept of Analysis of Variance(ANOVA ) (One – Way Classification).
- 2.4. ANOVA – Two-way Classification.
- 2.5. Graphical representation of data.
- 2.6. Importance of statistics in Biology.


**UNIT-III**

- 3.1. Usage of MD DOS commands: Basic concepts of Internal and external commands.
- 3.2. Directory and File commands, Copying, Erasing, Renaming and Displaying files.
- 3.3. Microsoft word: Concept of toolbar, Character, Paragraph and document formatting.
- 3.4. Drawing tool bar, header, footer, document editing, page set up, short cut keys, text and Graphics.
- 3.5. Microsoft Power Point: Slide presentation, slide layout and design, custom animation, Image importing, slide transition.
- 3.6. MS Excel –Applications, Functions, charts, pivot tables, validations, formatting of spread Sheet.

**UNIT-IV**

- 4.1. Introduction to Bioinformatics, History and emergence.
- 4.2. Biological databases (Nucleic acids and Protein)
- 4.3. Introduction to genomics and proteomics.
- 4.4. Biochips.
- 4.5. Data retrieval tools (BLAST, PubMed).
- 4.6. Applications of Bioinformatics.



  
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**B.SC. BIOTECHNOLOGY III YEAR**  
**SEMESTER – VI**

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**Elective Course DSE-6**

**ENVIRONMENTAL BIOTECHNOLOGY**  
**( ELECTIVE - a)**

**UNIT-I**

- 1.1.Introduction to environment and pollution.
- 1.2.Types of pollution- air, water and land pollution.
- 1.3.Types of pollutants- inorganic, organic and biotic sources.
- 1.4.Sources of pollution- domestic waste, agriculture waste, industrial effluents, municipal waste.
- 1.5. Biomonitoring of environmental pollutants by bioindicators.
- 1.6. Emission control biotechnology - air sampling techniques

**UNIT-II**

- 2.1. Renewable and non renewable energy resources.
- 2.2.Fossil fuels as energy source and their impact on environment.
- 2.3.Non conventional source- biomass as source as bio energy.
- 2.4.Types of biomass- plant, animal and microbial biomass.
- 2.5.Biodelignification by enzymes.
- 2.6.Biodesulphurisation of coal.

**UNIT-III**

- 3.1. Microbial treatment of waste water (sewage of industrial effluents)- aerobic and anaerobic methods.
- 3.2. Solid waste and management- bioremediation- concepts and types ( insitu and exsitu).
- 3.3. Bioremediation of toxic metal ions- bio sorption and bioaccumulation.
- 3.4. Microbial bioremediation of pesticides and xenobiotic compounds.
- 3.5. Phytoremediation- concepts and applications.
- 3.6. Degradative plasmids and genes in biomining.

**UNIT-IV**

- 4.1.Climate change, Green house gases and global warming.
- 4.2.Impact of pollution on environment and measurement methods.
- 4.3.Production of bio fuels, Bio ethanol and Bio methanol.
- 4.4.Conservation of Biodiversity.
- 4.5.Carbon sequestration- vision, methods and managements strategies.
- 4.6. GEMS and their impact on environment.



## **PRACTICAL PAPER –VI**

1. Estimation of BOD in water samples
2. Estimation of COD in water samples
3. Estimation of total dissolved solid in water samples
4. Isolation of microorganisms from soil/ industrial effluents
5. Production of biogas using cow/cattle dung
6. Bioremediation

## **SPOTTERS**

1. Aerosols
2. Biomagnification
3. Tidal energy
4. Habitat destruction
5. Biodegradable plastic - Poly hydroxyl butyrate
6. El Niño effect
7. Coral reefs
8. Xenobiotic compounds
9. Global warming
10. Bioethanol

## **REFERENCE BOOKS**

1. Text Book of Biotechnology- By H.K. Das ( Wiley Publications)
2. Biotechnology- By B.T. Nijaguna
3. Biogas Technology-by K Trehan
4. Industrial Microbiology by L.E. Casida
5. Food Microbiology by M.R. Adams and M.O Moss
6. Introduction to biotechnology by P.K. Gupta
7. Essentials of Biotechnology for Satya N. Das
8. Bioprocess Engineering by Shuler (Pearson Education)
9. Essentials of Biotechnology by Irfan Ali Khan and Atiyakhanum ( Ukaaz Publication)

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**B.SC. BIOTECHNOLOGY III YEAR**  
**SEMESTER – VI**

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**Elective Course DSE-6**

**ANIMAL BIOTECHNOLOGY**  
**( ELECTIVE - b)**

**UNIT-I**

- 1.1. Animal tissue culture, history, requirements for animal cell culture.
- 1.2. Substrate, liquids, culture mediums – Natural (Clots, Biological fluids, Tissue extracts),  
Completed natural and chemically defined media.
- 1.3. Explant – culture of explants, cell culture technique – initiation, preparation and sterilization  
of media.
- 1.4. Isolation of explants, disaggregation of explants, culture, subculture.
- 1.5. Cell lines, evolution of cell lines, maintenance of cell lines, Large scale culture of cell lines –  
monolayer, suspension and immobilized cell culture.
- 1.6. Development of primary culture and cell lines, subculture.

**UNIT-II**

- 2.1. Cultured cells and evolution of continuous cell lines (established cell lines).
- 2.2. Commonly used cell lines – their origin and characteristics.
- 2.3. Cell line preservation and characterization.
- 2.4. High level expression of foreign gene in animal cells - expression vectors, enhancers,  
Regulatory sequences.
- 2.5. Expression foreign genes in animal cell - advantages and disadvantages.
- 2.6. Properties of cell lines – Biology and characterisation of cultured cells.

**UNIT-III**

- 3.1. Transfection methods of animal cells (Calcium phosphate, DEAE – dextran, lipofection,  
Electroporation, Microinjection).
- 3.2. Embryonic stem cell transfer.
- 3.3. Selection of recombinant cells with various marker genes (Thymidine Kinase,  
Dihydrofolate reductase, CAD protein, DGPRT, HAT, Neomycin phosphotransferase)
- 3.4. Production of transgenic animals (Mice, Cattle, Sheep, pigs, Fish and Birds)
- 3.5. Applications, advantages and disadvantages of animal tissue culture.
- 3.6. Ethical issues related to transgenic animals.

**UNIT-IV**

- 4.1. Stem cells: Characteristic features, maintenance, culture and applications of Embryonic  
and adult stem cells.
- 4.2. Animal cloning – Nuclear transfer and embryonic stem cell method.
- 4.3. Molecular pharming: Transgenic animals and their applications.
- 4.4. Methods used for transgenesis with reference to transgenic mice, cattle, sheep, goats,  
pigs, chicken and fish.
- 4.5. Animal cells as bioreactors for the production of commercially important products.
- 4.6. Cryopreservation – principles.

## **PRACTICAL PAPER –VI**

1. Preparation of media
2. Isolation of cells from Chick Embryo
3. Establishment and maintenance of primary cell cultures
4. Subculture of monolayer cells
5. Subculture of suspension cells
6. Determination of viable cells by trypan blue test

## **SPOTTERS**

1. Trypsinization
2. Monolayer
3. Transgenic mice
4. Lipofection
5. Cells lines
6. Marker genes
7. Bioreactor
8. HAT
9. Dolly
10. Microinjection

## **REFERENCE BOOKS**

1. Strategies in transgenic animal sciences by Glemn MM and James M. Robl ASM
2. Press 2000
3. Practical biotechnology methods and protocols by S. Janarthana and S. Vincent
4. Animal cells as bioreactors by Terence Gartoright, Cambridge university
5. Essentials of biotechnology for students by Sayan N Das
6. Principles and practice of Animal tissue culture by Sudha Gangal university
7. Biotechnology by U. Satyanarayana



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**Core Course DSC-4**

**BIostatistics and Bioinformatics**

**UNIT-I**

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- 4.3. Introduction to genomics and proteomics.
- 4.4. Biochips.
- 4.5. Data retrieval tools (BLAST, PubMed).
- 4.6. Applications of Bioinformatics.



  
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