

Devi Ahilya Vishwavidhyalaya

B.Sc. Biotechnology

Subject- Biotechnology (as one subject)

15 Marks CCE + 85 Marks End Semester = 100marks each paper

B.Sc. I Year (2015-16) with minor corrections in (2014-15)

Semester I

Paper I: Biochemistry and Analytical Techniques

85 marks

Practicals

50 marks

Semester II

Paper II: Cell Biology & Metabolism

85 marks

Practicals

50 marks

B.Sc. II Year (2015-16)

Semester III

Paper III: Molecular Biology

85 marks

Practicals

50 marks

Semester IV

Paper IV: Microbial Biotechnology

85 marks

Practicals

50 marks

B.Sc. III Year (2016-17)

Semester V

Paper V: Immunology and Animal Biotechnology

85 marks

Practicals

50 marks

Semester VI

Paper I: Plant and Environmental Biotechnology

50 marks

Practicals

50 marks

Internship

100 marks

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B. Sc. I YEAR (BIOTECHNOLOGY)

Semester I

Paper I: Biochemistry and Analytical Techniques

Maximum Marks: 85

Unit I

Carbohydrates: Introduction and biological importance. Structure and properties of reducing sugars, Isomerism in monosaccharides; aldose-ketose, optical isomers, stereoisomers, D & L forms, epimers, anomers, Mutarotation –open and ring structures. concept of reducing and non reducing sugars), Disaccharide (maltose, sucrose, lactose), Oligosaccharide (raffinose) and Polysaccharide (starch, amylose and amylopectin, glycogen, peptidoglycan, cellulose, proteoglycan matrix).

Lipids: Introduction, Classes, Fatty acids [saturated, unsaturated, branched, essential fatty acids, Physical properties, Chemical properties, Saponification value, acid value, iodine number, rancidity]. Structure and function of phospholipids, Sphingolipids, lipoproteins and cholesterol.

Unit II

Amino acids: Structural and nutritional classification, properties of amino acids. Acid base behavior, Zwitterions, isoelectric pH, Color reaction of amino acids.

Protein structure: Peptide bond, outline of primary, secondary, tertiary and quaternary structure of proteins and their examples. Structural and functional proteins. Forces stabilizing secondary, tertiary and quaternary structure with examples.

Unit III

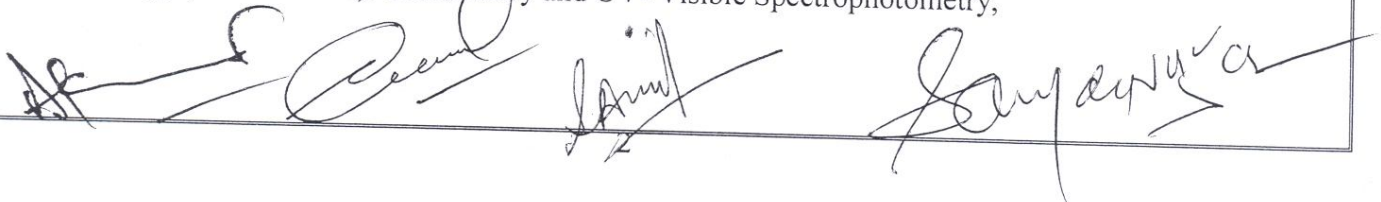
Enzymes: Outlines of enzyme classification. Active site, energy of activation, transition state hypothesis, lock and key hypothesis, induced fit hypothesis. Concept of K_m , Michaelis Menten equation. Enzyme activation, various types of enzyme inhibition and identification using double reciprocal plot. Introduction to Allosteric enzymes.

Definition of holoenzyme, apoenzyme, coenzyme, cofactor, prosthetic group and their examples. Concept of ribozyme, multiple forms, isozymes and abzymes.

Chemical composition of nucleotides, Watson Crick model of DNA structure. Types of DNA (A, B, Z: their structure and occurrence) and RNA (hn RNA, m RNA, r RNA, t RNA).

Unit IV

Light Microscopy (Bright field, dark field, fluorescence & Phase contrast) and Electron microscopy (TEM & SEM). Colorimetry and UV- Visible Spectrophotometry,



Electrophoresis Techniques and applications: PAGE (native and denature) and Agarose gel electrophoresis.

Unit V

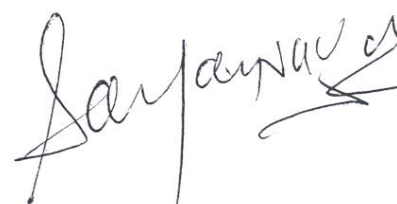
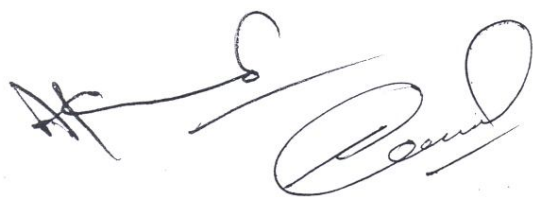
Concept, types and applications of Chromatography; Paper chromatography, Thin layer chromatography, Gel filtration chromatography, Ion exchange chromatography, Affinity chromatography.

List of Experiments

1. Principles and working knowledge of instruments like Colorimeter, pH meter, Centrifuge, Spectrophotometer, Microscope etc.
2. Qualitative analysis of Carbohydrates, Proteins and Lipids.
3. Quantitative estimation of Protein by Folin-Lowry unitary method.
4. Quantitative estimation of sugar by Nelson Somogyi's unitary method.
5. Analyzing the enzyme activity.
6. Study the effect of pH on enzyme activity.
7. Study the effect of temperature on enzyme activity.
8. Separation of amino acids by TLC
9. Separation of leaf pigments by Paper chromatography
10. Isolation of potato starch and observation under microscope.

Scheme of Practical Examination

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|--|------|
| 1. Quantitative analysis of by Proteins / Carbohydrates by unitary method. | (12) |
| 2. Qualitative detection of carbohydrates, proteins and lipids. | (10) |
| 3. Study the effect of pH / temperature on enzyme activity. | (10) |
| 4. Spotting. | (08) |
| 5. Viva- Voce. | (05) |
| 6. Practical Record. | (05) |



Recommended Books

1. Principles of Biochemistry, Author- Lehninger
2. Fundamentals of Biochemistry, Author- J. L. Jain
3. Biochemistry, Author- Voet and Voet.
4. Textbook of Biochemistry- S.P. Singh.
5. Biochemistry, Author- Stryer.
6. Introduction to protein structure, Authors- Branden and Tooze.
7. Principles of Biochemistry, Authors – Zubey, Parson and Vance.
8. *[Faint, illegible text]*

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B. Sc. I YEAR (BIOTECHNOLOGY)

Semester II

Paper II: Cell Biology & Metabolism

Maximum Marks: 85

Unit I

Cell Theory- prokaryotic and eukaryotic cells
Structure of prokaryotic cell, Eubacteria and Archaeobacteria. Size, shape and arrangement of bacterial cells. Gram's positive and Gram's negative cells.
Eukaryotic cell structure, plant cells, animal cells. Structure and difference from prokaryotic cell.

Unit II

Cell cycle and cell division- mitosis, meiosis. Anomalies in cell division and associated diseases.
Cell synchrony, Cell-cell interactions, Cell Signaling, Cell locomotion, Cell differentiation, Cell senescence and death.

Unit III

Structure and function of bacterial cell – flagella, pili, Cell wall, cytoplasmic membrane, nuclear region, mesosomes, ribosomes, vacuoles, metachromatic granules, spores and cysts.
Structure and function of an eukaryotic cell - Cell wall, cell membrane, mitochondria, chloroplast, endoplasmic reticulum, Golgi bodies, nucleus, cytoskeleton, microbodies, Centriole, Lysosome.

Unit IV

Carbohydrate Metabolism – Aerobic & Anaerobic glycolysis, sequence of reactions in glycolysis, regulation in glycolysis, citric acid cycle (amphibolic pathway), glycogenesis, glycogenolysis, Pentose-phosphate pathway, Oxidative Phosphorylation and ETC.

Unit V

Amino acid Metabolism – Amino acid breakdown (transamination, deamination, Urea cycle) diseases associated with defects in amino acid metabolism.

Lipid Metabolism – beta oxidation of saturated fatty acids, oxidation of unsaturated fatty acids, oxidation of odd chain fatty acids, energy yield, ketone bodies. Diseases related to defects in lipid metabolism.

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Prasad
Sanjay
Sanjay

List of Experiments

1. To study the plant cell structure using various plant material.
2. To study microbial cell by Monochrome staining and Gram staining.
3. Study the different stages of mitosis and meiosis.
4. Prepare slide for study of stomata.
5. Study of permanent slides like cell division, prokaryotic and eukaryotic cells, Muscles and Nerve cells, T.S. of stomatal cells.
6. To study the animal cell structure using cheek cells.
7. Permanent slide preparation.
8. Histochemical localization of lignin.
9. Observe various stages of mitosis in onion root tip.

Scheme of Practical Examination

- | | |
|---|----|
| 1. Observe different stages of mitosis in the given sample. | 12 |
| 2. Perform Gram staining of given bacterial culture. | 10 |
| 3. Study of plant/animal cell structure. | 10 |
| 4. Spotting | 08 |
| 5. Viva. | 05 |
| 6. Practical Record. | 05 |

Recommended Books

1. Molecular biology of the cell, Alberts.
2. Molecular cell biology, Lodish Scientific American Books, Inc.
3. Cell in Development and Inheritance, EB Wilson.
4. Cell Biology, P.S. Verma and Agrawal.
5. ...

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B. Sc. II YEAR (BIOTECHNOLOGY)

Semester III

Paper: Molecular Biology

Maximum Marks:85

Unit I

DNA and RNA, Chemical Structure, Types and Properties, Experimental Proof of DNA as genetic material, Genome- Concept, Plant, Animal, Bacterial and Viral Genome, DNA Replication. Types, Experimental proof of semi conservative replication, Replicon- Concept, proteins and enzymes involved in replication in prokaryotes and eukaryotes, Modes of DNA replication. Unidirectional, Bidirectional, Types of DNA replication. Y shaped, θ mode, rolling circle mechanism.

Unit II

Eukaryotic chromosomal organization, Euchromatin, Heterochromatin, chromatin structure, nucleosomes, histone and non histone proteins, Histone modifications, Introduction to epigenetics.

Unit III

Central Dogma of Molecular Biology, Gene concept, Prokaryotic genes. Eukaryotic genes, Transcription. Regulation of transcription in prokaryotes and eukaryotes (Post transcriptional RNA processing)

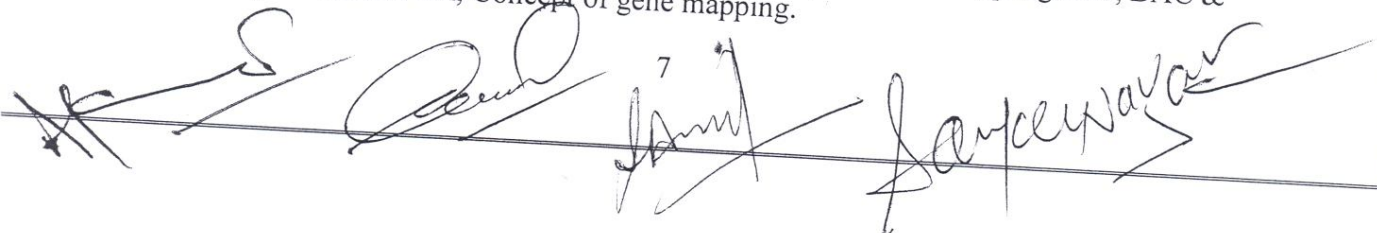
Concept of mRNA and hnRNA. RNA processing, splicing in eukaryotes, Translation in prokaryotes and eukaryotes.

Unit IV

Regulation of gene expression in prokaryotes, Operon concept, induction and repression, catabolite repression, Operon models lac, trp operon. Attenuation and enhancer elements, Insertion elements and transposons, Mutation. Silent, point, frameshift, transition, transversion, deletion, non sense mutation, DNA damage and repair. UV damage, SOS repair.

Unit V

Genomic and plasmid DNA isolation from bacteria, Enzymes in restriction digestion & ligation, linkers, Introduction to vectors for DNA transfer. Plasmid, phage, cosmid, phagemid, BAC & YAC, Gene amplification. PCR, Concept of gene mapping.



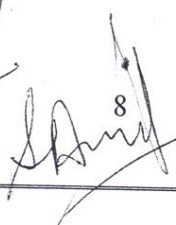
List of Experiments

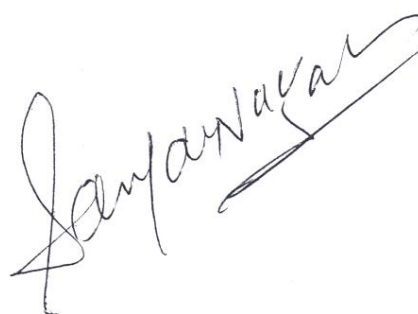
1. Chromosomal DNA isolation from Plant cells.
2. Chromosomal DNA isolation from Animal cells.
3. Genomic DNA isolation from Micro-Organisms.
4. Analysis of isolated DNA by Agarose gel electrophoresis.
5. Spectrophotometric analysis of DNA and DNA melting.
6. UV as a physical mutagen
7. Gradient Plate Technique

Scheme of Practical Examination (2 days minimum 3 hrs each day)

1. Isolation of DNA from Plant/Animal/Microbial source.	12
2. Electrophoretic analysis of DNA/Spectrophotometric analysis of DNA.	10
3. UV as a mutagen/Gradient Plate technique.	10
4. Spotting.	08
5. Viva.	05
6. Practical Record.	05







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Recommended Books

Benjamin Lewin, Gene IX, 9th Edition, Jones and Barlett Publishers, 2007.

J.D. Watson, N.H. Hopkins, J.W. Roberts, J.A. Seitz & A.M. Weiner; Molecular Biology of the Gene, 6th Edition, Benjamin Cummings Publishing Company Inc, 2007.

Alberts et al; Molecular Biology of the Cell, 4th edition, Garland, 2002.

Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd Edition, ASM Press, 1998.

Molecular Cell Biology, Authors-Lodish, Berk and Zippursky.

Gene Cloning, Author- T.A. Brown.

Biotechnology and its Applications, 4th Edition, Pearson Education, 2004.

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B. Sc. II YEAR (BIOTECHNOLOGY)

Semester IV

Paper: Microbial Biotechnology

Maximum Marks: 85

Unit I

Microbial classification- 3 kingdom, 5 kingdom, 3 domain etc. Bacterial Nutrition and Nutritional classes of bacteria, Microbiological media and its types, Methods of cultivation of microbes – aerobic and anaerobic.

Unit II

Microbial growth – mathematical expression of growth, growth curve, factors affecting growth. Batch, continuous, synchronous and diauxic growth. Quantification of microbial growth. Control of micro organisms- physical & chemical, Evaluation of chemical disinfectants- tube dilution test, agar diffusion test and phenol- coefficient.

Unit III

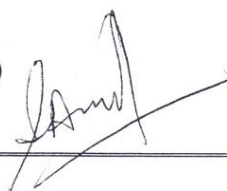
Fermentation Technology, Primary and Secondary Screening, Strain Improvement, Inoculum Development, Industrial Sterilisation process, Scale-up and Harvest and Recovery.

Unit IV

Types of fermentation – batch, continuous, fed batch process; Submerged and Solid State fermentation process, Basic design of a fermentor and factors affecting fermentor design. Types of fermentors - Fluidized, Packed Bed, Air lift Fermentor, Tray Fermentor and Tower Fermentor.


Unit V

Industrial Production of Ethyl Alcohol, Penicillin, Cyanocobalamin, Glutamic Acid, Citric Acid, Amylase, Protease.



List of Experiments

1. Principles and working knowledge of instruments like Autoclave, Laminar Air Flow, Hot Air Oven, Colony Counter etc.
2. Isolation of Micro-organism by Sector plate method.
3. Isolation of Micro-organism by Pour plate method.
4. Enumeration of bacteria by standard plate count method.
5. Techniques for the Cultivation of Anaerobic Microorganisms.
6. Effect of temperature on microbial growth.
7. Effect of pH on microbial growth.
8. Isolation of extremophiles.
9. Primary Screening for antibiotic producing microorganisms.
10. Primary Screening for amylase and protease producing microorganisms.



Scheme of Practical Examination (2 days minimum 3hrs each day)

1. Effect of temperature / pH on microbial growth.	12
2. Primary screening of antibiotic / amylase / protease producing microorganism.	10
3. Isolation of microorganism by sector plate / pour plate technique	10
4. Spotting	08
5. Viva.	05
6. Practical Record.	05

Recommended Books

1. Microbiology, Authors- Pelczar, Chan and Kreig.
2. Text book of Microbiology, Prescott.
3. Physical Biochemistry, D Freifelder.
4. General Microbiology - Stanier
5. Principles of Fermentation Technology - Whitaker, A. 2nd edition
6. ~~Microbiology, Authors- Pelczar, Chan and Kreig.~~
7. Introduction to Microbiology, Authors- Ingraham and Ingraham.
8. Elementary Microbiology, Author- H. A. Modi
9. Industrial Microbiology A. H. Patel
10. Microbiology, A Practical Approach. Authors- Patel and Phanse
11. General Microbiology, Authors- Powar and Daginawala.
12. Microbial Biotechnology, Hazarre.

