

M.Sc. Semester I & IV

Prospectus No. 20091220

संत गाडगे बाबा अमरावती विद्यापीठ

SANT GADGE BABA AMRAVATI UNIVERSITY

विज्ञान विद्याशाखा  
(FACULTY OF SCIENCE)

अभ्यासक्रमिका  
विज्ञान पारंगत परिक्षा (जीवरसायनशास्त्र)  
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OF  
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**Syllabus Prescribed for M.Sc. Part-I - Biochemistry**

**Semester - I**

**Paper - I**

**(Biomolecules)**

- Unit I** : Proteins Classifications - Isolation and Separation, assay methods Structures of peptide bond, Ramchandran Plot Modern approach to peptide synthesis, conformation of proteins, concept of covalent and weak bonds, primary, secondary tertiary and quaternary structure. Denaturation and renaturation of proteins, protein sequencing.
- Unit II** : Carbohydrates : Importance glycoproteins and glycolipids, Blood group sugar compounds, Lectins - specificity, characteristics and uses, Structure of glycogen and starch.
- Unit III** : Lipids : Occurance, structure of cholesterol (derivation excluding synthesis), Chemistry of bile acids, bile salts, structural derivation of certain steroided compounds such as testosterone, progesterone, estrogen and vitamin D.
- Unit IV** : Nucleic Acids : Classification, isolation, separation assay methods, structure of DNA, RNA and Nucleic acid sequencing.
- Unit V** : Porphyrins - importance of porphyrins in biology, classification, structure of hemoglobin, chlorophyll and porphyrins.

**Paper - II**

**(Analytical Techniques)**

- Unit I** : Technology Fundamentals (Life Science) - General Scheme for purification of bio-components methods for studying cells and organelles. Sub cellular fractionation and marker enzymes, Methods for lyses of plant, animal and microbial cell. Ultra centrifugation, Ultra filtration, Freeze drying and fractional precipitation. Use of detergents in isolation of membrane proteins.
- Unit II** : Chromatography - Basic principles and application of ION Exchange, gel filtration, purification, affinity, HPLC and Reverse phase chromatography, Gas chromatography, TLC and paper chromatography.
- Unit III** : Electrophoresis - Polyacrylamide/ starch / agarose gel electrophoresis, 2D-Electrophoresis, Isoelectric focussing, Southern, Northern and Western blotting.
- Unit IV** : Spectrophotometric techniques - UV, Visible and Infra Red, ESR, NMR, Mass Spectroscopy, Atomic emission and absorption, X-ray diffractions, fluorescence.

- Unit V** : Tracer Technique - Principle and application of tracer technique, Isotopic labeling and their measurements, Auto radiography, liquid scintillation spectrometry.

**Paper - III**

**(Advance Enzymology)**

- Unit I : Kinetics - I**
- Concept of steady state and rapid state Equilibrium kinetics.
  - Effect of temperature, pH, enzyme and substrate concentration on reaction rate.
  - Michaelis - Menton equation, single and double reciprocal plots.
- Unit II : Kinetics - II**
- Enzyme inhibitor types, kinetics of enzyme inhibition.
  - Role of co-enzymes in metabolism, Role of metals in enzyme kinetics. Activator kinetics, Bisubstrate kinetics.
  - Kinetics for reversible enzyme catalysed reaction, Haldane's relationship.
- Unit III: Mechanism of enzyme action -**
- Modes of enzyme catalysis - covalent, proximate or orientation effects, acid base etc.
  - Chemistry of active center, chemical modification studies by active site directed reagents, physical methods for determination of active site conformation.
  - Various theories of mechanism of enzyme action. Structure function relations of Ribonuclease and chymotrypsin.
- Unit IV:** Control of enzymes catalysed reaction - (Biological control)
- Multienzyme complexes and their significance in metabolic control.
  - Membrane bound enzymes in metabolic control.
  - Compartmentalization of enzyme and substrate, the shuttle systems.
  - Isoenzymes
- Unit V :** Allosteric interactions and enzyme regulation
- Allosterism, nature of allosteric enzymes and sigmoidal kinetics, mode of action, allosteric regulation.
  - Product inhibition, feed back control, enzyme induction and repression.
  - Mode of hormonal action on enzymes, concept of receptors, agonists and antagonists.

**Paper - IV**  
**(Bio-Energetics and Biological oxidation)**

**Unit I : Free Energy Concept -**

- a) Concept of free energy, standard free energy and measurement of free energy.
- b) Application of first and second law of thermodynamics to biological systems.
- c) High energy bonds - ATP and interconversion of nucleotide phosphates, phosphorylation potential.

**Unit II :** Mitochondrial Electrontransport - Mitochondrial organisation, sequence of electron carriers and site of oxidation phosphorylation, heme and non-heme iron binding proteins (Electron transport particles), Thermodynamic consideration, Redox potential, phosphate group transfer potential, Respiratory controls, Factors affecting ETC, reversible ETC.

**Unit III :** Oxidative phosphorylation - ATP synthetase complex, F1 - F5 ATP ase coupling factors, Theories of oxidative phosphorylation, Mechanism of oxidative phosphorylation coupled reactions, Uncouplers and inhibitors of energy transfer.

**Unit IV :** Photosynthetic Electron Transport - Ultra structure of chloroplast, Light harvesting complexes, photosystem I and II, Location and mechanism of energy transfer, Photosynthetic Electron Transport, Photorespiration.

**Unit V :** Photophosphorylation - Cyclic and non-cyclic photophosphorylation, Molecular mechanism of photophosphorylation. Photoregulation.

**M. Sc. I - Biochemistry**

**Semester - I**

**Practical - I**

**(Analytical Biochemistry)**

- 1) Isolation of DNA and RNA
- 2) Estimation of DNA and RNA -
  - i) DNA by Diphenylamine method
  - ii) DNA by spectrophotometric method
  - iii) RNA by orcinol method
- 3) Separation and identification of amino acid mixture by -
  - i) Paper chromatography technique
  - ii) Paper Electrophoresis technique
- 4) Thin Layer chromatographic separation of sugars and membrane lipids.

- 5) Separation and Identification of serum proteins by Polyacrylamide /agarose gel electrophoresis.
- 6) Separation of DNA by agarose gel Electrophoresis.
- 7) Separation of proteins using molecular Sieve chromatography (Gel filtration).
- 8) Purification of proteins by ion exchange chromatography (DEAE Cellulose chromatography)
- 9) Estimation of proteins by spectrophotometric method
- 10) Estimation of reducing sugars by DNSA method.

**Practical - II**  
**(Enzymology)**

- 1) Cellular Fractionation and study of Marker Enzyme with reference to their Localization.
- 2) Identification and quantitation of activity of a-amylase / invertase/ urease.
- 3) Determination of specific activity of an Enzyme.
- 4) Determination of Enzyme activity in presence of activators.
- 5) Determination of activity in presence of inhibitors.
- 6) Determination of optimum pH.
- 7) Determination of optimum temperature
- 8) Determination of Km.
- 9) Study of competitive and non-competitive inhibitors.
- 10) Demonstration of reversibility of enzyme reaction.

**M. Sc. Part-I - Biochemistry**

**Semester - II**

**Paper - V**

**(Clinical Biochemistry)**

- Unit I :** Gastric disorders : Disorders of gastric function, Methods of Evaluation, Pancreatic diseases, Steatorrhea, Malabsorption syndrome, Test for their evaluation.
- Unit II :** Blood disorders : Mechanism of coagulation and fibrinolysis, Abnormalities in blood coagulation, variation of plasma proteins (Properties and Function) in various diseases, Abnormalities of blood formation anemias, Haemoglobiopathies, Clinical significance of Faecal and urine analysis and clearance tests.
- Unit III :** Liver disorders & Renal disorders : Jaundice, Fatty Liver and Liver function tests and Renal function tests and Renal disorder, Isoenzymes in health and diseases, Biochemical diagnosis of diseases by enzymassay.

- Unit IV** : Human Genome, Genetic Diversity, Polymorphism Genetic Linkage, Chromosomal disorder, Monogenic disorders, Autosomal dominant, autosomal recessive X-Linked, Multifactorial disorders, Genetic heterogeneity, Allelic heterogeneity.
- Unit V** : Pathogenesis of genetic diseases, Diagnosis of metabolic diseases, Galactosemia, Hemophilia sickle cell anemia, Muscular dystrophy, Hypercholesterolemia, Gout, Turners Syndrome.

### Paper - VI

#### (Endocrinology and Neurochemistry)

- Unit I** : Insulin and Glucagon : Various types of hyperglycemias, Diabetes Mellitus, Experimental diabetes, hypoglycemia polyurea, Glucose Tolerance test, Radio immuno assay.
- Unit II** : Thyroid and Parathyroid : Calcium and phosphorus metabolism, Abnormalities of parathyroid function and methods of evaluation, Iodine Metabolism, hypo and hyper thyroidism, B.M.R. and other tests for evaluation of thyroid function.
- Unit III** : Biochemistry of reproductive disorders and birth control, Influence of various factor in reproduction with special reference to role of prostaglandins and gonadotropins, Biochemistry of fertilization, Mechanism and methods of birth control and the possible biochemical consequences thereof.
- Unit IV** : Neurophysiology : Neuronal membrane, Excitability, Ion channels and transport of Ions, Nerve and synapse structures : Structure function correlation of synapse, Transmission across the synapse, Membrane potential in the steady state, action potential generation and propagation.  
Presynaptic Events at Neuromuscular Junction : Cholinergic and non-cholinergic synapses, postsynaptic, Events at the Neuromuscular Junction.  
Enterophysiology of channels : EEG patterns.
- Unit V** : Neurotransmitter : Chemistry, synthesis, storage and release of nervous neurotransmitters, transmitter action, synaptic modulation and mechanism of neuronal integration, Neuropeptides.

### Paper - VII (Cell Biology)

- Unit I** : Structure and organisation of membranes, Membrane junction types and function. Membrane charge density, cell antigens and cell-cell recognition.
- Unit II** : Study of mitochondrial and chloroplast membranes Dynamics of endoplasmic membrane system, study of plasma membranes of certain cell types, Model membranes and liposomes, drug targeting.
- Unit III** : Receptors, Ligand binding and Schatchard-plot, Cell signaling
- Unit IV** : Major Organs of Movement of Cellular Motility -  
Muscle Contraction : Ultrastructure Sliding filament and the cross bridge cycle.  
Organisation, energy transduction, control of contraction by  $Ca^{++}$  ions.  
Spasmonemes.
- Unit V** : Cytoskeletal system and its activity -  
Microtubules, microfilaments and vesicles, the cytoplasmic matrix, biochemical dynamics of the cytoskeleton, amoeboid movements, pseudopod formation, sperm motility, cytoplasmic streaming cytoplasmic transport of vesicles.

### Paper - VIII

#### (Bioinformatics, Biostatistics and Research Methodology)

- Unit I** : a) Computer Related Introductory Topics :- History of development of computers, Basic Components and Computer, Hardware, CPU, Input, Output, Storage devices, Software, Operating Systems, Programming Languages (Machine, Assembly and Higher Level).  
b) Application of software :- Introduction to MS-EXCEL, Use of worksheet to Enter data, Edit data, Copy data, Move data, Use of input statistical functions for computations of Mean, S.D., Correlation, histogram, scatter plots Etc., graphical tools in EXCEL for presentation of data, Introduction to MS WORD Word processor, Editing, copying, moving, formatting, Table insertion, drawing flow chart etc.
- Unit II** : BIOINFORMATICS :Introduction to Internet and use of the same for communication, searching of database, Literature references etc. Introduction to Bioinformatics, Databank search - Data mining, Data Management and interpretation, BLAST/FASTA, Multiple Sequence alignment, protein Modeling, Protein structure Analysis, Docking,

Ligplot interactions, Genes, Primer designing, phylogenetic Analysis, Genomics and proteomics.

- Unit III :** Biostatistics : Statistical Evaluation of results, Probability theory, random variable and distribution functions. Point ad interval estimation, Multiple Linear regration. correlation and analysis of variance and covariance. Distribution of student - t, chi square ( $X^2$ ), F test, Correlation coefficient (r), Non-parametric statistics.
- Unit IV :** Research Methodology : Methodology of scientific research. The nature of scientific methods, Design of Experiments in biochemistry. Significance of statistical methods of biological investigations. Sampling techniques.
- Unit V :** Technical Writing : Preparation of scientific report, thinking and planning, Information ideas, order of paragraph writing, proper use of nouns, pronouns and articles, tenses, spellings etc. Preparation of a review, objective, design of the experiment, parameters used, data obtained, interpretation summary.

**M. Sc. Part-I - Biochemistry**  
**Semester - II**  
**Practical - III**  
**(Clinical Biochemistry)**

- 1) Hematology
  - a) Enumeration of White blood cells, Leukocytosis and Leukopenia.
  - b) Enumeration of Red blood cells and haemoglobin estimation.
  - c) Classification of anemias
  - d) Differential W.B.C. count.
  - e) Peripheral blood smears in Leukemias and hematological disorders
  - f) Erythrocyte sedimentation Rate (ESR), MCV, PCV, bleeding time, Clotting time and Prothrombin time.
  - g) Immunoelectrophoresis.
- 2) a) Serum protein Fractionation
  - b) Serum lipoprotein and glycoprotein Electrophoretic pattern.
    - a) Serum Cholesterol, Triglycerides and phospholipids.
    - b) Serum amylase.
- 3) Liver Function Tests.
  - a) Vander Berg Test and bilirubin thymol Turbidity tests.
  - b) SGOT, SGPT, LDH and alkaline and acid phosphatase (in serum assay)
- 4) Kidney Function Tests : Blood Urea, Urea Clearance, Phenol red clearance, P-amino hippuric acid clearance.

- 5) Adrenal Function Tests : Vinyl Mandelic acid Excretion, 17 Ketosteroid and Ketogenic steroid excretion.
- 6) Glucose tolerance test.
- 7) Analysis of gastric juice and semen.
- 8) Assay of serum  $\text{Na}^+$ ,  $\text{K}^+$  and  $\text{Ca}^{++}$  by flame photometry.
- 9) Assay of mucopolysaccharide and cerebrosides.
- 10) Radio immuno assay of Insulin.
- 11) Serological tests : Agglutination, Precipitation Complement fixation and ELISA technique.
- 12) Faeces Examination, Urine and CSF Examination.

**Practical - IV**  
**(Bioinformatics and Biostatistics)**

- 1) Word Processing, introduction to operating system.
- 2) Getting an amino acid sequence, nucleotide sequence and blasting.
- 3) Multiple sequence alignment.
- 4) Homology modeling
- 5) Structure analysis : Secondary, tertiary and quaternary structure, bond length, different interaction.
- 6) Searching of possible ligand, Ligand protein interactions.
- 7) Primer designing.
- 8) Phylogenetic studies.
- 9) Statistical analysis using EXCEL (Descriptive Statistics and Graphical Presentation).
- 10) Sketching of pmf/pdf of binomial, Poisson and normal distributions.
- 11) Correlation and Regression analysis.
- 12) Simple random sampling and stratified sampling.

**M. Sc. Part-II Biochemistry**  
**Semester - III**  
**Paper - IX**  
**(Basic Immunology)**

- Unit I :** Introduction to immune system -  
 Cells involved in immune system, Hematopoiesis and differentiation, Lymphocyte trafficking, B-lymphocytes. T-lymphocytes, Macrophages, (Dendritic cells, Natural killer and Limphokine activated killer cells, Eosinophils, Neutrophils and Mast cells).
- Unit II :** Adaptive Immunity : History, immunogenicity, Nature, Kinetics, thermodynamics of antigen antibody reactions inserting small, macromolecular and particulate antigens.
- Unit III :** Immune chemical techniques including, Phage

neutralization, Immunodiffusion, RIA, ELISA, agglutination hapten inhibition, immunofluorescence, immunoelectron microscopy.

- Unit IV** : Immunological organs and cells Methods of Separation of immune cells, Genetic basis of the immune response. The MHC - Structure and biology.
- Unit V** : Immunoglobulin super family and other cell surface adhesion molecular Lymphokines, Hypersensitivity / Transplantation.

### Paper - X

#### (Applied Immunology)

- Unit I** : Immunoglobulin - Structure isotypes, allotypes diotypes, paratope.  
Immunoglobulin gene Antibody diversity monoclonal antibodies.
- Unit II** : Cellular and molecular mechanism of Ab production humoral immunity and cell mediated immunity  
Regulation of immune response. The immune Network concept.
- Unit III** : In vivo immunity to infectious organisms : (Viruses, bacteria, fungi, protozoa, worms).
- Unit IV** : Autoimmunity and Autoimmune diseases, Immunological tolerance. Immuno deficiency.  
Transplantation immunology. Tumor Immunology, Psychoneuro Immunology, Immunostimulation.
- Unit V** : **Tumor Immunology**  
AIDS and other immuno dynamics, Hybridoma technology and Monoclonal antibodies.

### Paper - XI

#### (Fermentation Technology)

- Unit I** : Fermentation Technology Introduction - Microbial culture selection-use of mutants, recombinant DNA technology, cloning and gene amplification in selection.  
Equipment and instrumentation - for static, submerged and agitated cultures. Sterilisation, Scale up - inoculum building
- Unit II** : Measurement and control of environmental variable - Measurement of volume, mass, weight, gas flow temperature, pressure, pH, specifications etc.  
Isolation of fermentation products - removal of solids, primary separations, purification operations, product isolation.

- Unit III** : Fermentation process Kinetics - fermentation rates, final product yields, state of substrate conversion, time factors, productivity, average rate of product formation, kinetics of antibiotic fermentations. Analysis of rate pattern and Kinetic groups fermentation process types.
- Unit IV** : Bioreactors - batch, semi-batch, CSTF, recycle - CSTF, TFR, Fluidised bed reactors, plug-flow reactor, ideally mixed, non-ideally mixed reactors.  
Reactor analysis - Calculation of flow rate, conversion, volume of reactor, processing time, Concentration, residual time.  
Reactor design -overall and differential mass balance, rate of reaction.
- Unit V** : Bacterial and eucaryotic expression vectors, recombinant proteins, Mammalian cell cultures (Hela) in fermentors.  
Immobilisation techniques - Immobilisation of microbial cells and their characteristics.

### Paper - XII

#### (Recombinant DNA Technology)

- Unit I** : Basic Concepts in recombinant DNA technology. Advanced technique in Molecular Biology RAPD, RFLP, FELP, DNA fingerprinting, principles, Applications, Methods, Future Perspectives.  
DNA manipulation, insertion of Genes, Isolation, Manipulation and transfer. Vectors, plasmid, YAC principles and methods.
- Unit II** : Cloning - Reproductive and Therapeutic Principles, implication, social ethical perspectives. Methods for cloning (both).  
Introduction of DNA into living cells - Microinjector, biolistics, transfection, in vitro packaging etc.  
Gene synthesis - advantages, requirements technology, gene machines.  
Gene libraries - cDNA library, preparation, their advantages, disadvantages and detection of clone by immunoassays or radioactive probes, characterization of cDNA, Sub-cloning and expression system.
- Unit III** : Application of recombinant DNA technology - Application in Medicine - Production of insulin, interferons, recombinant vaccines, anti virus therapy, Gene therapy.  
Applications in Agriculture - Manipulating plant resistant to viruses, pesticides, Herbicides. Improving nutritional

value of plants prevention of fruit softening from damage.  
Manipulation of livestock.

**Unit IV :** Regulation of gene expression in prokaryotes general aspects  
- enzyme induction and repression constitutive enzymes,  
operon hypothesis, structure and regulation of lactose,  
galactose, arabinose, Tryptophan and histidine operons.  
Expression Vectors - CAT and luciferase.

**Regulation Mechanism -**

- Transcriptional Regulation - Positive, negative control, attenuation, stringent response. Holoenzyme modification, antitermination.
- Post transcriptional regulation - Spliced and unspliced introns.
- Translational regulation - Instability of mRNA, regulation at ribosome binding site, ribosomal binding efficiency, protein repressors.  
Autogenous translation repression, transacting RNA, repressors translation coupling biased codon usage, elongation block termination.

**Unit V : Regulation of gene expression in eukaryotes -**

Transcriptional regulation - Basic promoter elements response elements, enhancers, transcription, factors regulation to transcription initiation.

Post-transcriptional regulation - Poly A choice, splice site choice RNA editing. RNA transport from nucleus to cytoplasm and its regulation.

Translational Regulation - Modifications in translational apparatus and mRNA. mRNA making modification of RNA Sec. structure, use of different translation initiation codons, significance of control. Regulation of plant genes - Normal & stress conditions.

Special Mechanisms of gene regulation - Gene loss gene amplification and gene rearrangement.

**M. Sc. II - Biochemistry**

**Semester - III**

**Practical - V**

**(Immunology)**

- Determination of Blood group typing.
- Rapid latex agglutination test for detection of Hepatitis - B antigen.
- Detection of Australian Antigen by counter current immuno electrophoresis (IEP)
- Immunoglobulin separation by Fractional precipitation.

- Dialysis of antibody by Ultra membrane Filtration.
- Isolation of Ig-G from immuno globulins by Ion-exchange chromatography.
- Isolation of polymorphonuclear neutrophil cells.
- Determination of cell viability by Trypan blue dye.
- Pregnancy test by ELISA.
- Montoux test for demonstration of hypersensitivity.

**Practical - VI**

**(Biotechnology)**

- To immobilize yeast cells by gel Entrapment method.
- Production of alcohol from starch by immobilized cells of Baker's yeast and Estimation of Nicoloux method.
- To detect alcohol production by Idoform test.
- Quantitative estimation of alcohol produced.
- Production of citric acid by Aspergillus Niger and estimation of citric acid by titration method.
- Separation of proteins by SDS - PAGE.
- Isolation of plasmid DNA.
- Restriction - Digestion of DNA.
- Demonstration of PCR technique.
- Demonstration of RFLP.
- Demonstration of plant tissue culture techniques.

**M. Sc. Part-II Biochemistry**

**Semester - IV**

**Paper - XIII**

**(Physiology)**

**Unit I :** Cellular Signal Transduction and Metabolic Control -

- Flow of information - Information and order genetic messages, informational work.
- Development of Signals - Ionic triggers of development, transcellular ion currents in development.

**Unit II :** a) Information transactions in Eukaryotic Cells - The cyclic AMP facet; phosphorylation of Proteins, Ca<sup>++</sup> Messenger system, The CGMP story, intersection signals.

- Control of metabolism by endocrines paracrines.

**Unit III :** Cellular Transport Mechanism -

Membrane transport, Simple and facilitate diffusion, active transport, primary and secondary transport, porters, antiporters, Uniporters and symporters, the carrier concept, translocation of electric charge, Macromolecules as carriers glucose transporter system Protein targeting.

- Unit IV** : Pumps and Channels Circulation of Sodium, Na-pump regulation of cytoplasmic pH cell-volume. The proton circulation and pump Circulation of Calcium and pump ion regulated and Receptor operated Channels, ionomotive ATPases, Concept of membranance, depolarisation and ionophores, Macromolecules at channels, Group translocation.
- Unit V** : 1) Concept of Cell cycle  
2) Aging; Basic, Biochemical, Physiological immunological, viral and clinical aspects.  
3) Social behavioral and Psychological factors, Pharmacological control of aging.

#### Paper - XIV

##### (Advanced Molecular Biology)

- Unit I** : a) Evolution of genes, origin of life :  
The RNA world, The RNP world, The DNA world, Human gene map and genetic diversity, Human Genetic disorders.  
b) Gene Structure, Organisation and analysis : Location of genes, Chromomere, Recon Mucon, Citron, types of genes - Split, repeated house keeping Pu Cudo, overlapping etc.  
Gene analysis : Gene and Environmental and developmental transformation, genotype and phenotype, Developmental noise, Mandeliah analysis, Chromosome theory, Eucaryotic chromosome mapping.
- Unit II** : Replication of DNA :  
a) Replication in prokaryotes - E. coli DNA synthesis gene and cell division cycle, DNA unwinding DNA gyrase, Helicase helix distabilising proteins. Replication Enzymes - Polymerase, primase, telomerase, Replication of Extra chromosomal DNA - Mitochondria Chloroplase, plasmids.  
b) Replication in Eukaryotes : Mechanism, DNA polymerases, Replication of ss DNA, Reverse transcriptase, Methods of Replication (DNA syntheses, DNA Repair - Light and dark repair, error free and error prone repair.
- Unit III** : Transcription of DNA :  
c) Components of transcription machinery - Template, promoter, initiation site, activated precursors, cofactors, RNA Detection of mRNA and mRNA preparation, polymerases recognition by RNA polymerases, SL Protection assay and nuclear run-off assay. Transcription initiation, Elongation and termination in Prokaryotes.

- d) Transcription termination in Eukaryotes - RNA polymerase I, II and III termination, formation, discontinuous transcription in trypanosomes inhibitors of nucleic acid synthesis.

- Unit IV** : Genetic Code :  
Characteristics :- amino acids, triplet code, non overlapping code, Coumaless code, Polarity, codons and anticodons initiation and termination codons, degeneracy, Wobble hypothesis, Colinearity and universality of code.  
Deciphering the code :- Use of Homopolymers, heteropolymers and trinucleotides.  
Natural variation in the genetic code :- In codon assignment, variation in initiation, sense and termination, codons in Mitochondria site specific coding variation, read through translations of termination codons UGA and UGA, mRNA editing by insertion of nucleotides, non-triplet reading by ribosomal frame shifting.
- Unit V** : Translation : Activation and transfer of amino acids of RNA Initiation of synthesis - IFS Formylation of methionine BOS complex etc.,  
Elongation of polypeptide chain - Elongation factors, binding of aminoacyl RNA to 'A' site peptide bond formation, translocation, termination of polypeptide chain termination signal recognition, polypeptide release, processing in vitro protein synthesis system, Rate of protein synthesis - Signal hypothesis Pro and Eukaryotic protein synthesis, Inhibitors of protein synthesis.

#### Paper - XV

##### (Plant Biochemistry)

- Unit I** : Plant cell : structure and function of major cell organelles of plant cell, structure and function of plant cell wall.
- Unit II** : Photosynthesis : Structure and function of chloroplast system. Development of plastids and synthesis of photosynthetic pigments and their functions. C-4 pathway, Calvin and Hatch Pathway, Crassulacean acid metabolism.
- Unit III** : Respiration : Contribution of proteins, lipids and carbohydrates in respiration. Electron transport and energy coupling systems; generation of ATP. Effect of ethylene and cyanid on respiration, Respiration and sencecl of plant organs. Respiration and metabolic activity in wounded tissues.

- Unit IV** : Nitrogen metabolism : Structure of root nodule and organisation of plant nitrogenase system. Formation and assimilation of ammonia; Reduction of nitrate and mechanism of nitrogen fixation.
- Unit V** : Sulfur metabolism : Sulphate Activation, physiological importance of sulfate activation, Reduction of active sulfate, Respiratory and photosynthetic sulfur metabolism. Oxidation of inorganic sulfur.

### Paper - XVI

#### (Plant Nutrition and Reproduction)

- Unit I** : Concept of plant tissue culture and its application, various techniques of plant tissue culture.
- Unit II** : Reproduction in plants. Physiology of flowering senescence and seed formation. Biochemistry of fruit development and ripening. Physiology and biochemistry of seed dormancy and germination. Biochemical changes during germination of seeds.
- Unit III** : Phytohormones : Hormonal regulation of growth and development Synthesis, translocation metabolism and biochemical mode of action of auxins, Gibberelins, cytokins, Abscisic acid and Ethylene.
- Unit IV** : Water relations : Mineral nutrition in plants and translocation of elements from soil to plants, translocation of elements within the plant. Factors affecting salt absorption and translocation.
- Unit V** : Biochemistry of plant diseases and biochemical basis of resistance to plant diseases and defensive mechanisms.

### M. Sc. II - Biochemistry

#### Semester - IV

#### Practical - VII

#### (Plant Biochemistry)

- To study water imbibition of live and dead seeds.
- To study kinds of germination
- Assay of amylase and change in sugar content in germinating seeds.
- Estimations of Ascorbic acid in germinating seeds.
- Demonstration of presence of ascorbic acid in vegetable by dye method.
- Isolation of chloroplast from Spinach Leaves.
- Estimation of chlorophyll -a and -b from isolated chloroplast.
- Separation of green plant pigments by column chromatography.

- Demonstration of presence of pectin in guava by jelly formation.
- Determination of Lignin (Klason's method)
- Estimation of tannin in given sample.
- Effect of inhibitor on trypsin activity
- Isolation of plant DNA

#### Distribution of Marks in University Practical Examination (for Sem I to IV)

1. Long experiment	-	15 marks
2. Short experiment	-	10 Marks
3. Viva-voce examination	-	05 marks
4. Spotting	-	05 marks
5. Practical Record book	-	05 marks
6. Internal Assessment	-	10 marks
Total		- 50 marks

#### Project work-VIII

#### Examination of Project work:

- The examination should be held at the centers of practical examination.
- There shall be panel of examiners including Head of the department and the supervisor of the student.
- There should be at least 2 to 3 external examiners for a batch of up to 10 students or 3 to 5 external examiners for a batch of more than 10 students.
- The students should submit the project report within 20 days after the last/ final theory paper in university examination.
- The date of the viva-voce examination on project work should be within the 30 days after the completion of the theory examination.

#### Distribution of marks in project work examination:

1. Evaluation of project	-	20 marks
2. Viva-voce jointly by internal and external examiners)	-	20 marks
3. Internal assessment	-	10 marks
Total		- 50 marks

#### List of Book recommended for M.Sc. Biochemistry Semester-I to IV

- TextBook of Biochemistry by West & Tood.
- Principles of Biochemistry by Lehninger
- Principles of Biochemistry by White Handler & Smith.

4. Textbook of Biochemistry & Human Physiology by G.P.Talwar.
5. Biochemistry by Stryer.
6. Out lines of Biochemistry by Conn & Stumpf.
7. Biophysical Chemistry-by Upadhyay & Nath,Himalaya publ
8. Fundamentals of Biochemistry by ILJain,S Chand.
9. Animal Physiology by Arora M.P.,Himalaya Publication
- 10.. Practical Cytology, Genetics & Biostatistics by Goswami H:K.
11. Advances in Biotechnology by Kumar N.C.
12. Animal Nutrition and Feeding Practices by S.K.Ranjhan, Atlantic pub.
13. Biotechnology: A new Industrial Revolution by Steven prentis, Atlantic Publication.
14. The Story of Iodine Deficiency An International Challange in Nutnition Basil S. Hedzel, Atlantic Publ.
15. Nitrition & Preventive helth care by Mary Alic *Caliendo* Atlantic Publ.
16. The, Vegetarian Alternative A guide to helpful & human Diet Vick Sussma Atlantic Publ.
17. Genetics by P.S.Verma & V.K.Agrawal, S.Chand & Co. .
18. Cell Biology,Genetic, evolution & Ecology by P.S.Verma & V.K.Agrawal, S.Chand & Co.
19. Elementary Biochemistry by J.LJain, S.Chand & Co.,
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