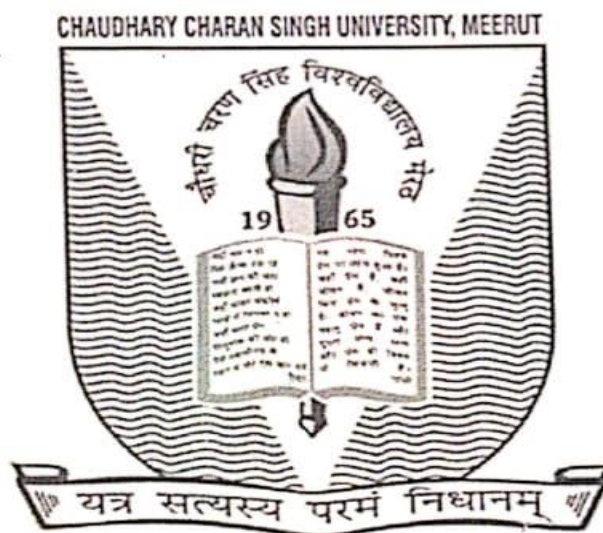


Chaudhary Charan Singh University, Meerut



Syllabus of: M.Sc. (Biochemistry)

[For fourth and fifth years of Higher education (PG)]

(As per guidelines of U.P. Government according to National Education Policy-2020
w.e.f. the session 2022-2023)

Head
Department of chemistry
C.C.S University Meerut

(For both University Campus and Colleges)

Members from the Board of Studies

S. No.	Name	Designation	College/ University	Signature
1.	Prof. M.K. Gupta	Dean, Faculty of Science	C.C.S. University Campus, Meerut	
2.	Prof. R.K. Soni (Convenor I)	Head, Department of Chemistry	C.C.S. University Campus, Meerut	
3.	Dr. Gyanendra Singh (Convenor II)	Department of Chemistry	MMH College, Ghaziabad	
4.	Dr. Sanjay Kumar	Department of Chemistry	SSV College, Hapur	
5.	Dr. Deepali Jain	Department of Chemistry	DN College, Meerut	
6.	Prof. S.K. Awashi	Department of Chemistry	Delhi University, Meerut	
7.	Prof. Alka Sharma	Department of Chemistry	Rajasthan University, Jaipur	
8.	Prof. Sanjeev Arora	Department of Chemistry	Kurukshetra University, Harayana	
9.	Dr. S.D. Kaushik	Retd. Principal	LR College, Shahibabad	
10.	Prof. Ranjana Agarwal	Director	CSIR-NISCAIR, New Delhi	



Head
Department of Chemistry
C.C.S. University Meerut



**DEPARTMENT OF CHEMISTRY
CH. CHARAN SINGH UNIVERSITY, MEERUT**

Program: M.Sc.
Program (Specific): M.Sc, Biochemistry Chemistry
Program Code: CPDBC11
Year of Implementation: 2022-23
(New Syllabus)

Program Outcomes

PO 1: To develop strong theoretical and practical background in fundamental concepts of science

PO 2: To provide platform to get opportunities in higher education for career advancement in the field of academics and research organizations

PO 3: To make the students effective in skills, tools, and techniques required for an industry/ organization or institute

PO 4: To expose the students to latest scientific knowledge, techniques and innovations and provide a platform to them to explore their research potential.

PSO 5: Its aim is to understand the fundamental chemical principles that govern complex biological systems

Program Specific Outcomes

PSO 1: Students gain systematic and coherent understanding of the fundamental concepts in Biological Chemistry and all other related allied Life Science subjects.

PSO 2: Students gain knowledge of basic aspects of Genetics and Microbiology

PSO 3: Students will be able to interpret data to address the challenges arising from the huge amount of genomic data and to overcome by analyzing through Biostatistics

PSO 4: Student will be familiar for Biological database handling and database management of different biological database.

PSO 4: Students will be able to understand the basic principle of equipment's, instruments used in the Research laboratories.

PSO 5: Instrumentation training familiarize the students with real working environments, enhances their knowledge & skills and boosts their confidence to do team work and collaborate with others.

PSO 6: Six-month project will help them to get familiar with Literature surfing, Designing of protocol, Data Interpretation and content writing.

Semester	Course Code	Course Title	Course Outcome
I	CPDBC-1111	General Chemistry	Students will learn to apply the fundamental principles of measurement, matter, atomic theory, chemical periodicity, chemical bonding, general chemical reactivity and solution chemistry to subsequent courses in science.
	CPDBC-1102	Fundamental Genetics and Microbiology	Students will learn the involvement of individual genes or groups of genes in health and disease and can Understand about genetic factors and genetic disorders in health and preventing disease .
	CPDBC-1113	Cytology and Human Physiology	. The objective of this course is to demonstrate significant cell biological principles, quantitative and analytical approaches that enable the students to translate the theoretical foundation in cell biology to be translated into human physiology.
	CPDBC-1114	Bioenergetics and Intermediary Metabolism	This course develops the skills in student to explain the concept of energy, cite examples and assess its importance to living organisms and relate the concept of entropy to the Laws of Thermodynamics. Students also able to explain the chemiosmotic hypothesis of ATP synthesis.
	General Chemistry Practical	Core Compulsory	The students are exposed to basic practical aspects of organic, Inorganic and Physical chemistry.
	Biochemistry Practical 1	Core Compulsory	Gain basic understanding Microbiology and genetics processes in the laboratory.
	Biochemistry Practical 2	Core Compulsory	The students gain hands on knowledge for quantitative and qualitative analyses of biomolecules.
II	CPDBC-1121	Plant Biochemistry	Students will able to answer the problem-based situations related to plant productivity, stress responses, chemical ecology and the production of secondary metabolites and their importance to mankind.
	CPDBC-1122	Advanced Enzymology	The major learning objective of the course is to understand the theories of enzyme kinetics, the mechanisms of enzyme catalysis, and the mechanisms of enzyme regulation in the cell.
	CPDBC-1123	Immunology	It develops the skills in students to describe how immunological responses are triggered and regulated through which they could transfer knowledge of immunology into clinical decision-making through case studies presented in class.
	CPDBC-1124	Biostatistics and Bioinformatic	The student would be able interpret the results accurate and meaningfully. They got the skills to organize vast reams of molecular biology data in an efficient manner and can develop tools that aid in the analysis of such data.
		Biochemistry Practical 3	The practical is ideal to provide opportunity to learn practically about kinetics, inhibitors and factors affecting enzymes also

			basic reactions between antigen and antibodies. practical also help students to observe various processes occur within plants
		Bioinformatics and Biostatistics Practical	The student could understand different types of Biological Databases and basics of sequence alignment and analysis and also make efficient to arrange the <i>results</i> of the hypothesis testing and make a statistical decision.
III	CPDBC-1131	Bioprocess Engineering and Fermentation Technology	The course outcomes ensure students ability for effective communication within biotech and other interdisciplinary professionals and empowers them with the ability to think and solve problems in the field of biotechnology by converting theoretical knowledge into practical.
	CPDBC-1132	Molecular Biology	They will understand the central dogma of biology and predict outcomes when the process malfunctions and gain skills required doing effective scientific research.
	CPDBC-1133	Clinical Biochemistry	They further able to understand the processes of drug designing and would be able to explain how the biochemical processes and signal transduction pathways.
	CPDBC-1134	Biophysics and Biochemical Technology	The course is particular designed to understand principles underlying the various biochemical techniques .
		Biochemistry Practical 4	The practical under this course enhance confidence in students to work with genetic material and make them to understand the basic mechanism of various Analytical Techniques.
		Biochemistry Practical 5	To be skilled in tissue culture and review the information of test and diagnose clinical disorders.
	Industrial Training		To provide the real insight of working procedure and environment of industries. Students will learn advanced tools and techniques, relate, apply and adapt relevant knowledge and skills to compete in the job market with this experience and exposure.
IV		Project and Dissertation:	Students gain the knowledge in research methodology and develop skills for literature survey, protocol designing, Result interpretation and thesis writing.

Value Added Courses

Course Code	Paper Title	Core Compulsory/ Elective/AE/DSE/SEC/Value added	Theory/ Practical	Credits	Teaching Hours
VCB-1	Medicinal Biochemistry	Value added	Theory (20) /Practical (10)	3	30

Value added courses Prerequisites

Students from all courses of University Campus and Colleges are eligible.

Value added courses outcomes

1. **(VBC-1) Medicinal Biochemistry:** It help students in correlating between pharmacology of a disease and its mitigation or cure. They could know the structural activity relationship of different class of drugs and gain knowledge about the mechanism pathways of different class of medicinal compounds.



**DEPARTMENT OF CHEMISTRY
CH. CHARAN SINGH UNIVERSITY, MEERUT**

**Program: M.Sc.
Program (Specific): M.Sc. BioChemistry
Program Code: CPDBC-11
Year of Implementation: 2022-23**

Course Structure and Evaluation Scheme

Course Duration: Four Semesters

Course Type: Self-financed

Pass Percentage: Theory-40% Practical- 40% Overall- 40%

Attendance Criterion: As per the norms decided by the statutory body

Maximum marks: 2100

Percentage range for Division: First-60%

						Ex t	Int	Tota l	
FIRST SEMESTER									
1	I	CPDBC-1111	General Chemistry	Core Compulsory	Theory	50	50	100	05

	CPDBC-1102	Fundamental Genetics and Microbiology	Core Compulsory	Theory	50	50	100	05
	CPDBC-1113	Cytology and Human Physiology	Core Compulsory	Theory	50	50	100	05
	CPDBC-1114	Bioenergetics and Intermediary Metabolism	Core Compulsory	Theory	50	50	100	05
	CH-507	Chemistry Practical	Core Compulsory	Practical	-	100	04	
		Biochemistry Practical 1	Core Compulsory	Practical	-			
		Biochemistry practical 2	Core Compulsory	Practical	-			

SECOND SEMESTER

II	CPDBC-1121	Plant Biochemistry	Core Compulsory	Theory	50	50		05
	CPDBC-1122	Advanced Enzymology	Core Compulsory	Theory	50	50		05
	CPDBC-1123	Immunology	Core Compulsory	Theory	50	50		05
	CPDBC-1124	Biostatistics and Bioinformatic	Core Compulsory	Theory	50	50		05
		Biochemistry Practical 3	Core Compulsory	Practical	---	100	04	
		Bioinformatics and Biostatistics Practical	Core Compulsory	Practical				

THIRD SEMESTER

2	III	CPDBC-1131	Bioprocess Engineering and Fermentation Technology	Core Compulsory	Theory	50	50		05
		CPDBC-1132	Molecular Biology	Core Compulsory	Theory	50	50		05

		CPDBC-1133	Clinical Biochemistry	Core Compulsory	Theory	50	50		05
		CPDBC-1134	Biophysics and Biochemical Technology	Core Compulsory	Theory	50	50		05
			Biochemistry Practical 4	Core Compulsory	Practical	-			
			Biochemistry Practical 5	Core Compulsory	Practical				
			15 days Instrumentation Training	Core Compulsory	Practical		100	100	04

Fourth Semester

	IV	CPDBC-PR	Six Month Project	Core Compulsory	Practical	-	-	600	25
		CVPDBC-1115	Medicinal Biochemistry	Value Added	Theory				03

Sem	Course Code	Course Title	Syllabus
I	CPDBC-1111	General Chemistry	<p>Unit 1: Basics</p> <p>Electronic Theory of valency, dipole moments, electronic displacements in a molecule-inductive effect, electrometric effect, resonance effect; hyperconjugation, Bonding Interaction, hydrogen bond, Vander Waal interaction, electrostatic force, hydrophobic interaction, Atomic and molecular orbital and concept of hybridization. Types of Organic Reactions in brief Substitution, (SN1, SN2), addition, elimination, rearrangement condensation and polymerization, mechanism of substitution in benzene ring: o-, p- and m- directing groups,</p> <p>,</p> <p>Unit 2: Hetero cyclic compounds</p> <p>Heterocycle system occurring in living systems: Numbering of the ring and properties of pyran, Furan, thiazole, indole, pyridine, pyrimidine, quinoline, purine, Free radical in biological system: oxygen as a free radical in auto oxidation of Fats, antioxidants.</p> <p>Unit 3: Stereochemistry</p> <p>Structural isomerism, stereoisomerism, geometrical isomerism (E and Z nomenclature), Optical isomerism, optical activity, meso compound, chirality, enantiomers, diastereoisomer, D, L, R, S, threo, erythro, conformation and configuration, conformational analysis of n- butane, cyclohexane, mono and di substituted cyclohexane, (boat and chair forms), Anomers and mutarotation.</p> <p>Unit 4: Electrochemistry</p> <p>Types of electrodes, standard electrode potential and its determination, its relationship with emf, electron transfer measures, Nernst equation, phosphate group transfer potentials, coupled reactions</p>

Unit 5: Water

Physical properties and structure of water, hydrogen bonding, ionization of water, pH scale, acid bases, Henderson- Hasselbalch equation, buffers, buffer solution and their action, ionization behavior of amino acids and protein, titration curve, buffer solutions and their action

Unit 6: Thermodynamics

Open, closed and isolated system, first law of thermodynamics, heat of formation and heat of reaction, second law of thermodynamics and calculation of entropy, Gibbs free energy, application of the first and second law of thermodynamics in understanding in living cells and chemical potential, equilibrium constant

**CPDBC -
1112**

**Fundamental Genetics
and Microbiology**

Unit1: Genetics

Nature of Genetic Material, Chromatin, Chromosomes and Genes, Mutation and mutagenesis: Types and mechanism of mutagenesis, Detection, Molecular basis and application, Biochemical event occurring during Mitosis and meiosis, Transposons, Transposition in human Chromosomes, Chromosomal Abnormality,

Unit 2: Mendelian Inheritance

Mendelian Genetics and Analysis: Extension of Mendelian Analysis, Mendelian Inheritance Chromosomal Basis of Inheritance, Genetic Recombination in Eukaryotes: Linkages and Crossing Over, Chromosome mapping, Chromosomal number (Euploidy and aneuploidy) and structural variation (Deficiencies, Duplications, Inversion and Translocation), Tetrad analysis, and Gene Conversion, Non-mendal inheritance,

Unit 3: Gene Regulation and Developmental Genetics

			<p>Gene expression regulation during differentiation and growth: Heterochromatization in human being and other mammals, dosage compensation, Mechanism, Sex chromatin Position effect.</p> <p>Developmental Genetics: Model system Drosophilla, Genetic screen, Pattern formation, Maternal effect, Homeotic Transformation</p> <p>Unit 4: Microbiology</p> <p>Types of Microorganism, general characteristics of main Group of microorganisms, Criteria used in the classification of microorganism, nutrition and growth of microbial cell, gram positive and gram-negative organism Lytic and lysogenic life cycle of Bacteriophages, Basic microbial genetics. Special feature of bacterial metabolism Entner-Doudroff Pathway, modified ED pathway</p> <p>Unit5:Microbiology and its application</p> <p>Role of Microorganism in Nitrogen Carbon, Sulphur and Phosphorus cycle, food spoilage, Fermentation, food borne Infection, Involvement of Microorganism in Domestic and Industrial sewage</p> <p>.</p>
CPDBC-1113	Cytology and Human Physiology		<p>Unit 1: Cell Organization</p> <p>Structural organization and function of prokaryotic and Eukaryotic intracellular organelles Cell wall, Nucleus, Mitochondria, Ribosomes, Golgi bodies, lysosomes, Endoplasmic reticulum, peroxisomes, plastids, Vacuoles, Chloroplast, structure and function of cytoskeleton and its role in motility, Cell cycle and their checkpoints, Mitosis and meiosis, their regulation steps in cell cycle and control, programmed cell death, ageing, senescence, apoptosis, CDK, Cyclin</p> <p>Unit 2: Cellular communication</p>

cell adhesion and role of different adhesion molecules, gap junction, ionophores, porin, nuclear pores, extracellular matrix, integrins.

Unit 3: Cancer

Characteristics of normal and transformed cell, Genetic rearrangement in progenitor cells, oncogenes, Proto-oncogenes, P53 and Rb as tumor suppressor genes, virus induced cancer, metastasis and interaction of cancer cell with normal cells, apoptosis and therapeutic intervention of uncontrolled cell growth, molecular approaches to Cancer Treatment.

Unit 4: Human Physiology1

Digestive system: Composition, function and regulation of saliva, gastric, pancreatic, intestinal and bile secretion, Digestion and absorption of carbohydrate, lipids, proteins, nucleic acids, minerals and vitamins.

Excretory system: Kidney, structure of nephron, glomerular filtration, Formation of Urine,, tubular reabsorption of glucose, water and electrolytes and tubular secretion

Endocrine system: Human hormone, basic mechanism of hormone action.

Unit 5: Human Physiology 2

Blood: Blood corpuscles, composition and function of plasma proteins, hemoglobin: synthesis and estimation, blood coagulation : its component and mechanism, role and clinical importance of 2,3- DPG, Bohr effect and chloride shift, transfer of blood gases: O₂ and CO₂, acidosis and alkalosis

Biochemistry of vision and muscle contraction

1.

CPDBC-1104

Bioenergetic and Intermediary Metabolism

Unit 1: Carbohydrate Metabolism

Approach for studying metabolism

Glycolysis, Citric Acid Cycle, its function in energy generation and biosynthesis of energy rich bonds, Glyoxylate cycle, Pentose phosphate pathway and its regulation, alternate pathway of carbohydrate metabolism, Gluconeogenesis, interconversion of sugars, biosynthesis of glycogen, starch and oligosaccharides, glyoxylate cycle, regulation of blood glucose, hormonal regulation of carbohydrate metabolism

Unit 2: Fatty Acid Metabolism

Digestion and absorption of dietary lipids

Fatty acid biosynthesis: acetyl CoA carboxylase, fatty acid synthetase, desaturase and elongase, biosynthesis of saturated and unsaturated fatty acid,

Fatty acid oxidation: α , β , γ oxidation and lipo-oxidation

Lipid biosynthesis: biosynthesis of triacyl glycerol and phosphoglycerides and sphingolipids, biosynthetic pathways for terpenes, cholesterol, steroids and prostaglandins, ketone bodies: formation and utilization
Metabolism of circulating lipids, chylomicron, LDL, HDL and VLDL, free fatty acids, lipids level in pathological conditions

Unit 3: Amino acid & Nucleic acid Metabolism

Amino acid: Classification, Chemical structure and general properties of amino acid
general concept of Amino acid metabolism, Peptide bond, Ramachandran Plot, Protein and its level of structure, intracellular proteins degradation (lysosomal, ubiquitin- the proteosomes) transamination, oxidative deamination, urea cycle and its regulation

Nucleic acid: De novo synthesis and salvage pathway of purine and pyrimidine nucleotides, regulation and degradation of purines and pyrimidines nucleotide, structure of ribonucleotides reductase, biosynthesis of ribonucleotides and deoxyribonucleotides and its regulation, Inhibitors of nucleotide metabolism

Unit 4: Biological oxidation

Biological oxidation, oxygenase, Hydroxylases, Dehydrogenases, and membrane potential, photon energy interconversion, chemotaxis and chemoreceptors, chemiosmotic theory, ion transport across energy transducing membranes, influx and efflux mechanism, transport and distribution of cations, anions and ionophores, uniport, antiport and symport mechanism, active and passive transport system, shuttle system, The mitochondrial respiratory chain, order and organization of carrier protein, proton gradient, p/O and H/P ratio, oxidative phosphorylation, uncouplers and inhibitors of energy transfer, fractionation and constitution of respiratory chain complexes.

ATP- synthetase complex, microsomal electron transport, partial reduction of oxygen, superoxide

Unit 5: Cell signaling

Types of signals and Cell surface receptor, signalling through G-Protein and receptor tyrosine kinase mediated signalling, Ca²⁺ flux and its interpretation in cytoplasm, Role of calcium binding protein, Importance of integrin in signalling, coupled receptor, Signal transduction pathway, second messenger and regulation of signalling pathway

II	CPDBC-1121	Plant Biochemistry	Unit 1: Plant Cell
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Structures and functions of plant cell (including cell wall, plasmodesmata, meristematic cells, vacuoles, secretory system and root quiescent zone)

Unit 2: Photobiology

Structure of organelles involved in photosynthesis in plants and bacteria, proton gradient and electron transfer in chloroplast of plant and in purple bacteria-differences from mitochondria, light receptors-chlorophyll, light harvesting complexes, bacteriorhodopsin, rhodopsin as an ion pump.

Hill reaction, photophosphorylation and reduction of CO₂

Unit 3: Primary Metabolites

C₂, C₄ and CAM metabolism, light and dark reactions, light activation of enzymes, regulation of photosynthesis, photorespiration, biological nitrogen fixation and ammonia assimilation, nitrate and sulphate reduction and their incorporation into amino acids translocation of organic and inorganic substances.

Unit 4: Metabolites

Special features of secondary plant metabolism, formation of phenolic acids, tannins, lignin, pigments, terpenes, terpenoids, plant phenolics alkaloids and surface waxes-their biosynthesis and functions.

Unit 5: Plant Hormones

Growth regulating substances and their work of action, molecular effects of auxins In regulation of cell extension and of gibberellic, abscisic acids and cytokinin in the regulation of seed dormancy, germination, growth and development and embryogenesis.

Biochemistry of seed development and fruit ripening defense system in plants

Unit 1: Introduction

Characteristics of enzyme, isolation and purification of enzyme, methods of enzyme analysis, coenzyme, holoenzyme, prosthetic group and cofactor, IUB system of enzyme, nomenclature and classification, specific activity, activation energy, active site, factor affecting rate of enzyme catalyzed reaction, enzyme assay, collision and transition state theory, Multiple forms of enzyme: Zymogen, Isozyme, Abzyme, Ribozyme, Multienzyme complex.

Unit 2: Enzyme Kinetics

Uni and multi substrate reaction with e.g. of each class, concept of ES complex, steady state hypothesis and Derivation and Modification of Michelis & Menton equation and their significances, different plot for determination of K_m and V_{max} and their physiological significance, K_{cat}/K_m and its importance. Multi substrate Reaction: Sequential and Ping Pong Mechanism with Examples, enzyme turnover and its significance,

Unit 3: Enzyme Catalysis

Experimental approach to study enzyme action: orientation and proximity effect, Acid-Base catalysis, covalent catalysis, nucleophilic catalysis, and microenvironment, mechanism of action of serine protease, chymotrypsin, lysozyme, ribonuclease and triose phosphate isomerase.

Enzyme Inhibition: reversible and irreversible inhibition, Determination of KI

Unit 4: Enzyme Regulation

General mechanism of enzyme regulation feedback inhibition, feed forward stimulation, Enzyme repression. induction and degradation, control of enzyme activity by product and substrate, covalent modification of enzyme, Allosteric concept with special reference to aspartate transcarboxylase and phosphofructokinase. concerted and sequential model for action of allosteric Enzyme, Positive

and Negative Cooperativity, Half site activity Hill Plot, Scatchard Plot monocyclic and multicycle cascade system with specific e.g

Unit 5: Enzyme Technology

Immobilized Enzyme and its Industrial application, Enzyme engineering, Enzyme Therapy: Assay of Enzyme activity for Diagnostic Purpose

CPDBC-1123

Immunology

Unit 1: Introduction to Immune System

Innate and acquired immunity, active and passive immunity, humoral and cell mediated immunity, primary and secondary immune modulation, haptens and adjuvant, Hematopoiesis, structure and function of primary and secondary lymphoid organs and cells of immune system, T and B cells lymphocytes with subsets and surface markers, Antigen presenting cells, Immune responses against foreign particle.

Unit 2: Nature of Antigens and Antibody

Structure and function of immunoglobulin, classes and subclasses of immunoglobulin with its biological activity, antigen antibody interaction, epitope and paratope, Antigen, vs. immunogenicity, factor that influence immunogenicity, immunoglobulin as antigen, clonal selection theory Generation of diversity in immune system. Monoclonal antibodies: production and purification

Unit 3: Immune activation

Major histocompatibility complex, polymorphism of MHC genes. HLA and H2 system, MHC antigen in transplantation, antigen processing and presentation: endogenous and exogenous response, T- cell diversity, T-cell

activation and differentiation, B-cell activation and proliferation.

Unit 4: Immune Effector Mechanism

Cytokines, Complement System, Vaccination, Transplantation and graft rejection, ELISA, RIA, ELISPOT Assay, Immunoelectrophoresis, Immunofluorescence.

Unit 5: Immunity and Infection

Autoimmunity, Hypersensitivity
Immunotherapy, Immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infection, Congenital and Acquired immunodeficiency.

CPDBC-1124

Biostatistics and Bioinformatics

Unit I: Introduction to Biostatistics

Aim and scope of statistics in biological sciences, Basic definition and applications, sampling and techniques, Data Collection and presentation: Types of data, methods of collection and graphic representation of data,
Measure of central tendency: mean median and mode
Measure of Variability: Standard deviation, standard error, Mean Deviation and coefficient of variation, correlation and regression, linear regression and regression equation.
Test of significance: Chi-square test, t-test, Z-test, f-test and standard error
Introduction to probability theory and distribution

Unit II- Introduction to Computer

Basic organization of computers, CPU, Input and Output devices, Personal computers, Mainframes and supercomputers, Hardware and software, Introduction to windows as an operating system, file and folders, commonly use commands, Basics of common application software packages for word processing (MS word), Spreadsheet (MS Excel) and Presentation (MS PowerPoint)

			<p>Unit III- Introduction to Bioinformatics:</p> <p>Bioinformatics and its relation with molecular biology with applications. Human genome Project, Examples of related tools (FASTA, BLAST, BLAT, RASMOL), databases (GENBANK, PubMed, PDB) and software (RASMOL, Ligand Explorer). Data generation; Generation of large-scale molecular biology data (Through Genome sequencing, Protein sequencing, Gel electrophoresis, NMR Spectroscopy, X-Ray Diffraction, and microarray), Important bioinformatics resources (NCBI, EBI, SIB).</p> <p>Unit IV- Biological Databases:</p> <p>Introduction to data types and Source, Primary & Secondary Database, Primary & Secondary nucleotide sequence database (GenBank, EMBL, DDBJ, (TrEMBL) Primary & Secondary Protein sequence database- (PIR, SWISS PROT, PROSITE, Pfams, PRINTS, UniProt), Primary & Secondary Molecular Structure database (-PDB, CSD, CATH, SCOP) Composite and other database.</p> <p>Unit V- Sequence Analysis:</p> <p>Concept of Scoring matrix (PAM and BLOSUM), local alignment, global alignment, multiple sequence alignment (Clustal W algorithm), Heuristic Method-FASTA and BLAST and their types, similarity searching scores and their statistical interpretation, BLAT PS I & PI II BLAST. introduction to Phylogenetic: Phylogenetic Basics, Tree styles, Terminologies, types of phylogenetic tree, Distant based method – (UPGMA, NJ) Character Based Method - (MP and ML).</p>
III	CPDBC-1131:	Bioprocess Engineering and Fermentation Technology	<p>Unit 1: Recombinant DNA technology</p> <p>Methods of creating recombinant DNA molecules, spacing properties of restriction enzymes and their modes of action, selection screening, y, synthesis of genes, cloning vector(lambda phage, plasmid, M-13 phage, Cosmid, BAC,YAC) shuttle vectors yeast and viral vector, expression vectors production in</p>

bacteria, cloned genes, subcloning, sequencing by Sanger's method, protein production in bacteria, site directed mutagenesis, AFLP, PCR, RAPD, antisense- RNA technology, chromosomal walking, jumping, landing , DNA chips, mycelium cell fusion ,selection of hybrid, hybridomas, protoplast fusion and HAT-medium, screening assay.

Unit2: Plant cell culture

Micropropagation, somatic cell culture, somaclonal variation, somatic cell hybridization, protoplast isolation, protoplast fusion, protoplast culture, genetic transformation various method for gene transformation (all vectors and vector less method), production of transgenic plants and their uses, production of secondary metabolites, primary and transferred cell culture, differentiated cell in culture

Unit 3: Animal Cell Culture

Primary cell culture and established cell line, measurement of viability and cytotoxicity, characterization of culture cell, disaggregation of tissues and primary culture, maintenance of cell culture, cell separation, scaling up of animal cell culture, cell synchronization, cell transformation, application of cell culture

Unit 4: Genomics and Proteomics

Structural, functional and comparative Genomics, construction of cytological maps based on banding Pattern, construction of DNA library, genomic Vs. cDNA library, Sequence-tagged sites (STSs), Expressed sequenced Tags (ESTs), microsatellites, Variable number tandem repeats,
The Human Genome Project- mapping and sequencing of Human Genome, Proteomics and proteome, RNA and Protein assays of genome function and expressed sequences

Unit 5: Fermentation Technology

		<p>Primary and secondary metabolites in biotechnology, continuous and batch type culture technique, principal types of fermenter, general design of fermenter, fermentation process brewing, manufacture of penicillin, production of single cell protein, production strategies for antibodies and other organic compounds</p> <p>.</p>
<p>CPDBC-1132</p>	<p>Molecular Biology</p>	<p>Unit 1: DNA</p> <p>DNA as genetic material-Biochemical evidence, Primary, secondary and three-dimensional structure of DNA, Circular and Spherical DNA, Satellite and Repetitive DNA, Structure of Chromosomes and Chromatin, Heterochromatin, Euchromatin, DNA Supercoiling, Denaturation and Renaturation of DNA, Histones, Nucleosomes, DNA replication, DNA repair and Recombination c-values paradox, cot curve, counterions</p> <p>Unit 2: RNA</p> <p>Role of RNA, Types of RNA, Primary and Secondary structure of RNA, Transcription – DNA directed RNA synthesis, Transcription Factor, RNA polymerase, Initiation, Elongation, and Termination of transcription, RNA processing, inhibitors of transcription, post transcriptional Modification—Splicing, cap addition, Polyadenylation, RNA directed DNA synthesis</p> <p>Unit 3: Translation</p> <p>Structure and function of ribosome, genes, split genes, general features of genetic code, identification of genetic codes, identification of anticodon, wobble hypothesis, initiation elongation & termination of protein synthesis in prokaryotes and eukaryotes, post translation modification of protein, protein sorting and targeting</p>

Unit 4: Gene Regulation in Prokaryotes and Eukaryotes

Interaction between DNA-DNA binding protein in eukaryotes, short term and long term, regulation of gene expression, DNA binding protein to regulate transcription, (Zinc Finger, Leucine, Zipper, Helix loop Helix protein), DNA methylation coordination positive and negative control of gene –operon model, inducible system-lactose and arabinose operon, repressible system-tryptophan operon, lytic cascade and lysogenic, repression attenuation and antitermination, antisense RNA

Unit 5: Transposable genetic element

Transposons, prokaryotic transposable genetic elements and mechanism of transposition, eukaryotes transposable genetic element in yeast, drosophila and maize, reassociation kinetics, Transgenic Organism.

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CPDBC-1133

Clinical Biochemistry

Unit1: Introduction, symptoms and treatment of Metabolic disorders

Disorder associated with Carbohydrate: Glucuronic acid pathway, glycogen storage disease; factors influencing blood glucose level, pentosuria, Diabetes mellitus, Galactosemia

Protein calorie malnutrition- Kwashiorkor and Marasmus; Ketone bodies, ketosis caused by abnormal metabolic pathway of Fatty acid, Disorders associated with protein and lipid metabolism: Gaucher's disease, Tay- Sach's, Niemann Pick Diseases, Alkaptonuria, Cystic

Unit 2: Introduction, symptoms and treatment of Inherited Disorders

Phenylketonuria, Alkaptonuria, Albinism, Lesch-Nyhn syndrome, Down syndrome, Cystic fibrosis, Thalassemia, Turner's syndrome, Cirrhosis, Klinefelter Syndromes.

		<p>Unit 3: Clinical analysis;</p> <p>Clinical investigation of sugar levels in blood and urine, carbohydrate tolerance tests, haemorrhagic disorders, disseminated intravascular coagulation, acquired prothrombin complex disorders, Functional test of liver, kidney, thyroid, gastrointestinal and pancreas, biochemical diagnosis of diseases by enzymatic assays, Clinical tissue analysis: biopsy and liquid biopsy, Molecular diagnostic tests</p> <p>Unit 4: Vitamins and Minerals</p> <p>Role of Vitamins in metabolic processes and various diseases resulting from the deficiencies of vitamins. Biochemistry of vitamin and minerals and diseases with their deficiency</p> <p>Unit 5: Pharmacology</p> <p>History of development of pharmacology, introduction & general principles for route of drug administration, pharmacokinetics (absorption, distribution, metabolism and excretion) and pharmacodynamics (general mechanism of drugs). Clinical trial and drug development; Study of drug discovery, preclinical studies and phases of clinical trials in drug development.</p>
CPDBC-1134	Biophysics and Biochemical Techniques	<p>Unit 1 : Spectroscopy</p> <p>Nature of electromagnetic radiations; Basic principle, instrumentation and applications; Atomic absorption and emission spectroscopy and its application, Principles and application of biophysical methods used for analysis of biopolymer structure-UV, Visible, Infrared, X-ray diffraction, Raman, Fluorescence and NMR spectroscopy, ORD and CD</p> <p>Unit 2: Electrophoretic technique</p> <p>General principles and instrumentation, Factors affecting mobility migration of charged particles in an electric field, Electrophoresis of proteins -Native PAGE, SDS-PAGE, Gradient gels, isoelectric focusing gels, two-dimensional</p>

PAGE, Detection estimation and recovery of proteins in gels, Northern, Southern and Western Blotting, Electrophoresis of Nucleic Acid- Agarose gel electrophoresis, Pulse field electrophoresis

UNIT 3: Chromatography:

Principle and application of normal and reverse phase chromatography, paper and thin layer chromatography, column chromatography: adsorption & gas liquid chromatography, ion exchange, Affinity chromatography, HPLC—Basic principle, instrumentation and application

UNIT4: Centrifugation:

Basic principle, relate centrifugal force, instrumentation factors affecting sedimentation velocity, sedimentation coefficient, determination of molecular weight, differential centrifugation, density gradient, rate zonal, isoprene centrifugation

Unit 5: Radioisotope technique & microscopy

Types of Radioactive decay; rate of radioactive decay; radioactive isotopes and their half - lives; Units of radioactivity; Measurement of radioactivity-methods based upon gas ionization & excitation; quenching emulsion counting, Geiger Mueller counter Autoradiography; Specific activity of radioisotope; Safety aspects; Radiation Dosimetry; Detection and measurement of isotopes and application of isotopes in biological science

Microscopy: Light microscopy, electron (scanning and transmission) microscopy, and phase contrast, freeze-etch and freeze-fracture methods for EM staining of organelles and marker enzyme, resolving power of different microscopes

Industrial Training

**DEPARTMENT OF CHEMISTRY
CH. CHARAN SINGH UNIVERSITY, MEERUT**

**Program: M.Sc.
Program (Specific): M.Sc. BioChemistry
Program Code: CUHB58
Year of Implementation: 2022-23
(New Syllabus)**

**Medicinal Biochemistry
(Value added course: VBC-1) Total Lectures: 30**

Theory (Lectures: 20)

Unit1: Nutritional and Medical Biochemistry: -

Obesity, starvation, balanced diet, basal metabolism rate and body mass index, vitamins and its deficiency related diseases

Cancer and introduction to carcinogens and oncogenes, AIDS, HIV or HPV, CT scan, MRI, X- RAY, Electro cardiogram, ELISA, RIA,

Unit 2: Carbohydrate, protein and Lipid metabolism disorders: -

Diabetes mellitus, glucose and galactose intolerance test, glycogen storage disease, pentosuria, galactosaemia, hyperlipidaemia, ketoacidosis, phenylketonuria, metabolism inborn errors

Unit3: Diagnostic tests: -

Blood group testing, liver and bile function test, renal function test, pulmonary function test, thyroid test, blood sugar level test, SPO2 monitoring.

Unit 4: Introduction to defence mechanism of body: -

Human defence system and its mechanism, Antigen and Antibody, Auto immune disorders, Sickle cell anaemia, Jaundice, malaria, typhoid, Bacterial, fungal and viral infections, skin diseases.


**Coordinator
Biochemistry
C.C.S.U. Meerut**

