JAYA COLLEGE OF ARTS AND SCIENCE,THIRUNINRAVUR-602024.

DEPARTMENT OF CHEMISTRY

M.Sc. BIOCHEMISTRY

ACADEMIC YEAR 2020-2021

PROGRAMME OBJECTIVES

- PO1: In order to make students more career oriented and nurturing their scientific temperaments students will get exposure to the depth of core understanding of various dimensions of Biochemistry during these two years the study.
- PO2 : The training provided will give students the breadth and depth of scientific knowledge.
- PO3: A strong understanding of fundamentals of biochemical process at an advanced level.
- PO4: Better understanding of major thrust areas of the discipline Knowhow on current developments in the biochemical research
- PO4: Perfect gain insight into biochemical research ethics for production of quality research and publication.
- PO5: An ability to get engages them in lifelong learning to foster their growth as a successful researcher and established as an entrepreneur in the field of biochemistry
- PO6: To provide advanced-level training in biochemistry so that graduates of the programme can carry out research and out-reach activities, and innovation in the medical, agricultural and industrial sectors.
- **PO7:** To produce well trained, nationally and internationally competent post graduates.
- **PO8** To develop a fascination and passion for science that enables them to strive for success inscientific settings.
- **PO9:** Be able to do analyses, research and innovation in their work.

PROGRAMME OUTCOMES

- **PO 1 :** Understanding of the scientific basis of life process and orientation towards the application of knowledge acquired in solving clinical problem.

- **PO2:** Biochemistry master's students will be able to demonstrate an understanding of fundamental biochemical principles, metabolic pathways and the regulation of biochemical processes

- **PO 3** : Enhancing student's skills & employability through academic, research and internship opportunities (PG service learning).

- **PO 4 :** Exposure to basic research through the provision of PG research based project.

- **PO 5 :** Developments of analytical and Cognitive skills in Biochemistry that allow independent exploration of biological science through research methods.

- **PO 6 :** Acquiring an appreciation of impact of life science on society.

- **PO 7 :** Analysis & interpretation of investigative data in life science.

- **PO8:** They will gain the hands on knowledge of various techniques useful in biochemistry whichcan help them to stand with a skillful job at various industries and research labs

- **PO9:** Students get ready to apply informatics and statistics to explore biological data for experimental and research purpose.

- **PO10** They acquire communication skill, team work strength and leadership qualities throughvarious activities during their course work.

COURSE STRUCTURE

I SEMESTER

Course Components/Title of the paper	Credits	MARKS		
		CIA	EXT	TOTAL
Core Paper – I : Biomolecules	4	25	75	100
Core Paper – II : Biochemical Techniques	4	25	75	100
Core Paper – III : Physiology and Cell Biology	4	25	75	100
Elective Paper – I :Microbiology	3	25	75	100
Soft Skill – I	2	40	60	100

II SEMESTER

Course Components/Title of the paper	Credits	MARKS		
		CIA	EXT	TOTAL
Core Paper – IV: Enzymes and Enzyme Technology	4	25	75	100
Core Paper – V :Intermediary Metabolism-I	4	25	75	100
Core Paper – VI : Intermediary Metabolism-II	4	25	75	100
Core Paper – VII : Practical-I	3	40	60	100
Core Paper – VIII : Practical-II	3	40	60	100
Elective Paper – II : Energy and drug metabolism	3	25	75	100
Extra Disciplinary Paper – I : Essential Biochemistry	3	25	75	100
Soft Skill – II	2	40	60	100
*Internship	2			

*** Internship will be carried out during the summer vacation of the first year and marks should be sent to the University by the College and the same will be included in the Third Semester Marks Statement.**

III SEMESTER

Course Components/Title of the paper	Credits	MARKS		
		CIA	EXT	TOTAL
Core Paper – IX :Biotechnology	4	25	75	100
Core Paper – X: Clinical Biochemistry-I	4	25	75	100
Core Paper – XI: Molecular Biology	4	25	75	100
Elective Paper – III: Biostatistics	3	25	75	100
Extra Disciplinary Paper – II : Life style - diseases Prevention	3	25	75	100
Soft Skill - III	2	40	60	100

IV SEMESTER

Course Components/Title of the paper	Credits	MARKS		
		CIA	EXT	TOTAL
Core Paper – XII : Hormones	4	25	75	100
Core Paper – XIII :Clinical Biochemistry-II	4	25	75	100
Core Paper – XIV: Practical-III	4	25	75	100
Core Paper – XV: Project and viva	3	25	75	100
Elective Paper IV: Signal transduction	3	25	75	100
Elective Paper V: Immunochemistry	3	25	75	100
Soft Skill - IV	2	40	60	100

COURSE OBJECTIVES & COURSE OUTCOMES FOR M.Sc BIOCHEMISTRY

SEMESTER –I

COURSE TITLE	BIOMOLECULES
CODE	MEN1A

COURSE OBJECTIVES

CO1: The objective is to study about the structure and biological functions of macromolecules such as proteins, polysaccharides, lipids, and nucleic acids, as well as small molecules such as primary metabolites, secondary metabolites, and natural products.

CO2: Analyse and study the chemical and biochemical properties of bio molecules

CO3 : To understand relationships between biological molecules and human health

CO4: Easily understand the basic concepts/functions of solutes, chemical bonding and organic compounds

COURSE OUTCOMES

After the completion of this course, the student will be able to

CO1: Understand biochemistry at the atomic level, draw molecules and reaction mechanisms perfectly.

CO2: Understand in detail about amino acid structures, types of amino acids, classifications, structure of proteins and types of proteins.

CO3: Learn the molecular structures of amino acids, differentiating essential and non-essential amino acids, biologically important modified amino acids and their functions. Recognize thes tructural levels of organization of proteins,3D structure of proteins, its functions, denaturation (hemoglobin, myoglobin etc.).

CO4: Describe/recognize lipid and porphyrin structures, lipoproteins and functions of porphyrins (heme, chlorophyll etc.). Chemistry and Metabolism of Proteins and Lipids and Porphyrins

CO5: Understand the relationship between the properties of macromolecules and cellular activities, cell metabolism and chemical composition.

Syllabus

UNIT-I

Carbohydrates- classification, structure, function and properties of monosaccharides (glucose, galactose, fructose), Disaccharides (lactose, cellobiose, sucrose, maltose). Homopolysaccharides (starch, glycogen, cellulose, inulin, dextrin, agar, pectin, dextran) Glycosaminoglycans– source, structure, functions of hyaluronic acid, chondroitin sulphates, heparin, keratan sulphate, proteoglycans. O- Linked and N-linked glycoproteins. Bacterial cell wall (peptidoglycans, teichoic acid) and plant cell wall carbohydrates.

UNIT-II

Lipids – classification of lipids, structure, properties and functions of fatty acids, triglycerides, phospholipids, glycolipids, sphingolipids and steroids. Eicosanoids-classification, structure and functions of prostaglandins, thromboxanes, leukotrienes. Lipoproteins – structure, function and mechanism of transport.

UNIT-III

Amino acids – classification, structure and properties of amino acids. Proteins – classification based on composition, structure and functions. Primary, secondary, super secondary and quaternary structure of proteins. Determination of amino acid sequence. Forces involved in stabilization of protein structure. Ramachandran plot. Folding of proteins. Structural characteristics of collagen and hemoglobin.

UNIT-IV

Nucleic acids – types and forms (A, B, C and Z) of DNA. Watson-Crick model- Primary, secondary and tertiary structures of DNA. Triple helix and quadruplex DNA Mitochondrial and chloroplast DNA. DNA supercoiling. Determination of nucleic acid sequences by Maxam Gilbert and Sanger‟s methods. Forces stabilizing nucleic acid structure. Properties of DNA and RNA. C-value, C-value paradox, Cot curve. Structure and role of nucleotides in cellular communications. Major and minor classes of RNA and their structure.

UNIT-V

An overview of vitamins – source, structure and functions of water soluble and fat soluble vitamins – vitamin preparation, enrichment and fortification – overload and criteria of food sources. Antioxidants and oxidative stress. Phytochemicals – structure and functions of carotenoids, flavonoids, triterpenoids, polyphenols and lipoic acid.

COURSE TITLE	**BIOCHEMICAL TECHNIQUES**
CODE	**MEN1B**

COURSE OBJECTIVES

To develop the skills of the application of basic and advanced techniques employed in quantitative and qualitative analysis of biomolecules.

COURSE OUTCOMES

After the completion of this course, the student will be able to

CO1: Demonstrate broad knowledge in modern analytical instrumentation with deep knowledge in its core concepts and its applications.

CO2: Understand the principle, Instrumentation of different types of Light microscopy and electron microscopy and its applications in various fields of research**.**

CO3: Acquire knowledge about the basics and latest developments in the instrumentation techniques of Centrifugation, Electrophoresis (IEF, 2D PAGE) and Chromatography and their applications in various research fields.

CO4: Demonstrate skill to explain about principle, Bioinstrumentation and applications of latest spectroscopy techniques like Turbidometry, AAS, NMR, ESR and Nephelometry.

CO5: Learn about basic Radioactivity principles, measurement method and its biological applications. Get exposed to latest technology of Biosensors and its wide range of applications ranging from clinical, environmental and agricultural field.

CO6: Acquire cognitive, technical and creative skills which enables students to gain an established knowledge and practice concerning modern analytical instrumentation and measurement techniques.

CO7: Understand the importance and applications of advanced biochemical instrumentation techniques in modern day research.

SYLLABUS

Unit-I

General approaches to biochemical investigation. Organ and tissue slice technique, cell distribution and homogenization techniques, cell sorting, and cell counting, tissue culture techniques. Cryopreservation, and manometric techniques. Electrochemical techniques: Basic principles. The pH electrode. Ion-selective, gas- sensing and oxygen electrodes. Biosensors- principle and applications.

UNIT-II

Basic principles of chromatography- adsorption and partition techniques. Chiral Chromatography and counter current Chromatography. Adsorption Chromatography - Hydroxy apatite chromatography and hydrophobic interaction Chromatography. Affinity chromatography.

Gas liquid chromatography- principle, instrumentation, column development, detectors-flame ionisation detectors (FID), nitrogen phosphorus detectors (NPD),electron capture detector (ECD), Flame photometric detector. Rapid scanning fourier transform infrared detector, Mass spectrometer detector and applications. Low pressure column chromatography - principle, instrumentation, column packing, detection, quantitation and column efficiency, High pressure liquid chromatography- principle, instrumentation, delivery pump, sample injection unit, column packing, development, detection and application. Reverse HPLC, capillary electro chromatography and perfusion chromatography

UNIT-III

General principles of electrophoresis, supporting medium, factors affecting electrophoresis, Isoelectric focusing-principle, ampholyte, development of pH gradient and application. PAGE-gel casting-horizontal, vertical, slab gels, sample application, detection-staining using CBB, silver, fluorcescent stains. SDS PAGE-principle and application in molecular weight determination principle of disc gel electrophoresis ,2D PAGE. Electrophoresis of nucleic acids-agarose gel electrophoresis of DNA, DNA sequencing gels, pulsed field gel electrophoresis- principle, apparatus, application. Field inversion gel electrophoresis. Electrophoresis of RNA, capillary electrophoresis-principle, instrumentation and calibration curve. Microchip electrophoresis. Immuno electrophoresis-qualitative, rocket, 2D electrophoresis.

UNIT-IV

Basic laws of light absorption- principle, instrumentation and applications of UV-Visible, IR, ESR, NMR, Mass spectroscopy, Turbidimetry and Nephlometry. Luminometry (Luciferase system, chemiluminescence). Atomic flame and flameless spectrophotometry. Principle, working and uses of x-ray diffraction, optical rotatory dispersion (ORD) and circular dichroism.

UNIT-V

Principle, working and applications of light microscope, dark field, phase contrast and fluorescent microscope. Electron microscope- Principle, instrumentation of TEM and SEM, Specimen preparation and applications-shadow casting, negative stainingand freeze fracturing.

Nature of radioactivity-detection and measurement of radioactivity, methods based upon ionisation (GMcounter) and excitation (scintillation counter), autoradiography and applications of radioactive isotopes, Biological hazards of radiation and safety measures in handling radioactive isotopes.

COURSE TITLE	PHYSIOLOGY & CELL BIOLOGY
CODE	MEN1C

COURSE OBJECTIVE

- Learn fundamentals of the cell and its various components
- study membrane structure and transmembrane transport mechanisms
- understand the physiology of cell organelles
- learn fundamentals of nuclear structure and function
- study the concept of cell division and cellular differentiation
- This course will enable the students to – Learn fundamentals of the cell and its various components study membrane structure and transmembrane transport mechanisms understand the physiology of cell organelles.
- Aim to understand such remarkable processes as how the heart develops and works to pump blood, how neurons communicate with one another, how insulin regulates blood sugar, and how specific gene products determine the morphology and functional capacityof the nervous system.

COURSE OUTCOMES

CO1: Describe the origin of life, from the abiotic world to multicellular organisms, including an account of endosymbiosis

CO2: Explain the structural characteristics of prokaryotic and eukaryotic cells

CO3: Explain the structure, properties and functions of various classes of macromolecules in cells

CO4: Describe the intricate relationship between various cellular organelles and their corresponding functions

CO5: Understand the inter relationships within and between anatomical and physiological systems of the human body

CO6: Describe the structure of major human organs and explain their role in the maintenance of healthy individuals.

SYLLABUS

UNIT-I

Major classes of cell junctions- anchoring, tight and gap junctions. Major families of cell adhesion molecules (CAMs)- cadherins, integrins. Types of tissues. Epithelium- organization and types. The basement membrane. Connective tissue and extracellular matrix- proteoglycans, glycoproteins and glycosaminoglycans.

UNIT-II

Composition of membranes- the lipid bilayer, peripheral and integral proteins. The fluid mosaic model. Brief account of membrane rafts. Endocytosis and exocytosis. Membrane transport: types. Diffusion- passive and facilitated. General classes of transport systems-uniport, symport, antiport. Active transport- primary and secondary. The P-type ATPases (Na^+K^+-ATPase), F-type ATPases (ATP synthases), ABC transporters, ionophores, aquaporins, ion channels (ligand-gated and voltage-gated).

UNIT-III

Digestive system- structure and functions of different components of digestive system, digestion and absorption of carbohydrates, lipids and proteins, role of bile salts in digestion and absorption, mechanism of HCl formation in stomach, role of various enzymes and hormones involved in digestive system.

Composition of blood, lymph and CSF. Blood cells - WBC, RBC and energy metabolism of RBC, Blood clotting mechanism and blood groups- ABO and Rhesus system.

UNIT- IV

Respiratory system-Gaseous transport and acid-base homeostasis. Mechanism of the movement of O_2 and CO_2 through lungs, arterial and venous circulation. Bohr effect, oxygen and carbon dioxide binding hemoglobin. pH maintenance by cellular andintracellular proteins. Phosphate and bicarbonate buffers, Metabolic acidosis and alkalosis. Respiratory acidosis and alkalosis. Regulation of fluid and electrolyte balance.

UNIT-V

Sensory transduction, Nerve impulse transmission- nerve cells, synapses, reflex arc structure, resting membrane potential, Nernst equation, action potential, voltage gated ion-channels, impulse transmission, neurotransmission, neurotransmitter receptors,

synaptosomes, synaptotagmin, rod and cone cells in the retina, changes in the visual cycle, photochemical reaction and regulation of rhodopsin, odour receptors, learning and memory.

Chemistry of muscle contraction – actin and myosin filaments, theories involved in muscle contraction, mechanism of muscle contraction, energy sources for muscle contraction.

COURSE TITLE	MICROBIOLOGY
CODE	MENAA

COURSE OBJECTIVE

- To produce microbiologist having profound knowledge of general microbiology and develop ability in students to meet the challenges of modern world
- To provide theoretical and practical education with vision of helping students in accumulating microbiological techniques and ideas essential for working in various field which is directly or indirectly concerned with microbiology.
- To provide students the knowledge so that they can contribute to the invention and innovation in the field of agricultural, medical, industrial, environmental microbiology.
- To make students capable of providing expert ideas, counsel and consultancy in various aspects concerning microbiology.

COURSE OUTCOMES

CO1 Demonstrate theory and practical skills in microscopy and their handling techniques andstaining procedures

CO2 Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes and also Understand the structural similarities and differences among various physiological groups of bacteria/archaea Know various Culture media and their applications and also understand various physical and chemical means of sterilization CO3 Know General bacteriology and microbial techniques for isolation of pure cultures ofbacteria, fungi and algae

CO4 Master aseptic techniques and be able to perform routine culture handling tasks safely

and effectively Comprehend the various methods for identification of unknown microorganisms

CO5 Gaining knowledge and hands on experience on general microbiological concepts likestaining, enrichment and isolation of microbes

CO6 Understand the basic microbial structure and functions of various physiological groups of prokaryotes and eukaryotes and also learn the theory and practical skills in microscopy handling and staining techniques

CO7 Know various Culture media and their applications and understand various physical and chemical means of sterilization and also learn various techniques for isolation of pure cultures

CO8 Understand the microbial physiology and know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.

SYLLABUS

UNIT-I

Molecular taxonomy- bacteria, viruses (DNA, RNA), algae, fungi and protozoa. Lytic cycle and lysogeny. Distribution and role of microorganisms in soil, water and air. Types of culture media, isolation of pure culture, growth curve and the measurement of microbial growth.

UNIT-II

Contamination and spoilage of foods – cereals, cereal products, fruits, vegetables, meat, fish, poultry , eggs, milk and milk products. General principles of food preservation- low temperature, drying, radiation, canning. Food fermentation- cheese, yoghurt, pickles and bread.

UNIT-III

Food poisoning- bacterial food poisoning, *Salmonella*, *Clostridium blotulinum* (botulism), *Staphylococcus aureus*, fungal food poisoning – aflatoxin, food infection – *Clostridium, Staphylococcus* and *Salmonella*. Pathogenic microorganisms, *E. coli, Pseudomonas, Klebsilla, Streptococcus, Haemophilus , & Mycobacterium*, causes, control, prevention and cure.

UNIT-IV

Antimicrobial chemotherapy, General characteristics of antimicrobial agents.

Mechanism of action – sulfonamides, sulphones and PAS . Penicillin, streptomycin-spectra of activity, mode of administration, mode of action, adverse effects and sensitivity test. Antiviral, and antiretroviral agents.

UNIT-V

Isolation, screening and maintenance of isolates of microbial strains, strain improvement through mutant selection. Downstream processing and *in situ* recovery of products. Industrial production of alcohol and α-amylase. Industrial production ofantibiotics- streptomycin. Organic acids-citric acid. Biofertilizers- Example, Rhizobium species and blue green algae. Single cell protein and biomass production

SEMESTER - II

COURSE TITLE	ENZYMES & ENZYME TECHNOLOGY
CODE	MEN2A

COURSE OBJECTIVES

This paper aims to provide a basic understanding of biological catalysis, Mechanism of action of enzymes, structure and function relationship, Understanding the enzyme kinetics and role of coenzymes/ co-factors and an overview of Industrial application of enzymes.

Course outcomes

After the completion of this course, the student will be able to

CO1: Distinguish the fundamentals of enzyme properties, nomenclatures, characteristics and mechanisms.

CO2: Apply biochemical calculation for enzyme kinetics.

CO3: Discuss the factors affecting enzymatic reactions.

CO4: Describe the concepts of co-operative behaviour, enzyme inhibition and allosteric regulation.

CO5: Compare methods for production, purification, characterization and immobilization of enzymes.

CO6: Describe the major applications of enzymes in industry, understand the principles of enzyme immobilisation techniques and enzyme extraction procedures

CO7: Develop new ideas for the development of enzyme-based drugs.

CO8: Discover the current and future trends of applying enzyme technology for the commercialization purpose of biotechnological products.

SYLLABUS

UNIT-I

Enzyme techniques- Isolation and purification of enzymes. Criteria of purity of enzymes , Enzyme activity units. Katal and International units.Enzyme assay- Different types - coupled enzyme assay. Applications of stopped flow techniques. Isoenzymes and their separation by electrophoresis with special reference to LDH. Significance of LDH and CK isoenzymes.

UNIT-II

Enzyme kinetics – Rate of enzymatic reaction , effect of substrate and enzyme concentration , pH, temperature on enzyme activity. M-M equation, L-B plot, Eadie Hofsee Plot. Determination of Km .Catalytic efficiency, Sigmoidal kinetics , Allosteric enzymes = significance , structure and regulatory functions with special reference to aspartate transcarbomylase. Role of covalent modification in regulation of enzymes-regulation of glutamine synthase , glycogen synthase and glycogen phosphorylase.

UNIT-III

Coenzymes – cofactors and prosthetic groups. Structures and functions of coenzymes- reactions involving CoA, TPP, NAD+, NADP, biotin, folic acid, FMN, FAD, tetrahydrofolate and cobamide. Multienzyme complexes . Functions of pyruvate dehydrogenase and fatty acid systhase complexes. Methanogenesis, coenzymes involved in methanogenesis. Significance of Vitamin K- dependent carboxylation in blood clotting process.

UNIT-IV

Mechanism of enzyme action- Enzyme active site, mapping of active site, identification of amino acids like lysine, cysteine, serine and histidine in the active site. Enzyme specificity. Mechanism of enzyme action . Mechanisms of enzyme catalysis-covalent catalysis, proximity and orientation effect, acid-base catalysis.

UNIT-V

Enzyme technology – production and industrial uses of enzymes like amylase, protease, pectinase, lipases and cellulose. Designer enzymes, abzymes, biosensors and

ribozyme, Methods of Immobilization of enzymes and their applications. Enzymes as therapeutic agents

COURSE TITLE	INTERMEDIARY METABOLISM-I
CODE	MEN2B

COURSE OBJECTIVES

The paper intends to provide a basic understanding of the biochemical reactions of molecules, Role of enzymes as key elements that govern the biochemical transformations, break-down and synthesis of various biomolecules and the turnover of carbohydrates, proteins, lipids and nucleic acids.

Course outcomes

After the completion of this course, the student will be able to

CO1: Discuss the overall concept of cellular metabolism – anabolic and catabolic pathways, energy storage and release, production of building blocks for macromolecule synthesis.

CO2: Explain glucose homeostasis (pathways and hormonal regulation). Discuss Krebs cycle, electron transport, and the pentose phosphate pathway.

CO3: Analyze the role of fat in energy production, membrane synthesis, and production of bioactive molecules.

CO5: Explain nucleotide biosynthetic pathways. Describe diseases associated with defective nucleotide biosynthesis and therapies that utilize the biosynthetic pathways

CO6: Explain biosynthesis & degradation of heme

CO7: Understanding the versatile role of coenzymes

SYLLABUS

UNIT-I

Glycolysis – aerobic and anaerobic, inhibitors, and regulation. Feeder pathway- entry of hexoses into glycolysis, Pyruvate dehydrogenase complex-mechanism and regulation. Citric acid cycle- regulation. ATP/ADP cycle. Glyoxalate cycle and its regulation. Gluconeogenesis-source, key enzymes, reaction sequence and its regulation. Synthesis and degradation of starch.

UNIT-II

Pentose phosphate pathway- significance and its regulation. Metabolism of glycogen and its regulation. Uronic acid pathway. Biosynthesis of N-linked and O-linked glycoproteins, mucopolysaccharides- Chondroitin sulphate, bacterial cell wall polysaccharide.

UNIT-III

Metabolism of nucleotides-De novo synthesis and salvage pathways of purine and pyrimidine nucleotides. Regulation and inhibitors of nucleotide biosynthesis. Role of ribonucleotide reductase and its regulation. Degradation of purine and pyrimidine nucleotides.

UNIT-IV

Versatile role of PLP as coenzyme.-transamination, deamination and decarboxylation. Trans methylation and one carbon transfer. Regulation of urea cycle, Inherited disorders of urea cycle enzymes. Conversion of amino acids to specialized products- Serotonin, GABA, epinephrine, nor-epinephrine, melanin, creatinine and NAD.

UNIT-V

Biosynthesis and degradation of heme. Oxidation and reduction of inorganic sulphur compounds by microbes and plants. Sulpho transferases and their biological role- rhodanases, sulphatases, 3-mercapto pyruvate sulphur transferases. Oxidation of cysteine to sulphate and inter conversion of sulphur compounds.

COURSE TITLE	**INTERMEDIARY METABOLISM-II**
CODE	**MEN2C**

COURSE OBJECTIVES

Students will learn the biochemical pathways for synthesis and breakdown of complex biomolecules and metabolic disorders arise out of malfunction of metabolic pathways

Course outcomes

After the completion of this course, the student will be able to

CO1: Analyze the role of fat in energy production, membrane synthesis, and production of bioactive molecules.

CO2: Describe the structure, biosynthesis, oxidation and storage of fatty acids.

CO3: Describe the basic metabolic pathways of cholesterol, bile acids, sphigolipids and lipoproteins.

CO4: Describe common pathways of amino acid catabolism to release ammonia (handled by the urea cycle) and carbon skeletons.

CO5: Differentiate between ketogenic and glucogenic amino acids, and diseases resulting from defective catabolism and biosynthesis of non-essential amino acids.

SYLLABUS

UNIT-I

Oxidation of fatty acids-oxidation of saturated and unsaturated fattyacids (α, β & ω oxidation) Oxidation of fatty acids with odd and even numbered carbon atoms. Regulation of β oxidation. Ketogenesis and its regulation. Biosynthesis of fatty acid – saturated and unsaturated, chain elongation, regulation.

UNIT-II

Biosynthesis and degradation of triacylglycerol, phosphoglycero lipids-lecithin, cephalin, plasmalogens and phosphatidyl inositol, Sphingolipid-sphingomyelin, cerebrosides, sulfatides, and gangliosides. Biosynthesis of prostaglandins, thromboxanes and leukotrienes and hydroxyl eicosanoic acids. Cholesterol biosynthesis and its regulation. Biosynthesis of bile acids. Lipoprotein metabolism-chylomicrons, VLDL, HDL and LDL**.**

UNIT-III

Biosynthesis of essential amino acids.- Role and biological significance of glutamate dehydrogenase, glutamine and asparagine synthetase, lysine, proline and phenylalanine hydroxylase. Interconversion of amino acids - proline to glutamate, methionine to cysteine, serine to glycine. Biosynthesis of spermine and spermidine.

UNIT IV

Degradation of aminoacids –glucogenic and ketogenic aminoacids. Formation of acetate from leucine and aromatic aminoacid, pyruvate from cysteine, threonine and hydroxy proline, α-keto glutarate from histidine and proline , succinate from methionine, threonine, valine and isoleucine, Oxaloacetate from aspartate, glycine and serine.

UNIT V

Integration of Metabolism-Interrelationship of carbohydrate, protein and fat

metabolism-role of acetyl CoA and TCA cycle. Interconversion of major food stuffs. Metabolic profile of the principal organs and their relationships.

COURSE TITLE	ENERGY & DRUG METABOLISM
CODE	MENAB

COURSE OBJECTIVE

- Explain what metabolic pathways are
- State the first and second laws of thermodynamics
- Explain the difference between kinetic and potential energy
- Describe endergonic and exergonic reactions
- Discuss how enzymes function as molecular catalysts

COURSE OUTCOME

CO1 Explain the role of catabolic and anabolic pathways in cellular metabolism.CO2 Distinguish between kinetic and potential energy.

CO3 Distinguish between exergonic and endergonic reactions in terms of available energy change. CO4 List the three main kinds of cellular work and provide examples of each. Explain in generalterms how cells obtain the energy to do cellular work.

CO5 Describe the structure of ATP and identify the major class of macromolecules to which ATPbelongs.

CO6 Explain how ATP performs cellular work

SYLLABUS

UNIT-I

Thermodynamic- principles in biology- Concept of entropy, enthalpy and free energy change.Redox systems. Redox potential and calculation of free energy. Biological oxidation – Oxidases, dehydrogenases, hydroperoxidases, oxygenases. Energy rich compounds – phosphorylated and non-phosphorylated. High energy linkages.

UNIT-II

Electron transport chain-various complexes of ETC, Q-cycle. Inhibitors of ETC. Oxidative phosphorylation-P/O ratio, chemiosmotic theory. Mechanism of ATP synthesis

- role of F_0-F_1 ATPase, ATP-ADP cycle. Inhibitors of oxidative phosphorylation ionophores, protonophores .Regulation of oxidative phosphorylation.

UNIT-III

Light reaction-Hills reaction, absorption of light, photochemical event. PhotoETC-cyclic and non-cyclic electron flow. Photophosphorylation-role of CF_0-CF_1 ATPase. Dark reaction- Calvin cycle, control of C3 pathway, and Hatch-Slack pathway (C4 pathway), Photorespiration.

UNIT-IV

Energy sources of brain, muscle, liver, kidney and adipose tissue. Amphibolic nature of Citric acid cycle. Anaplerotic reaction. Inhibitors and regulation of TCA cycle. Transport of extra mitochondrial NADH – Glycerophosphate shuttle, malate aspartate shuttle. Energetics of metabolic pathways – glycolysis, (aerobic and anaerobic) ,citric acid cycle, beta oxidation.

UNIT-V

Activation of sulphate ions – PAPS, APS, SAM and their biological role. Metabolism of xenobiotics – Phase I reactions – hydroxylation, oxidation and reduction. Phase II reactions – glucuronidation, sulphation, glutathione conjugation, acetylation and methylation. Mode of action and factors affecting the activities of xenobiotic enzymes.

COURSE TITLE	**EXTRA DISCIPLINARY PAPER-I ESSENTIALS OF BIOCHEMISTRY**
CODE	**MENBA**

COURSE OBJECTIVE

- Through this course the students are exposed to importance of biological macromolecules
- They acquire knowledge in the quantitative and qualitative estimation of biomolecules
- They study the influence and role of structure in reactivity of biomolecules
- Principles and application of modern imaging techniques.
- Intermediates in enzyme-catalysed reactions and their investigations.

COURSE OUTCOMES

CO1 Through this course the students are exposed to importance of biological macromolecules.

CO2 They acquire knowledge in the quantitative and qualitative estimation of biomolecules

CO3 They study the influence and role of structure in reactivity of biomolecules

CO4 At the end of the course, the students have a thorough understanding on the role ofbiomolecules and their functions.

CO5 At the end of the course, the students have a thorough understanding on the role ofbiomolecules and their functions.

SYLLABUS

UNIT-I

Major nutrients of food - energy yielding and protective food nutrients.Energy value of foods – units of energy, calorific value of carbohydrates, lipids and proteins. Energy requirements for infants, children, adolescents, adults, pregnant women and lactating mothers. Significance of balanced diet.

UNIT-II

Nutritional aspects of carbohydrates – Different carbohydrates in the diet – utilization. Glycosuria, Diabetes mellitus – types and symptoms. Dietary management of Diabetes mellitus – food chart for diabetic patients-Diabetic coma.

UNIT-III

Nutritional aspects of lipids – lipids present in diet and their functions, essential fatty acids, lipoproteins , lipemia –ketosis– atherosclerosis – symptoms. Role of diet in the management of atherosclerosis and hyperlipidemia.

UNIT-IV

Nutritional aspects of proteins – essential amino acids, nitrogen balance, positive and negative nitrogen balance. Dietary sources of proteins – protein malnutrition in children, Kwashiorkor and Marasmus.

UNIT- V

Vitamins – sources, recommended daily allowance (RDA) and functions of vitamins A, D and B complex (thiamine, riboflavin, niacin, pyridoxine, folic acid and cobalamine . Deficiency disorders of vitamins A, D and B complex). Minerals – essential

minerals of calcium and iron. Deficiency disorders of anemia and rickets.

CORE PAPER VII - PRACTICAL –I

I. Biochemical studies and estimation of macromolecules

1. Isolation and estimation of glycogen from liver.
2. Isolation and estimation of DNA from animal tissue.
3. Isolation and estimation of RNA from yeast.
4. Separation of starch from plant source and assessment of its purity.
5. Denaturation of DNA and absorption studies at 260nm.
6. Denaturation of Protein and absorption studies at 280nm.

II. Colorimetric estimations

1. Estimation of lactate.
2. Estimation of pyruvate.
3. Estimation of tryptophan.
4. Estimation of protein by Lowry‟s method.

III. Estimation of minerals and vitamins

1. Estimation of calcium and iron.
2. Estimation of vitamins – Thiamine, Riboflavin.

IV. Group experiment

Subcellelular Organelles - Separation of Mitochondria and Nucleus and identification of the subcellular organelles using marker enzymes.

CORE PAPER – VIII - PRACTICAL-II

Isolation, purification and assay of alkaline phosphatase from kidney.

1. Assay of amylase.
2. Assay of superoxide dismutase.
3. Assay of ATPase.
4. Assay of catalase.
5. Assay of acid phosphatase.
6. Effect of pH, temperature substrate concentration and inhibitors on activity of

alkaline phosphatase

7. Test for blood grouping (Haemagglutination).
8. Culture and inoculum preparation.
9. Separation of lipids by TLC.
10. Separation of proteins by SDS-PAGE.

COURSE TITLE	BIOTECHNOLOGY
CODE	MEN3A

COURSE OBJECTIVES

- The ability to develop novel biotechnology ideas and products.
- Master skills associated with screening of industrially important important strains.
- Know the various vaccines and their production.
- Exhibit a knowledge of various case studies in plant genomes and genetically modified foods.

COURSE OUTCOMES

CO1 Understand the architecture of protein designing, fusion proteins,methods of drug design and delivery.

CO2 Understand production of high value therapeutics, antibody engineering, gene knock out experiments,human gene therapy.

CO3 Comprehend the various methods of microbial mining ,bioremediation and production of microbial polysaccharides.

CO4 Analyse the genetically modified foods and applying the knowledge in maintaining health and lifestyle.

CO5 Importance of GM foods which are prepared for using recombinant DNA technology .its pros and cons.

SYLLABUS

UNIT I

Basic techniques: Cutting DNA molecules, Restriction digestion, isoschizomers, joining DNA molecules – DNA ligase, double linkers, adaptors, homopolymer tailing, selection of recombinants and screening – genetic methods, immuno chemical methods, South- Western screening, Nucleic acid hybridization methods, synthesis of probes, radio-active and non-radioactive labelling of probes, analysing DNA sequences methods:

Automated sequencing, Next Generation Sequencing Analysis (NGS), *in silico* sequence analysis,

Unit II

Cloning strategies**:** Cloning vectors – plasmids (pBR 322, pUC 18), phage and M 13, cosmids, phasmids, expression vectors, ; pMal; GST; pET-based vectors, Protein purification, His-tag; GST-tag; MBP-tag, Inclusion bodies- Methodologies to reduce formation of inclusion bodies, yeast vectors – YEP, YIP, YRP, YCP and YAC, shuttle vectors. Genomic DNA libraries, chromosome walking, cDNA cloning, RACE, RAPD. Site directed mutagenesis of cloned genes.

Unit III

Animal cell culture- media, primary culture, contamination, disaggregation, subculturing. Introduction of genes into animal cells**:** Reporter genes, selectable markers, viral vectors – SV 40, Retroviruses and Baculovirus, Adenoviruses, Transferring genes into animal cells in culture, oocytes, eggs, embryos and specific tissues, transgenic animals, Creation of knock out mice. Hazards and safety aspects of biotechnology. Patents and IPR.

Unit IV

Plant tissue culture- media, callus and protoplast cultures. Production of biochemicals from plant cell culture. Micropropagation Agro bacterium – mediated gene transfer to plant cells, Plant based vectors, Ti and Ri as vectors microprojectiles, transgenic plant technology – for pest resistance, herbicide tolerance, delay of fruit ripening and use of plants to produce commercially important proteins.

Unit V:

Applications of recombinant DNA technology: production of insulin and growth hormone in *E. coli*.

Genome mapping, types of gene map, molecular markers. The Human Genome Project- goals, results, potential benefits and risks. DNA microarrays. Techniques for separation and identification of proteins, 2D-gel electrophoresis, mass spectrometry, MALDI-TOF. Protein arrays. Applications of proteomics. Bioinformatics- introduction, biological databases, database similarity searches- FASTA, BLAST. Multiple sequence alignment, construction of a phylogenetic tree.

COURSE TITLE	CLINICAL BIOCHEMISTRY-I
CODE	MEN3B

COURSE OBJECTIVE

• The course aims to provide an advanced understanding of the biochemical mechanisms and pathophysiological processes responsible for common biochemical disorders.

• The course provides an overview of normal and abnormal metabolic functions, the impact of disorders on metabolic processes, an overall picture about the molecular basis of diseases and novel strategies to prevent the diseases.

• The main objective is to teach and practice students to learn how they can identify and quantify a variety of analytes in blood and bodily fluids using analytical techniques in clinical laboratory.

• Understanding the concept of Biochemical analyzing instruments, chemicals and normal ranges of biochemical components in our body.

• Clinically relevant biochemical analysis for deeper understanding of all biochemical components i.e., Proteins, Electrolytes, Hormones etc

COURSE OUTCOMES

CO1 Understand the Basic concepts and principles of Clinical Biochemistry, detail on the various biological specimens including the process of collection, preservation and Storage.

CO2 Gain Knowledge on the collection, and analysis of Amniotic fluid and on the Immunological tests related to diagnosis of anomalies during pregnancy. Understand the Blood groups, Blood banking and adverse reactions of blood Transfusions.

CO3 Describe of the blood clotting pathways and the blood clotting disorders. Enumerate of the different types of anemias based on aetiology.

CO4 Understand the pathophysiological processes responsible for common biochemical disorders such as jaundice, Pancreatitis, Fatty liver etc.

CO5 Differentiate three types of jaundice and their systematic analysis. Detailed study of Jaundice, Cirrhosis, Hepatitis, Fatty liver and gall stones. Serum enzyme activities in Diseases.

CO6 Understand Formation of urine and gain perception on the various renal function tests and renal disorders.

CO7 Gain understanding of the need for Gastric function tests, Collection of gastric contents, their examination.

CO8' Appreciate the Clinical application of enzymes in diagnosis, Discussion on Isozymes and understanding their role in diagnosis. Understanding the enzyme patterns in diseases of various organs such as pancreas, liver, bones, heart and muscle

CO9 Understand the aetiology, types, clinical manifestations and treatment of Diabetes mellitus and various disorders of carbohydrate metabolic pathways.

SYLLABUS

UNIT-I

Biochemical investigations in diagnosis, prognosis, monitoring, screening. Specimen collection- blood and urine. Factors influencing biochemical variables. Sample analysis and reporting- precision, accuracy, specificity, sensitivity. Sources of error. Interpretation of results- normal reference ranges. Good laboratory practices.

UNIT-II

Applications of Clinical Biochemistry-Biological specimens used for the diagnosis. Preservation of biological specimens -blood, urine, CSF and amniotic fluid. Diabetes mellitus-causes, pathology, types, Metabolic complications- acute and long-term, Diagnosis-by GTT, Glycated Haemoglobin. Management- diet and life-style modifications and anti-diabetic drugs. Hypoglycaemia.

UNIT-III

Disorders of blood cells- Hemolytic, iron deficiency and aplasticanemia and diagnosis. Porphyrias, Thrombocytopenia, Causes of leucopenia, leukemia and leucocytosis. Disorders of blood clotting mechanism - Von willebrand‟s disease, Hemophilia A, B and C, diagnostic test for clotting disorders.

UNIT-IV

Disorders of lipid metabolism -Normal levels of blood lipids and their functions. Hyperlipidemia –Atherosclerosis -causes and symptoms-diagnosis. Hypolipidemic agents, Hyper and Hypolipoproteinamia- Types and pathology.

UNIT-V

Disorders of calcium and phosphorous metabolism. Factors affecting blood phosphorous and calcium levels..Biological functions of calcium and phosphorous. Role in bone formation. Blood calcium homeostasis. Role of PTH and calcitonin. Hypo and Hypercalcemia**).**

COURSE TITLE	MOLECULAR BIOLOGY
CODE	MEN3C

UNIT-I

Genetics-Mendel laws of inheritance-dominance-complete, incomplete and co dominance, multiple alleles-gene mapping in haploids and diploids, recombination mapping- restriction mapping- mode of gene information transfer in bacterial-conjugation, transformation and transduction.

UNIT-II

The bacterial chromosome and plasmids. Organization of eukaryotic chromatin-nucleosomes, 30 nm fiber, higher order structure. Organization of organelle genomes. Enzymes and mechanism of prokaryotic and eukaryotic replication. Telomeres, telomerase and end replication. Regulation of replication.

UNIT-III

Mutation, spontaneous and induced mutation, molecular mechanisms of mutation. DNA repair mechanisms-Direct repair, excision repair, mismatch repair, recombination repair, SOS response, eukaryotic repair system. Recombination and mobile genetic elements- the Holliday model, the general recombination in E.*coli*, site specific recombinations, transposons and retroposons.

UNIT-IV

Transcription- Prokaryotic and Eukaryotic transcription, Subunits of RNA polymerase, eukaryotic RNA polymerases, E.coli and eukaryotic promoters and enhancers. Transcription factors. mechanism of prokaryotic and eukaryotic transcription. Post Transcriptional modifications- mRNA 5‟ capping and 3‟ polyadenylation, splice, spliceosomes assembly, alternative splicing, Regulation of Transcription- Trp and Lac operon. Gene regulation, levels of gene expression, methylation.

UNIT-V

Ribosomes, Genetic code, nature of genetic code, wobble hypothesis, activation, initiation, elongation, termination of translation in prokaryotes, inhibitors of protein synthesis. Protein synthesis in eukaryotes and its regulation. Post translational modification. Protein sorting- signal peptides, targeting of mitochondria, secretor and lysosomal proteins. Protein degradation- the ubiquitin pathway.

COURSE TITLE	BIOSTATISTICS
CODE	MENAB

Course Objective:

This course will encompass the methodology and theory of statistics as applied to problems in the field of life sciences. The course will provide students with basic understanding and application of computational biology.

Course Outcomes:-

After the completion of course the student will be able to

CO1 Understand and explain types and methods of data collection.

CO2 Develop the skills to analyze the collected data.

CO3 Develop the skills to represent the analyzed data.

CO4 Understand the applications of statistical tools like mean, mode, median,

mean deviation, standard deviations.

CO5 Describe and use the tool like correlation, regression, ANOVA—t test, Z test, chi square test.

CO6 Understand and explain the concept, type and applications of probability

SYLLABUS

UNIT – I

Nature of biological and clinical experiments – Collection of data in experiment- Primary and secondary data. Methods of data collection. Classification and tabulation.

Different forms of diagrams and graphs related to biological studies. Measures of Averages- Mean, Median, and mode. Use of these measures in biological studies.

UNIT- II

Measures of Dispersion for biological characters – Quartile deviation, Mean deviation, Standard deviation and coefficient of variation. Measures of skewness and kurtosis. Correlation and regression – Rank correlation – Regression equation. Simple problems based on biochemical data.

UNIT-III

Basic concepts of sampling- Simple random sample stratified sample and systemic sampling. Sampling distribution and standard error. Test of significance based on large samples. Test for mean, difference of means, proportions and equality of proportions.

UNIT-IV

Small sample tests – Students„t" test for mean, difference of two way means, tests for correlation and regression coefficients. Chi-square test for goodness of a non independence of attributes. F test for equality of variances. ANOVA- one way and two way. Basic concept related to biological studies.

UNIT-V

Operating systems and application programmes, MS excel and Statistical package for social sciences (SPSS) for basic statistical functions, Regression, correlation, ANOVA, Chi square test with specific biological examples.

COURSE TITLE	ED PAPER- II LIFESTYLE DISEASES PREVENTION
CODE	MENBB

COURSE OBJECTIVES

The objective is to make a connection between knowledge of anatomy and physiology and realworld situations, including healthy lifestyle decisions and homeostatic imbalances.

COURSE OUTCOMES

CO1: Gain insights about the current lifestyle as a consequence of industrialization

CO2: Understanding the concepts of cancer

CO3: Gain knowledge about cardiovascular system and associated disorders

CO4: Gain knowledge about gastro-intestinal tract and associated disorders

CO5: Gains knowledge about structure/ function of kidney and associated disorders

CO6: Have basic understanding of the pathophysiology of addictions (alcohol, smoking, drugs)

CO7: Understand the socio-economic implications associated with alcohol and drug abuse

CO8: Understand the functioning of gallstones and ulcer

SYLLABUS

UNIT-I

Obesity- prevalance –casuses, consequences, symptoms- Coronary Heart Diseaseand type 2 diabetes mellitus- lifestyle and dietary management of obesity.

UNIT-II

Hypertension – blood pressure-normal level of blood pressure, dietary management of hypertension, stroke and chronic renal failure due to hypertension. Kidney stone- causes, types, symptoms and treatment (only Lithotropy), dietary management for prevention of kidney stones.

UNIT-III

Cancer-types of cancer, aetiology of breast cancer diagnosis (self examination, Mammography) and treatment (radiation, chemotherapy, surgery).Cervical cancer-causes, Types of cervical cancer, symptoms, diagnosis and treatment (radiation,

chemotherapy, surgery). Cigarette smoking and symptoms, diagnosis and treatment (chemotherapy)

UNIT-IV

Aging-Factors influencing aging. Age related diseases- dementia, osteoporosis, Osteo arthritis - causes sign and symptoms, preventive measures of aging with special reference to antioxidants.

UNIT-V

Gallstones- causes, factors, aetiology of gall stones, types of gall stones, symptoms, preventive aspects of gall stone. Drug therapy – ursodeoxy cholic acid, surgical treatment and dietary management. **–** Ulcer – causes and prevention.

SEMESTER-IV

COURSE TITLE	**HORMONES**
CODE	**MEN4A**

COURSE OBJECTIVES

➢Srudy the historical experiments that lead to the discovery of various hormones.

➢ Deeply understand the communication between the nervous system and the endocrine system.

➢ Learn the structure, functions and the disorders associated with the various hormones starting from the pituitary hormones to the gonadal hormones.

➢ Appreciate and analyze the endocrine regulation of the various metabolisms such as carbohydrate metabolism, Protein metabolism, calcium homeostasis, menstrual cycle, pregnancy and menopause.

➢ Apply the knowledge of hormones in assay of hormones such as T3, T4 and TSH and understand the strategy behind contraception.

➢Learn the etiology of the disorders associated with the carbohydrate, aminoacid, lipid and nucleic acid metabolism.

➢Present a case study on a hormonal and a metabolic disorder**.**

COURSE OUTCOMES

CO1: Understand the basic terminologies of hormones, classification of hormones based on its chemistry.

CO2: Deduce the structure of amino acid derived, protein and steroid hormones.

CO3: Understand the synthesis of various hormones by respective gland.

CO4: Understand the regulation of hormones action by feedback mechanism.

CO5: Understand the mechanism of action of steroid hormones,

CO6: Understand the mechanism of action of pancreatic hormones,

CO7: Understand the mechanism of action of thyroid hormones

CO8: Understand the mechanism of action of sex hormones**.**

CO9: Demonstrate various types of second messengers and their action.

CO10: Learn various functions of thyroid, pancreatic and sex hormones.

CO11: Demonstrate the dysfunction of various endocrine glands

SYLLABUS

Unit I:

Hormones – Classification, Biosynthesis, circulation in blood, modification and degradation. Mechanism of hormone action, Target cell concept – Feedback control and regulation. Hormones of Hypothalamus and pituitary – Vasopressin and oxytocin, Hypothalamic releasing factors. Anterior pituitary hormones – actions and feedback regulation of synthesis. Growth promoting, Lactogenic hormones. Glysoprotein hormones, the POMC family, Endorphins.

Unit II:

Pancreatichormones – cell types of the islets of Langerhans. Insulin – structure, Biosynthesis, regulation of secretion, Biological actions and mechanism of action.

Glucagon, somatostatin and pancreatic polypeptide. Insulin like growth factors – structure, biological action. Gastrointestinal hormones – secretin, gastrin, cholecystokinin – biological action, regulation of secretion.

Unit III:

Thyroid hormones – synthesis, secretion, transport, biological action, metabolic fate and mechanism of action, regulation. Parathyroid hormone – biological action, regulation of calcium and phosphorus metabolism and the role of calcitonin. Calcitriol – Biosynthesis, transport, functions, mechanism of action.

Unit IV:

Adrenal hormones – Glucocorticoids, mineralocorticoids, synthesis, secretion, transport, metabolism and excretion. Biological effects. Mechanisms of action, adrenal androgens, metabolic effects and functions. Adrenal medulla – Catecholamines, biosynthesis, storage, metabolism, regulate of synthesis. Chemical nature and biological action of prostaglandins.

Unit V:

Gonadal Hormones – Chemical Nature. Biosynthesis, metabolism and metabolism of action of androgen, estrogen and progesterone. Factors involved in the regulation of gonadal hormone activities. Ovarian cycle. Pregnancy, biochemical changes in pregnancy.

COURSE TITLE	**CLINICAL BIOCHEMISTRY-II**
CODE	**MEN4B**

COURSE OBJECTIVE

- The course aims to provide an advanced understanding of the biochemical mechanisms and pathophysiological processes responsible for common biochemical disorders.
- The course provides an overview of normal and abnormal metabolic functions, the impact of disorders on metabolic processes, an overall picture about the molecular basis of diseases and novel strategies to prevent the diseases.
- The main objective is to teach and practice students to learn how they can identify and quantify a variety of analytes in blood and bodily fluids using analytical techniques in clinical laboratory.
- Understanding the concept of Biochemical analyzing instruments, chemicals and normal ranges of biochemical components in our body.

• Clinically relevant biochemical analysis for deeper understanding of all biochemical components i.e., Proteins, Electrolytes, Hormones etc

COUSRE OUTCOMES

CO1 Understand on the etiology, types, clinical manifestations, diagnosis and treatment of various amino acidurias.

CO2 Detail the nucleic acid metabolism disorders.

CO3 Elaborate on the role of Serum lipids including triglycerides, cholesterol and phospholipids in diseases. Detail the clinical role of serum cholesterol and state the Clinical features of atherosclerosis.

CO4 Understand the molecular basis of Cancer – cancer cells, difference between cancer and normal cells. To identify the various diagnostic approaches – CT, MRI, PET and SPECT and learn about Tumor marker.

CO5 interpret molecular structure and interactions present in proteins, nucleic acids, carbohydrates and lipids.

CO6 explain organization and working principles of various components present in living cell.

CO7 Understand the aetiology, types, clinical manifestations and treatment of Diabetes mellitus and various disorders of carbohydrate metabolic pathways.

SYLLABUS

UNIT-I

Clinical enzymology, functional and non- functional serum enzymes –Normal levels. Clinical significance of AST, ALT, ALP, ACP, CK, γ-GT, amylase, pseudocholinesterase. Enzyme pattern in diseases- myocardial infarction and liver diseases. Isoenzymes –LD, CK and ALP. Enzymes as therapeutic agents.

UNIT-II

Inborn errors of metabolism- Inborn errors of carbohydrate metabolism-Galactosemia, fructosuria, Glycogen storage diseases -causes and symptoms Inborn errors of lipid metabolism -Taysach‟s disease, Gaucher‟s and Niemannpick‟s disease-causes and symptoms. Inborn errors of aminoacid metabolism-phenyl ketonuria, Tyrosinemia, Maple syrup urine disease and alkaptonuria- causes and symptoms.

Amniocentesis, prenatal detection of inborn errors of metabolism in developing fetus-Autosomal recessive mode of inheritance- cystic fibrosis, X linked recessive inheritance-Duchenne muscular dystrophy .

UNIT-III

Liver function tests based on synthesis, excretion and detoxification. Jaundice-classification, pathology and Differential diagnosis.Plasma protein changes in liver diseases. Hepatitis A,B and C. Cirrhosis and fibrosis. Portal hypertension and hepatic coma. Acute phase proteins -CRP, Haptoglobins, α-fetoprotein, ferritin and transferrin-their clinical significance.

UNIT-IV

Renal function tests -tests for glomerular and tubular function-Acute and chronic renal failure-Glomerulonephritis, Nephrotic syndrome, uraemia-urinary calculi-Nephrocalcinosis and Nephrolithiasis-causes, pathology and symptoms. Dialysis-Hemodialysis and peritoneal dialysis.

UNIT-V

Hormonal disorders-causes and the pathology of thyroid disorders-Hypothyroidism and Hyperthyroidism-Diagnostic methods – disorders associated with adrenal, pituitary and sex hormones- Addison‟s disease, Cushing‟s syndrome, pituitary tumour, Hypopituitarism, Hypogonadism-Causes, pathology ,symptoms and diagnosis.

COURSE TITLE	**ELECTIVE PAPER-IV SIGNAL TRANSDUCTION**
CODE	**MENAD**

COURSE OBJECTIVES

• To gain insight in the basic concepts of cellular signal transduction

• To understand the overall concept that alterations in cell signaling pathways are involved in disease development and progression.

• To gain knowledge on the functioning and regulation of kinases, phosphatases, adhesion receptors, G-protein coupled receptors, nuclear hormone receptors, cytokine and their receptors.

• To gain insight in the role of the various signaling pathways in development and progression of cancer and atherosclerosis.

• To understand which elements in the various signaling pathways represent candidate drug targets for treatment of cancer and atherosclerosis.

• To understand how the host immune system modulates disease progression.

COURSE OUTCOMES

After finished this course, Students are able to

CO1 Identify the types of signals.

CO2 Identify types of receptors, their molecular composition, and the differences among them.

CO3 Describe how a cell propagates a signal.

CO4 Describe how a cell responds to a signal

CO5 Analys the endocytosis and exocytosis.

SYLLABUS

Unit I:

General functions and structure of signaling pathways, Mechanism of intracellular and intercellular signal transduction, Hormone and hormone analogues; Recognition and interaction of hormones with receptors , Signal amplification , regulation of inter and intracellular signaling; Receptor superfamilies and subtypes., intra cellular signaling molecules-secondary messengers; Divergence, convergence and cross talk

Unit II:

Protein kinases and protein phosphatases : Classification, structure protein kinases, ser/ thr protein kinases , Regulation of PKA, PKB, PKC, Ca2+/ calmodulin-dependent protein kinases , Structure and regulation of phosphatases, I,2A,2B,PP2A; subcellular localization.

Unit III:

G- protein coupled signal transduction pathways: Transmembrane Receptors– Structure, Major classes of trimeric G proteins based on Gs unit, mechanism of signal transmission, toxins as tools in characterization of G- protein, GTPase switches, G proteins that regulate ion channels; G-protein and gene control

Unit IV:

Signaling and Gene control: TGF receptors; Cytokine receptors and JAK – STAT; Receptor Tyrosine Kinases(RTK), activation of ras, genetic analysis – drosophila eye development; MAPK; Phosphoinositide cascade, NF-kB; signal induced protein cleavage, Down modulation of receptor signaling.

Unit V:

Nuclear receptors, Principles of signaling by nuclear receptors, Classification and structure of nuclear receptors, Mechanism of transcriptional regulation by nuclear receptors, transactivation.Steroidhormonesignaling

COURSE TITLE	ELECTIVE PAPER - IMMUNOCHEMISTRY
CODE	MENAC

COUSRE OBJECTIVE

• Main purpose of this course is to gain essential knowledge in the field of immunology.

• Understanding fundamentals, recognize different types of antigens, appreciate the differences between innate and adaptive immune response.

• Understand humoral immunity understand cell mediated immunity, appreciate immune system's role in organ transplants, developing tolerance and autoimmunity and immunity against cancer.

• This course is intended to equip the student with the knowledge and understanding of the vertebrate immune system, its component and mechanism of immune responses with specific reference to the human immune defence system.

• Also understand the principles and applications of antigen-antibody reactions.

COURSE OUTCOMES

CO1: Classify fundamentals and anatomy of immune system.

CO2: Describe innate immune system, physiological anatomical and cellular components of innate mechanisms – complement fixation, phagocytosis and toll like receptors.

CO3: Be able to explain genetic basis of antibody structure and generation of antibody diversity.

CO4: Demonstrate the role of MHC I and MHC II in antigen presentation and the concept of MHC polymorphism

CO5: Describe the concept of B and T cell maturation and activation and generation of cytokines.

CO6: Explain the basis of hypersensitivity, immune deficiency and autoimmune diseases.

CO7: Apply the principles of immunological techniques, viz. immunoprecipitation, immunoelectrophoresis, ELISA, RIA, FACS, Western blot, Hybridoma technology, generation and applications of monoclonal antibodies.: Demonstrate the role of MHC I and MHC II in antigen presentation and the concept of MHC polymorphism

SYLLABUS

UNIT-I

Scope and advances in immunology. Achievements in the field of immunology Immunity – innate & acquired immunity– factors contributing for innate immunity – role of lymphokines in acquired immunity. Vaccines – different types – Attenuated vaccines-Preventive vaccines-DNA vaccines- . Antigenic competition. Contradictions in vaccinotherapy and Production of vaccines.

UNIT-II

Antibodies – classification, structure, properties & biological functions – abnormal immunoglobulins – isohemeagglutinins. Monoclonal antibodies – commercial production by hybridoma technique & applications. Cooper Antigens – nature & different types, classification based on epitope. Iso and neo antigens. MHC gene arrangement and functions of Class I and Class II antigens in human and mice.Factors affecting antigenicity and immunogenicity of antigens. Complement system- activation by direct and alternate pathways. Biological functions of complements.

UNIT-III

Antigen – Antibody reactions- General mechanism – Qualitative and quantitative determination of antigen-antibody reactions. Diagnostic tests based on antigen- antibody reactions – with special reference to typhoid, syphilis, HIV & Retro virus infection. ELISA, RIA and immuno fluorescence techniques. Cross reaction with examples.

UNIT-IV

Immune response – humoral & cell mediated immune response – ontogeny of T& B cells – clonal selection theory of antibody formation. Primary & secondary immune response. Immune response against bacterial, viral and fungal antigens. Immuno survielence.

UNIT-V

Pathology of immune system – Autoimmune disorders – causes and effects – systemic & localized types. Hypersensitivity reactions – causes & effects – different types of hypersensitivity reactions (eg) allergy, atopy, anaphylatoxis, serum sickness . Disorders associated with complements. Transplantation and transfusion immune reactions. Graft rejection and adverse reactions of mismatched blood transfusion.

CORE PAPER XIV - PRACTICAL-III

1. Antioxidant status: Estimation of super oxide dismutase and catalase. Estimationof vitamine E and C.
2. Haematology: RBC count, WBC count – total and differential count, ESR, PCV, MCV. Estimation of hemoglobin.
3. LPO, Nitrite, glutathione and GPX.
4. Estimation of Sodium, Potasium and Calcium
5. Estimation of ALT, AST, CPK by kit method.
6. Liver function test: Estimation of bilirubin – direct and indirect. Estimation of plasma protein, A/G ratio, Thymol turbidity test, Assay of serum glutamate oxaloacetate transaminase, alkaline phosphatase, isoenzyme separation of LDH by electrophoresis.
7. Renal function test: Qualitative tests for normal and pathological components of urine. Estimation of blood and urine urea, creatinine, creatine and uric acid. Urea Clearance test. Chemical analysis of kidney and gall stones.
8. Estimation of blood glucose by orthotoluidine and glucose oxidase method. Determination of glycosylated Hb. Glucose tolerance test.
9. Lipid profile: Estimation of cholesterol by Zak‟s method, lipoprotein profile, estimation of ketone bodies, estimation of triglycerides, free fatty acids and phospholipids.