BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600 108.

M.Sc. - BIOCHEMISTRY

CORE PAPER I – BIOMOLECULES

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 6 **SEMESTER: I**

CREDITS: 5 **SUBJECT CODE – 19 MGA**

OBJECTIVES:

- **To study the structure, functions and types of carbohydrates, Lipids and Nucleic acid.**
- **Compare the primary, secondary & tertiary structure of protein physiology.**

UNIT-I (18hrs)

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

UNIT-II (18 hrs)

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

UNIT-III (18 hrs)

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

UNIT-IV (18 hrs)

Nucleic acids – types and forms (A, B and Z) of DNA. Primary, secondary and tertiary structures of DNA. Mitochondrial and chloroplast DNA. Major classes of RNA and their structure. Determination of nucleic acid sequences by Maxam Gilbert and Sanger's method. . Properties of DNA and RNA. C-value, C-value paradox, Cot curves. Structure and role of cAMP, cGMP.

UNIT-V (18 hrs)

An overview of vitamins – source, structure and functions of water soluble and fat soluble vitamins – Enrichment and fortification of food. Hypervitaminosis – With special reference to vitamin A, D. Antioxidants and oxidative stress. Phytochemicals – structure and functions of carotenoids, flavonoids, polyphenols.

BOOKS FOR STUDY:

- Biochemistry - Donald Voet & Judith, 2nd edn (1995)
- Biochemistry - A.L.Leningher, 3rd edn (2000)
- Biochemistry - Leubert Stryer, 4th edn (1995)

BOOKS FOR REFERENCE:

- Nucleic acids - Adam & Smith, 10th edn (1986)
- Chemistry of natural products - Gurdeep Chatwal, vol.2 (1983)

E-BOOKS AND E-RESOURCES:

- Biomolecules by Sathyanarayana
- Biomolecules by S.R.Mishra
- Biomolecules by T.Devasena
- https://www.springer.com
- https://www.elsevier.com
- https://www.kobo.com

LEARNING OUTCOME:

- Understanding the structure, functions and types of macromolecules.
- Understood the role of free radicals, benefits of antioxidants and oxidative stress.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600 108.

M.Sc. - BIOCHEMISTRY

CORE PAPER II – BIOCHEMICAL TECHNIQUES

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 6 **SEMESTER: I**

CREDITS: 5 **SUBJECT CODE : 19MGB**

OBJECTIVES

- **To understand the various techniques**
- **To understand the principle, instrumentation and application of bioinstruments.**
- **Theoretical aspects of modern technique will be dealt.**

UNIT-I (18hrs)

Cell culture techniques, tissue culture hood, CO_2 incubator, autoclaves, principle, instrumentation and application, Types of animal cell culture, preparation of cell culture nutritional requirements, culture media, culture procedure and determination of growth of Bacterial cultures. Plant cell culture-media, culture system-Cell counting and sorting techniques.

UNIT-II (18hrs)

Chromatographic techniques- principles of Chromatography in adsorption and partition techniques, Partition chromatography- Normal and reverse phase liquid chromatography, Chiral Chromatography and counter current Chromatography. Adsorption Chromatography -hydroxy apatite Chromatography and hydrophobic interaction Chromatography.

Gas liquid chromatography- principle, instrumentation, column development, detectors-flame ionization detectors (FID), nitrogen phosphorous 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, quantition 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 (18hrs)

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, tube gels, sample application, detection-staining using CBB, silver, fluorescent stains. SDS PAGE-principle and application in molecular weight determination principle of disc gel electrophoresis 2D PAGE. Electrophoresis of nucleic acid-agarose gel electrophoresis of DNA, DNA sequencing gels, pulse 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 and 2D electrophoresis.

UNIT-IV (18hrs)

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

UNIT-V (18hrs)

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 staining and freeze fracturing.

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

BOOKS FOR STUDY:

- Practical Biochemistry – Keith Wilson and John walker, 6th edition. Ion, Cambridge university press.
- Biophysical chemistry – Upadhya and Upadhya
- Practical Biochemistry – Varley
- Instrumental methods of chemical analysis – Chatwal and Anand

BOOKS FOR REFERENCE:

- Chromatography – Srivatsava
- Analytical Biochemistry – Holme and H. Peck, (1998). Analytical biochemistry. 3rd edition, Longman publishers
- Practical Biochemistry – Keith Wilson and Goulding

E-BOOKS AND E-RESOURCES:

- Biochemistry by Lehninger
- Principles and Techniques of Biochemistry by Wilson and Walker
- https://www.springer.com
- https://www.bookboon.com

LEARNING OUTCOME:

- Understood to isolate, separate and purify the macromolecules applying different techniques.
- Understood to diagnose which causes different biochemical substances and diseases.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600 108.

M.Sc. - BIOCHEMISTRY

CORE PAPER III - INTERMEDIARY METABOLISM-I

(For the students admitted from the year 2019 - 20)

HOUR PER WEEK: 6 **SEMESTER: I**

CREDITS: 5 **SUBJECT CODE: 19MGC**

OBJECTIVES:

- **To understand the various pathways of carbohydrate, protein and nucleic acid metabolism.**
- **To study the mechanism and regulation of various metabolic pathways.**

UNIT-I (18 hrs)

Glycolysis – aerobic and anaerobic, inhibitors and regulation. Feeder pathway- entry of hexoses into glycolysis Pyruvate dehydrogenase complex, TCA cycle, Glyoxalate cycle. Gluconeogenesis- source: reaction sequence and its regulation. Synthesis and degradation of starch.

UNIT-II (18 hrs)

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)and bacterial cell wall polysaccharide.

UNIT-III (18 hrs)

Denovo and salvage pathways, regulation and inhibitors of purine and pyrimidine biosynthesis. Role of ribonucleotide reductase and its regulation. Degradation of purine and pyrimidine nucleotides.

UNIT-IV (18 hrs)

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

UNIT-V (18 hrs)

Biosynthesis and degradation of heme. Oxidation and reduction of inorganic sulphur compound 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.

BOOKS FOR STUDY:

- Lehninger's Principles of Biochemistry- David L. Nelson and Michael Cox -3rd edn- Macmillan
- Biochemistry – Lubert Stryer- 5th edn-W.H Freeman company, Newyork
- Harper's Biochemistry- Robert K. Murray- 26th edn- Mc Graw Hill
- Biochemistry – Donald Voet and Judith Voet-2nd edn- John Wilay and sons.

BOOKS FOR REFERENCE:

- Human Biochemistry – James M.Orten & Otto.W.Neuhan- 10th edn- The C.V.Mosby Company.

E-BOOKS AND E-RESOURCES:

- Intermediary metabolism by Braeckman B.P
- Biochemistry by Lehninger
- Biochemistry by Sathyanarayana
- https://www.books.google.com
- www.wormbok.org

LEARNING OUTCOME:

- Understood the different metabolic pathways of biomolecules.
- Acquired the knowledge on mechanism and regulation of various Metabolism

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M.Sc. - BIOCHEMISTRY

CORE ELECTIVE PAPER I – MICROBIOLOGY

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 4 **SEMESTER: I**

CREDITS: 4 **SUBJECT CODE – 19EG1**

OBJECTIVES:

- **Microbiology is the study of microbes, helps us to understand the characteristics of microbes, its distribution in soil, water and air.**
- **To understand the contamination, spoilage of foods.**
- **To study Bacterial and fungal food poisoning and infections.**
- **It gives us insights into the complexicity of nature and economic benefits of microbes.**

UNIT-I (12 hrs)

Principles, operation and maintenance of instruments in microbiology. Maintenance of aseptic conditions. Mode of functioning and applications of lyophiliser, fermentors, BOD and COD incubators.

General characteristics of bacteria ,virus and yeast. Distribution and role of micro-organism in soil, water and air. Types of culture media, isolation of pure culture, growth curve and the measurement of microbial growth.

UNIT-II (12 hrs)

Contamination and spoilage of foods – cereals, cereal products, fruits, vegetables, meat, fish, poultry, eggs, milk and milk products and general principles of food preservations.

UNIT-III (12 hrs)

Food poisoning- bacterial food poisoning, salmonella, clostridium botulism, staphylococcus aureus, fungal food poisoning – aflatoxin, food infection – clostridium, staphylococcus and salmonella.

UNIT-IV (12 hrs)

Antimicrobial chemotherapy, General characteristics of anti- microbial agents. Mechanism of action – sulfonamides, sulphones and PAS . Penicillin, streptomycin, tetracycline, chloramphenicol – spectra of activity, mode of administration, mode of action, adverse effects and sensitivity test.

UNIT-V (12 hrs)

Pathogenic microorganism, Salmonella, E.coli, Pseudomonas, Klebsiella, staphylococcus, streptococcus, haemophilus , & mycobacterium, causes, cure, control and prevention.

BOOKS FOR STUDY:

- Microbiology - Pelzar,
- General Microbiology - Stainer, 5th edition
- Food Microbiology - Frazier, 3rd edition
- Molecular Biotechnology -Primrose, 2nd edition

BOOKS FOR REFERENCE:

- Textbook of Microbiology - Dubey and Maheshwari
- Microbiology - Joshua, 4th edition

E-BOOKS AND E-RESOURCES:

- Microbiology by Pelczar 7th Edition
- Microbial disease by P.J.Quinn, B.K.Markey
- https://archive.org
- https://openstax.org
- Openaccessbooks.com

LEARNING OUTCOME:

- Acquired the knowledge about the causes of infective diseases.
- Understood the sign, symptoms, preventive measures and treatment of food poisoning and food infection.

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M.Sc. - BIOCHEMISTRY

CORE ELECTIVE PAPER I – PLANT BIOCHEMISTRY

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 4 **SEMESTER: I**

CREDITS: 4 **SUBJECT CODE – 19EG2**

OBJECTIVES:

- **To gain insights into the primary metabolic pathways occurring in plants.**
- **To gain knowledge on plant metabolites.**
- **To understand the industrial potential of plant metabolites.**

UNIT I: (12 hrs)

Ultra Structure and organization of chloroplast membranes, lipid composition of chloroplast membranes, electron transport chain. Thylakoid membrane protein complexes. Calvin cycle: Biochemistry of RuBp Carboxylase or oxygenase, Hatch and slack pathway, CAM plants; productivity of C4 plants.

UNIT II : (12 hrs)

Nitrogen fixation, nitrogenase complex, electron transport chain and mechanism of action of nitrogenase. Structure of 'NIF'genes and its regulation, Hydrogen uptake and bacterial hydrogenases, Nitrate Metabolism: Enzymes of nitrate metabolism, Ammonium assimilation enzymes: glutamine synthetase, glutamate synthase and GDH.

UNIT III: (12 hrs)

Plant growth regulators: Auxins; gibberellins, cytokines, abscicic acid and ethylene - biosynthesis and their metabolic functions, synthetic growth hormones, inhibitors. Stress response in Plants.

UNIT IV: (12 hrs)

Major chemical classes of secondary metabolites: A brief account of the following classes: Alkaloids, terpenoids, flavonoids, Phenolics and phenolic acids,steroids, coumarins, quinines, acetylenes, cyanogenic glycosides, amines and nonprotein amino acids,gums, mucilages, resins etc. (Structures not necessary. Give examples of the compounds and the plants in which present and their importance).

UNIT V: (12 hrs)

Importance of secondary metabolites: Uses of secondary metabolites to man: as drugs, precursors of drugs in pharmaceutical industry, as natural pesticides/insecticides; other

uses of secondaryImportance of secondary metabolites: Uses of secondary metabolites to man: as drugs, precursors of drugs in pharmaceutical industry, as natural pesticides/insecticides; other uses of secondary metabolites.

BOOKS FOR STUDY:

- Plant Metabolism, 1st Ed, 1980,H.D Kumar and H.N Singh
- Secondary Metabolites 1st Ed., 2000,K.G Ramawat, Biotechnology

BOOKS FOR REFERENCE:

- Plant Biochemistry, 1st Ed, 1997, P.M Dey and J.B. Harborne (Editors)
- Plant Metabolism 1st Ed, 1997, Prof David T. Dennis, Prof David H. Turpin, Dr Daniel D. Lefebvre and Dr David B. Layzell(Ed)
- Plant Biochemistry, 3rd Ed, 2004, Hans-Walter Heldt Professor Em,

E-BOOKS AND E-RESOURCES:

- https://ssec.si.edu › stemvisions-blog › what-photosynthesis
- https://nios.ac.in › media › documents › Lesson-10
- https://www2.estrellamountain.edu › biobk › BioBookPLANTHORM
- https://www.ncbi.nlm.nih.gov › pubmed

LEARNING OUTCOME:

- Understand the mechanism of Nitrogen fixation and its importance in agricultural production and economics.
- Know the significance of plant growth regulators in the development of plants.
- Acquire knowledge about the importance of secondary metabolites and its industrial applications.

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M.Sc. - BIOCHEMISTRY

CORE ELECTIVE PAPER I – NANOTECHNOLOGY

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 4 **SEMESTER: I**

CREDITS: 4 **SUBJECT CODE – 19EG3**

OBJECTIVES:

- **To understand the basics of nano, nanoparticles and nanomaterials.**
- **To gain knowledge on various methods of synthesis of nanoparticles and applications of nanoparticles.**
- **To study the characterization of new nanoparticles.**

UNIT I: (12 hrs)

Introduction to Nanotechnology: Definition and Nanoscale, classification of Nanomaterials: Quantum Dots, wells and wires. Emergence of Nanotechnology – Challenges in Nanotechnology - Carbon age–New form of carbon (from Graphene sheet to CNT).

UNIT II: (12 hrs)

Definition of Nano system – Types of Nanocrystals-One Dimensional (1D)-Two Dimensional (2D) Three Dimensional (3D) nanostructured materials. Carbon Nanotubes (CNT) – Metals (Au, Ag) – Metal oxides (TiO_2, CeO_2, ZnO), Biological system – DNA and RNA – Lipids – Size dependent properties – Mechanical, Physical and Chemical properties.

UNIT III: (12 hrs)

Synthesis of bulk nanostructured materials – Sol Gel processing- Mechanical alloying and milling inert gas condensation technique-bulk and nano composite materials – Grinding – high energy ball milling-types of balls-WC and ZrO_2-materials –ball ratio-limitations- melt quenching and annealing

UNIT IV: (12 hrs)

Characterisation: Spectroscopic techniques - Infra red spectroscopy (IR)- UV-visible Absorption, Imaging techniques - Diffraction analysis – XRD, Imaging techniques – Scanning Electron Microscope, Transmission Electron Microscope, Atomic Force Microscopy.

UNIT V: (12 hrs)

Nanotechnology for drug discovery - protein and peptide based compounds for cancer and diabetes - drug delivery - nanoparticle based drug delivery - lipid nanoparticles - vaccination - cell therapy -Gene therapy.

BOOKS FOR STUDY:

- Nanotechnology, MJP Publishers, 2010, S.Shanmugam.
- Nanotechnology, John Wiley & Sons Ltd., 2010, Edited by Jurgen Schulte.

BOOKS FOR REFERENCE:

- Introduction to Nanotechnology, John Wiley & Sons, Inc., 2009, Charles.P.Poole.Jr. Frank.J.Owens.
- Nanotechnology, Jaico publishing house, 2011, Richard.E.Smalley.
- Nanotechnology, Wiley publishing Inc., 2010, Richard Booker, Earl Boysen.
- Nanosystems, K. Eric Drexler, John Wiley & sons Inc., 2010
- Callister's material science and engineering, Wiley India, 2011, R. Balasubramaniam.

E-BOOKS AND E-RESOURCES:

- https://nptel.ac.in › courses
- https://www.nano.gov
- https://www.ncbi.nlm.nih.gov
- Introduction to Nanotechnology, John Wiley & Sons, Inc., 2009, Charles.P.Poole.Jr. Frank.J.Owens.

LEARNING OUTCOME:

- Acquire knowledge about basics of nanoscale, nanoparticles and nanomaterials.
- Gain expertise in designing experiments and research hypothesis.
- Understand the principle and industrial application of nanoparticles.
- Understand the mechanism for synthesis of nanoparticles.

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M.Sc. - BIOCHEMISTRY

CORE PAPER IV- ENZYMES AND ENZYME TECHNOLOGY

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 5 **SEMESTER:II**

CREDITS: 5 **SUBJECT CODE- 19MGD**

OBJECTIVES:

- **To understand the nature, kinetics and regulation of enzymes.**
- **To study isolation, purification and uses of enzymes.**
- **To understand the mechanism of enzyme action.**
- **To study the production and Industrial applications of enzymes.**

UNIT-I (15 hrs)

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 (15 hrs)

Enzyme kinetics – Rate of enzymatic reaction, effect of substrate and enzyme concentration, pH, temperature on enzyme activity. M-M equation, L-B plot, Eadie Hofstee plot. Determination of Km, sigmoidal kinetics and Vmax. 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. Bisubstrate reactions, sequential mechanism compulsory order and random order mechanism, non-sequential mechanism, Ping-pong mechanism.

UNIT-III (15 hrs)

Coenzymes, Cofactors and prosthetic groups. Structure and function of coenzymes – reactions involving CoA, TPP, NAD+, NADP, biotin, folic acid, FMN, FAD, tetrahydrofolate and cobamide. Multienzyme complexes. Function of pyruvate dehydrogenase and fatty acid synthase complexes. Methanogenesis, coenzymes involved in methanogenesis. Significance of Vitamin K – dependent carboxylation in blood clotting process.

UNIT-IV (15 hrs)

Mechanism of enzyme action – enzyme active site, mapping active site, identification of amino acids like lysine, cysteine, serine and histidine in the active site. Enzyme specificity. Mechanism of enzyme action – Factors contributing for maximum catalytic efficiency of

enzymes – covalent catalysis, proximity – orientation effect, acid-base catalysis and effect of strain-stress on enzymes and substrates.

UNIT-V (15 hrs)

Enzyme technology – production and industrial uses of enzymes like amylase, protease, pectinase, lipases and cellulose. Designer enzymes, abzymes, biosensors and ribozyme, Synzymes (synthetic enzymes).Enzyme as therapeutic agents.

BOOKS FOR STUDY:

- Understanding enzymes: Palmer T, Ellis Harwood Ltd, 2001
- Enzyme structure and mechanism: Alan Fersht, Freeman & Co, 1997
- Methods in enzymology Ed. Colowick and Kaplan, Academic press (Continuing series)
- Textbook of Biochemistry with clinical correlations (4 th edition) – Thomas M.Devlin
- Biochemistry chemical reactions of living cells (2001) David E. Matzler. Vol. I.

BOOKS FOR REFERENCE:

- Biological chemistry: H.R Mehler & EH Cordes Harper& Rev
- Enzyme kinetics Siegel interscience – Wiley 1976
- Principles of enzymology for food sciences: Whitaker Marc Dekkar, 1972

E-BOOKS AND E-RESOURCES:

- Enzyme technology by Martin F.chaplin,Christopher Bucke
- Enzymology and Enzyme technology by S.M.Bhatt
- https://iopscience.iop.org
- https://www.sanfoundry.com

LEARNING OUTCOME:

- Acquired the knowledge on medical and industrial applications of Enzymes.
- Understood the mechanism, and kinetics of enzyme action.

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M.Sc. - BIOCHEMISTRY

CORE PAPER V - PHYSIOLOGY AND NUTRITION

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 5 **SEMESTER:II**

CREDITS: 5 **SUBJECT CODE – 19MGE**

OBJECTIVES:

- **To understand the structure and physiology of various organ in the body.**
- **To obtain a better understanding of the principles of nutrition dietetics through the study of physiology.**
- **To study drug-nutrient interactions, effect of drugs on food and nutrition and nutritional therapy for prevention of diseases.**

UNIT-I (15 hrs)

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

UNIT- II (15 hrs)

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 di oxide binding hemoglobin. pH maintenance by cellular and intracellular proteins. Phosphate and carbonate buffers through the lungs and the kidney. Metabolic acidosis and alkalosis. Respiratory acidosis and alkalosis. Hormonal regulation of water balance in man.

Cell- cell adhesion, cell-matrix adhesion, cell junctions, tight junctions, desmosomes, gap junctions and communication between cells.

UNIT-III (15 hrs)

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, synaptogramin, 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.

UNT-IV (15 hrs)

An overview of minerals- sources and functions of minerals- requirements of macro and micro elements- under load and overload criteria for food sources.

UNIT-V (15 hrs)

Nutrition and body's defense- Dietary guidelines for disease prevention, the process of cancer development, the body's defense system and nutritional therapy, drug-nutrient interactions, drug- nutrient problems in modern medicine. Effect of drugs on food and nutrients.

BOOKS FOR STUDY:

- The Living body – C.H. Best & N.B. Taylor 4th edition
- Anatomy of Physiology – Warrick 5th edition
- Human Nutrition and Dietetics – Davidson 6th edition
- Food Science – GG Birch 2nd edition

BOOKS FOR REFERENCE:

- Text book of Human Physiology- Saradha Subramanian and M. Kutty 1st edition
- Textbook of Medical Biochemistry – M.N. Chatterjee and Rana Shinde
- Textbook of Physiology and Biochemistry – R.A. Agarwal, Anil K. Srivatsava & K. Kaushal Kumar 2nd edition.
- Advanced Textbook on Nutrition- DR.M.Swaminathan 2nd edn

E-BOOKS AND E-RESOURCES:

- Biochemistry by satyanarayana.
- Harper's Biochemistry-Robert K.Murray- 26th Edition- MC Grawhill
- https://www.elsevier.com
- https://www.alibris.com

LEARNING OUTCOME:

- Understood the structure and physiological functions of various organs in the body.
- Acquired the knowledge about the drug-nutrient interactions, effect of drugs and nutrients and nutritional therapy for prevention of diseases.

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M.Sc. - BIOCHEMISTRY

CORE PAPER VI - INTERMEDIARY METABOLISM-II

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 5 **SEMESTER:II**

CREDITS: 5 **SUBJECT CODE – 19MGF**

OBJECTIVES:

- **To study the biosynthesis and degradation of fatty acids, triacylglycerol and phospholipids.**
- **Regulation of β - oxidation and biosynthesis of fatty acids.**
- **To understand the biosynthesis and regulation of cholesterol.**
- **To study the metabolism of lipoproteins, hormones and amino acids.**

UNIT-I (15 hrs)

Oxidation of fatty acids saturated and unsaturated fatty acids (α, β and ω oxidation), regulation of β oxidation, fate of propionyl CoA. Ketogenesis and its regulation. Fatty acid synthase complex, fatty acid biosynthesis and microsomal elongation of fatty acids.

UNIT-II (15 hrs)

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 eicosinoic acids.

UNIT-III (15 hrs)

Cholesterol biosynthesis and its regulation. Biosynthesis of bile acids. Lipoprotein metabolism-chylomicrons, VLDL, HDL and LDL**.** Metabolism of glucocorticoids mineralocorticoids**,** androgen, estrogen and progesterone.

UNIT-IV (15 hrs)

Role 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-V (15 hrs)

Degradation of amino acid –glucogenic and ketogenic amino acid. Formation of acetate from leucine and aromatic amino acid, pyruvate from cysteine, threonine and hydroxyl proline,

α-keto glutarate from histidine and proline, succinate from methionine, threonine, valine and isoleucine, Oxaloacetate from aspartate, glycine and serine.

BOOKS FOR STUDY:

- Lehninger's Principles of Biochemistry- David L. Nelson and Michael Cox -3rd edn- Macmillan
- Harper's Biochemistry- Robert K. Murray- 26th edn- Mc Graw Hill
- Biochemistry – Donald Voet and Judith Voet-2nd edn- John Wilay and sons.

BOOKS FOR REFERENCE:

- Human Biochemistry – James M.Orten & Otto.W.Neuhan- 10th edn- The C. V. Mosby Company.
- Biochemistry – Lubert Stryer- 5th edn-W.H Freeman company, Newyork

E-BOOKS AND E-RESOURCES:

- Intermediary metabolism by Braeckman B.P
- Biochemistry by Lehninger
- Biochemistry by Sathyanarayana
- https://www.books.google.com
- www.wormbok.org

LEARNING OUTCOME:

- Understood the metabolism of fatty acids, triacylglycerol and phospholipids.
- Acquired the knowledge about the metabolism of lipoproteins, hormones and amino acids.

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M.Sc. - BIOCHEMISTRY

ELECTIVE PAPER II- ENERGY AND DRUG METABOLISM

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 4 **SEMESTER:II**

CREDITS: 4 **SUBJECT CODE – 19EG4**

OBJECTIVES:

- **To understand ETC, mechanism of ATP synthesis and regulation of oxidative phosphorylation.**
- **To study the light and dark reactions of photosynthesis.**
- **Energy and drug metabolism study is to identify and characterize drug metabolites and specific enzymes responsible for its metabolism.**

UNIT-I (12 hrs)

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. High energy compounds.

UNIT-II (12 hrs)

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 (12 hrs)

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

UNIT-IV (12 hrs)

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 pathway – glycolysis, (aerobic and anaerobic) citric acid cycle, beta oxidation.

UNIT-V (12 hrs)

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

BOOKS FOR STUDY:

- Lehninger's Principles of Biochemistry- David L. Nelson and Michael Cox -3rd edn-Macmillan
- Biochemistry – Lubert Stryer- 5th edn-W.H Freeman company, Newyork
- Harper's Biochemistry- Robert K. Murray- 26th edn- Mc Graw Hill
- Text book of Medical Biochemistry – M.N Chatterjee and Ranashinde- 4th edn-Jaypee

BOOKS FOR REFERENCE:

- Plant physiology – Devlin
- Biochemistry – Donald Voet and Judith Voet-2nd edn- John Wilay and sons.

E-BOOKS AND E-RESOURCES:

- Biochemistry by Lehninger
- Biochemistry by Sathyanarayana
- https://www.books.google.com
- www.wormbok.org

LEARNING OUTCOME:

- Acquired the knowledge about ETC, mechanism of ATP synthesis and regulation of oxidative phosphorylation.
- Understood the knowledge about energy and drug metabolism

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600 108.

M.Sc. - BIOCHEMISTRY

ELECTIVE PAPER II

PHYTOCHEMISTRY AND PHARMACOGNOSY

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 4 **SEMESTER:II**

CREDITS: 4 **SUBJECT CODE – 19EG5**

OBJECTIVES:

- **To understand the basic terminologies: pharmacognosy, medicinal plant, crude drug, folk medicine and flora.**
- **To acquire knowledge on the physical, chemical and biological properties of drugs.**
- **To understand the identity and purity of particular pharmaceutical compounds.**

UNIT I: (12hrs)

Glycosides, Anthraquinones. Flavonoids (definition, natural sources, classification, biogenesis, extraction, isolation, identification and therapeutic applications). Anthocyanins, Coumarins, Terpenes, Volatile Oils (definition, classifications, natural sources, medicinal and non medicinal uses, pharmacological and toxicological effects).

UNIT II: (12 hrs)

Saponins and Alkaloids (definition, natural sources, classification, physical and biological properties, localization, nomenclature, physico-chemical properties, extraction, detection, isolation, purification, biosynthetic origin and pharmacological activities.

UNIT III: (12 hrs)

Historical development, modern concept and scope of Pharmacognosy. Significance of Pharmacognosy in various systems of medicine viz; Ayurveda, Unani, Homeopathic, Siddha and Allopathic systems practiced in India. Common drugs of plant origin. Quantitative microscopyan overview. Importance of authentication of plants. Preparation of herbal extracts. Natural pesticides and Insecticides-Tobacco, Pyrethrum, Neem. Introduction to herbicides and fungicides. Study of Indian toxic plants.

UNIT IV : (12 hrs)

Harmonization of regulatory requirements including ICH activity. Regulatory requirements of different regions applicable to pharmaceutical developments, manufacturing, quality control on finished products, extended release products, biopharmaceutical and bioequivalence assessment and good clinical practices and comparison with regulation in India. Filing of INDA, NDA and ANDA for approval and registration.

UNIT V: (12hrs)

Role of stability testing, stability test guidelines. Protocol of stability testing including testing under different climatic zones and conditions. Conduct of stability testing, presentation and recording of stability data, determination of shelf life. Stability test equipment and recent developments in this area. Documentation: Importance of documentation, statuatory requirements and procedure for documentation, critical examination of documents.

BOOKS FOR STUDY:

- Pharmacognosy, Niraliprakasham, 42nd edition: sep 2008, C.K. Kokate, A.P. Purohit and S.B. Gokhle
- Phytochemistry , Pharmacology and Therapeutics –Vol 3, Daya publishing house, 1st edition, 2014,Gupta, Vijay Kumar and Singh, Medicinal plants.

BOOKS FOR REFERENCE:

- A Guide for Health Care Professionals- By Carol A. Newal, Linda A. Anderson and J. David Phillipson. (1997), Herbal Medicines.
- Text books of Pharmacognosy and Phytochemistry; Elsevier india publishers, 1st edition, 2012, Biren Shah, Avinashseth.
- Pharmacognosy and Pharmacobiotechnology; New age india (P) ltdpublisher; 2nd edition, 2007, Ashutosh Kar.

E-BOOKS AND E-RESOURCES:

- www.bsienvis.nic.in
- Pharmacognosy and Pharmacobiotechnology; New age india (P) ltdpublisher; 2nd edition, 2007, Ashutosh Kar

LEARNING OUTCOME:

- Understand the basic terminologies: pharmacognosy, medicinal plant, crude drug, folk medicine and flora.
- Acquire knowledge on the methods for detection and identification of natural drugs.
- Evaluate the purity of the medicinal drug as well as detection of its adulteration.
- Understand the procedures for clinical trials of herbal products.

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M.Sc. - BIOCHEMISTRY

ELECTIVE PAPER II- BIOETHICS

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 4 **SEMESTER:II**

CREDITS: 4 **SUBJECT CODE – 19EG6**

OBJECTIVES:

- **To study the Human rights**
- **To study about the ethical issues related to human and animals.**

UNIT I (12hrs)

Introduction to HR, definition fundamental rights- International Instruments- UDHR- United Nation commission for HR- ICCPR (International Covenant on civil and political rights)-Historical Development of HR.

UNIT II (12hrs)

Development of HR in India – Article 21 of Indian Constitution- Protection of Human Rights Act 1993- NHRC- SHRC (functions)-Economics of HR and Human Relations – Theory of moral sentiments by Adam Smith. Economic philosophy of Thiruvalluvar.

UNIT III (12hrs)

Students activity – Assignment/seminar- case study- definition, women rights, newspaper articles- right to livelihood, right of women, right to food, water, education, medical care and shelter.

UNIT IV (12hrs)

Bioethics- Definition; Ethical concerns regarding trangenesis. Bioethical issues of reproductive and therapeutic cloning - Applications of cloning- Therapeutic cloning and FDA approved cloned food. Bioethics in animal genetic engineering – IAEC guidelines of animal experiments; bioethics in plant genetic engineering, ethics of using recombinant drug.

UNIT V (12hrs)

Genetically modified foods- contradiction – health hazards. Labeling- Regulations of field experiments and release of GMOs into the field, Biohazards, Biosafety measures. Intellectual Property Rights- Introductions –Patent Procedure in India.

BOOKS FOR STUDY:

- Concept, theory and practical of human rights. Praveen Vadkar.
- Contemporary issues in bioethics – Beuchamp.

BOOKS FOR REFERENCE:

- Genes VII, First edition, Benjamin Lewin, 2000.
- Theory of Moral Sentiments, Adam Smith
- Thirukural: Arathuppal and Porutpal - Thiruvalluvar.

E-BOOKS AND E-RESOURCES:

- www.practical bioethics.org
- www.britannica.com
- www.ncbi.nlm.nih.gov.in
- Adam smith, theory of moral sentiments.

LEARNING OUTCOMES:

- Gained knowledge about the human rights.
- Acquired knowledge about the ethical issues related to human and animals.

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M.Sc. - BIOCHEMISTRY

SUPPORTIVE ELECTIVE PAPER I-
NUTRITIONAL ASPECTS OF DISEASES

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 3 **SEMESTER:II**

CREDITS: 3 **SUBJECT CODE – 19SG1**

OBJECTIVES:

- **Nutrient – Related diseases that cause illness in humans.**
- **To understand the deficiency and overload of major and minor nutrients in the diet.**

UNIT-I (9 Hrs)

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

UNIT-II (9 Hrs)

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 (9 Hrs)

Nutritional aspects of lipids- lipids present in diet. Functions: essential fatty acids; lipoproteins- lipemia-ketosis-atherosclerosis-symptoms, risk factors. Role of diet in the management of atherosclerosis.

UNIT-IV (9 Hrs)

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

UNIT-V (9 Hrs)

Vitamins- sources, recommended daily allowance (RDA) and functions of vitamins A, D and B complex. Deficiency disorders of vitamin A, D, and B complex (thiamine, riboflavin, niacin, pyridoxine, folic acid and cobalamine) (structure not necessary)

Minerals- essential minerals like calcium and iron. Deficiency disorder of anemia and rickets.

BOOKS FOR STUDY:

- Advanced Textbook on Nutrition- DR. M.Swaminadhan 2nd edn
- Textbook of Medical Biochemistry –M.N.Chatterrjae and Rana Shinde 4th edition.
- Human Nutrition and Dietetics –Davidson 6thedition.

BOOKS FOR REFERENCE:

- Food science- GG Birch 2ndedition.

E-BOOKS AND E-RESOURCES:

- Harper's Biochemistry-Robert K. Murray-26th edition- MC.Grawhill
- Biochemistry by Sathyanarayana
- https://www.elsevier.com
- https://m.alibris.com

LEARNING OUTCOME:

- Acquired knowledge about the major energy yielding, protective food nutrients and nutritional aspects of food.
- Understood the deficiency and overload of major and minor nutrients in the diet.

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M.Sc. - BIOCHEMISTRY

CORE PRACTICAL – I

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 4 **SEMESTER:II**

CREDITS: 4 **SUBJECT CODE – 19MG1**

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. Estimation of lactate.
6. Estimation of pyruvate.
7. Estimation of tryptophan.
8. Estimation of protein by Lowry's method.
9. Estimation of calcium.
10. Estimation of iron.
11. Estimation of Ascorbic acid

GROUP EXPERIMENT:

Sub cellular Organelles - Separation of Mitochondria and Nucleus and identify the subcellular organelles using marker enzymes.

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M.Sc. - BIOCHEMISTRY

CORE PRACTICAL – II

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 4 **SEMESTER:II**

CREDITS: 4 **SUBJECT CODE – 19MG2**

1. Assay of Acid phosphatase.
2. Assay of Alkaline phosphatase
3. Assay of ATPase.
4. Assay of Catalase.
5. Assay of Amylase.
6. Effect of substrate concentration and Km on the activity acid phosphatase.
7. Effect of inhibitor concentration on the activity of acid phosphatase.
8. Effect of temperature on the activity of alkaline phosphatase.
9. Effect of pH on activity of alkaline phosphatase.
10. Test for blood grouping (Haem agglutination).

GROUP EXPERIMENT - Separation of proteins by SDS-PAGE.

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M.Sc. - BIOCHEMISTRY

CORE PAPER VII - BIOTECHNOLOGY

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 5 **SEMESTER:III**

CREDITS: 5 **SUBJECT CODE – 19MGG**

OBJECTIVES:

- **Biotechnology is the study of technology involving living systems and organisms, to produce genetically engineered products.**
- **To understand the applications of various techniques in industry and research.**

UNIT-I (15 Hrs)

Molecular tools of genetic engineering, restriction endo nucleases-, DNA ligases, alkaline phosphatase and DNA modifying enzymes. Vectors as the cloning vehicles- plasmids, bacteriophages, cosmids, artificial chromosome vectors, shuttle vectors. Methods of gene transfer – transformation, conjugation, electrophoration, liposome mediated gene transfer, transduction, and direct transfer of DNA .

UNIT-II (15 Hrs)

Gene cloning strategies - Cloning from genomic DNA or mRNA, Genomic DNA libraries, chromosome walking, cDNA cloning, PCR, Inverse PCR, RT- PCR,. RACE, RAPD. ELISA and Blotting techniques. Genomics – an overview, genome projects, proteomics – basic principles of DNA microarray.

UNIT-III (15 Hrs)

Plant Biotechnology: Agro bacterium mediated gene transfer to plant cells, micro projectiles, transgenic plant technology- for pest resistance, herbicide tolerance, delay of fruit ripening. Nif gene and its role in nitrogen fixation. Transgenic plants and their uses.

UNIT-IV (15 Hrs)

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

UNIT-V (15 Hrs)

Animal cell culture- cell separation, establishment of cells in culture and mass cultivation of cells, Hybridoma technology and its applications. Transgenic mice, animal bioreactors, IVF, recombinant vaccines and DNA vaccines. Gene therapy : antisense nucleotides as therapeutic agents .

BOOKS FOR STUDY:

- Biotechnology- Glick and Pasternak
- Biotechnology-Keshav Trehan , 2nd edition
- Biotechnology- Sathyanarayana

BOOKS FOR REFERENCE:

- An introduction to genetic engineering- Old RW, Primrose SB Blackwell Publishing (2003)
- Molecular cloning- A laboratory manual: Cold Spring Harbor Lab Press (2005)- Sambrook J, Fritsch EF, Maniatis T

E-BOOKS AND E-RESOURCES:

- A Textbook of Biotechnology by RC Dubey.
- Molecular Biotechnology by Jack.J.Pasternak
- https://www.elsevier.com
- https://open.umn.edu

LEARNING OUTCOME:

- Acquired the knowledge to produce genetically engineered products.
- Understood the applications of various techniques in industry and research.

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M.Sc. - BIOCHEMISTRY

CORE PAPER VIII - CLINICAL BIOCHEMISTRY

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 5 **SEMESTER:III**

CREDITS: 5 **SUBJECT CODE – 19MGH**

OBJECTIVES:

- **To understand the applications of various biochemical parameters.**
- **To understand the pathology,diagnosis of various metabolic disorders.**

UNIT-I (15 hrs)

Collection and Preservation of biological specimens -blood, urine, CSF and amniotic fluid. Disorders of carbohydrate metabolism hypoglycemia, Diabetes mellitus-causes, pathology, types, Metabolic complications, Diagnosis-by GTT, Glycated Hemoglobin, Treatment with anti-diabetic drugs and herbal remedy for Diabetes mellitus.

UNIT-II (15 hrs)

Disorders of blood cells- Hemolytic, iron deficiency and aplastic anemia 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-III (15 hrs)

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

UNIT-IV (15 hrs)

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

UNIT-V (15 hrs)

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 tumor, Hypopituitarism, Hypogonadism-Causes, pathology ,symptoms and diagnosis.

BOOKS FOR STUDY:

- Biochemistry with clinical correlation – Devlin Thomas M.
- Textbook of Biochemistry – R. Swaminathan
- Inborn errors of Metabolism – Duncan
- Medical Biochemistry – Chatterjee
- Clinical chemistry in diagnosis and treatment-P.D.Mayne

BOOKS FOR REFERENCE:

- Clinical Biochemistry – Zilva and Pannell
- Lecture notes on Clinical chemistry – L.G. Whitby

E-BOOKS AND E-RESOURCES:

- A Textbook of Biochemistry by R.Swaminathan.
- Medical Biochemistry- Chatterjee.
- https://www.bookboon.com
- Journals.sagepub.com

LEARNING OUTCOME:

- Understood the application of various biochemical parameters.
- Acquired the knowledge of pathology and diagnosis of various metabolic disorders.

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M.Sc. - BIOCHEMISTRY

CORE PAPER IX - CELL AND MOLECULAR BIOLOGY

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 5 **SEMESTER:III**

CREDITS: 5 **SUBJECT CODE – 19MGJ**

OBJECTIVES:

- **To understand the genetic material and the process involved in the conversion of gene to protein.**
- **To understand the mechanism of mutations and protein processing.**

UNIT-I (15 hrs)

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

UNIT-II (15 hrs)

DNA as the genetic material (classical experiments), Replication machinery. Prokaryotic replication mechanism, Organization of chromosomes, eukaryotic DNA Replication, The roles of topoisomerases.

UNIT-III (15 hrs)

Mutation, Mutagens, spontaneous and induced mutation, molecular mechanisms of mutation. DNA repair mechanisms-Direct repair, excision repair, mismatch repair, recombination repair, SOS response. The Holliday model, the general recombination in E.*coli*, transposons and retroposons.

UNIT-IV (15 hrs)

Transcription- Prokaryotic and Eukaryotic transcription, Subunits of RNA polymerase, promoters and enhancers. Transcription factors. Post Transcriptional modifications- mRNA 5' capping and 3' polyadenylation, splicing and tRNA, GU-AG rule, Tryp and Lac operon.

UNIT-V (15 hrs)

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. Post translational modification. Protein sorting-signal peptides.

BOOKS FOR STUDY:

- Genes VI – Benjamin Lewis
- Genes VII – Benjamin Lewis
- Biochemistry – Donald Voet and Judith Voet
- Cell - Cooper

BOOKS FOR REFERENCE:

- Molecular cell biology- Baltimore
- Molecular and cellular biology-Wolfe. S.L

E-BOOKS AND E-RESOURCES:

- Molecular biology of the cell by Bruce Alberts
- Watson Molecular biology of the gene 7^{th} edition
- https://www.intechopen.com
- https://kundoc.com

LEARNING OUTCOME:

- Acquired the knowledge about the genetic material and processing of gene to protein.
- Understood about the mutagens, types of mutation and mechanism of mutation.

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M.Sc. - BIOCHEMISTRY

ELECTIVE PAPER III - BIOSTATISTICS

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 4 **SEMESTER:III**

CREDITS: 4 **SUBJECT CODE – 19EG7**

OBJECTIVES:

- **To study various statistical parameters such as mean, mode, median, ANOVA, student "t" test and SPSS.**
- **To understand the various methodology in research.**

UNIT-I (12 Hrs)

Collection of data 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. Simple problem based on biochemical data.

UNIT-II (12 Hrs)

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

UNIT-III (12 Hrs)

Basic concepts of sampling – Simple random sample stratified sample and systemic sampling distribution and standard error. Test of significance based on large samples. Small sample tests- Student 't' test for mean, difference of two way means, Chi- square test for goodness of a non-independence of attributes.

UNIT-IV (12 Hrs)

F test for equality of variances. ANOVA- one way and two way. Simple problem based on biochemical data be studied.

UNIT-V (12 Hrs)

Use of computer in statistical Data processing.SPSS software for calculation graph Pad Prism for diagram, MS Excel, simple problems-to be studied using software.

BOOKS FOR STUDY:

- An introduction to Biostatistics – second revised edition by N. Gurumani
- Statistical methods for biologist by S.Palanichamy & M.Manoharan.

BOOKS FOR REFERENCE:

- SPSS for you by A. Rajathi and P.Chandran, MJP publishers.

E-BOOKS AND E-RESOURCES:

- Research methodology and Biostatistics-1st edition-Elsevier
- Biostatistics and Research Methods by J. Richard
- https://www.elsevier.com
- https://www.kopykitab.com

LEARNING OUTCOME:

- Acquired knowledge to measure various statistical parameters.
- Understood the application of various methodologies in research.

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M.Sc. - BIOCHEMISTRY

ELECTIVE PAPER III - MEMBRANE BIOCHEMISTRY

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 4 **SEMESTER:III**

CREDITS: 4 **SUBJECT CODE – 19EG8**

OBJECTIVE:

- **To study the structure of the cells**
- **To study the composition and function of membrane**
- **To study the transport and receptor cells**

UNIT I (15hrs)

Biological Membranes – Structure and functions of plasma membrane Chemical composition and properties of biomembranes – Models of lipid membranes - preparation and properties. Detergents, micelles, Liposomes. Cytological, chemical and physical methods to study membrane structure, Lipid raft and calveolae - Different models of cell membrane a historical - perspective. Cell-Cell communication-Gap junctions, desmosomes and tight junctions.

UNIT II (15 hrs)

Red cell membrane- Isolation, Major Proteins in RBC membrane (Spectrin, Ankyrin, Band 4.1, Anion exchange proteins. Glycophorin) - Diseases caused due to mutations that affect membrane proteins - Hereditary spherocytosis, Paroxysmal nocturnal hemoglobinuria. Plant cell Walls Structure, composition and biosynthesis.

UNIT III (15 hrs)

Membranes surrounding mitochondria, Endoplasmic reticulum. Membrane surrounding nucleus and lysosomes. Bacterial cell wall- Structure Composition and biosynthesis. Inhibitors of cell wall synthesis.

UNIT IV (15hrs)

Transport across biomembranes - Simple diffusion and Fick's law, facilitated diffusion - Kinetics of facilitated transport - Symport, antiport and Uniport. Active transport - protein Pumps - Na+ - K+ATPase and its metabolic significance, Gastric HCl secretion .

UNIT V (15hrs)

Receptors-Definition and Types - Neurotransmitter and its types - Structure and functions of adrenergic and cholinergic, glucose receptors, Action potential generation, -

Photoreceptors and vision - Receptor desensitization, Receptor mediated endocytosis, LDL receptors - biological and clinical significance - Familial hypercholesterolemia. Hormonal receptors -G-proteins and adenylatecyclase . Cystic fibrosis and Wilson disease

BOOKS FOR STUDY:

- Biochemistry – Stryer L, 4thediton, 1999, W.H. Freeman & Company, New York.
- Molecular cell biology – Lodish etal. 7th edition. W.H. Freeman & Company.2012

BOOKS FOR REFERENCE:

- Biochemistry – Voet. D &Voet. J.G, 1st edition, 1990, John Wiley & Sons, Inc.
- Principles of Biochemistry – Nelson D.L, Cox M.M, 2nd edition, 1993, CBS publishers & Distributors, Delhi.

E-BOOKS AND E-RESOURCES:

- http:www.ncbi.nlm.nih.gov
- http://www.wikibooks.org
- http:www.omicsonline.org

LEARNING OUTCOMES:

- Acquired the knowledge about the structure of cell membrane
- Gained knowledge about composition and function of membranes.

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M.Sc. - BIOCHEMISTRY

ELECTIVE PAPER III - BIOCHEMICAL TOXICOLOGY

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 4 **SEMESTER:III**

CREDITS: 4 **SUBJECT CODE – 19EG9**

OBJECTIVES:

- **To provide a complete understanding of the responses of the body to toxic agents and the therapeutic approaches to toxicity.**
- **To gain knowledge on the forensic aspects like legal procedures and types of trauma.**

UNIT I: (12hrs)

Fundamentals of Toxicology and dose-Response Relationships: Biomarkers, Criteria of Toxicity Evaluation of Toxicity Interactions; Dose Response; Measurement of Dose-Response; Relationships Linear Dose Response Hormesis; Hazard and Risk Assessment Duration and Frequency of Exposure and Effect of action.

UNIT II: (12hrs)

Factors Affecting Toxic Responses: Disposition: Absorption, Sites of absorption, distribution, Excretion; Metabolism: types of Metabolic change phase I reactions; Phase 2 reactions; control of Metabolism, Toxication vs. Detoxication

UNIT III: (12hrs)

Test protocol, Genetic toxicity testing & Mutagenesis assay: In vitro test systems: bacterial mutation tests-Reversion test, Ames test, Fluctuation test, and Eukaryotic mutation test. In vivo test system Mammalian mutation test - Host mediated assay and Dominant Lethal test. Biochemical basis of toxicity.

UNIT IV: (12hrs)

Toxic Responses to Foreign Compounds: Direct Toxic Action, Mechanism and response in cellular toxicity, pharmacological, physiological and Biochemical effects; Developmental Toxicology-Teratogenesis, Immunotoxicity, Genetic Toxicity and Chemical Carcinogenesis.

UNIT V: (12hrs)

Biochemical Mechanisms of Toxicity: Tissue Lesions: Liver Necrosis; kidney Damage; Lung Damage, Liver damage, Cardiac damage; Neurotoxicity; Exaggerated and Unwanted pharmacological effects; Physiological effects; Biochemical Effects: Lethal Synthesis and Incorporation, Interaction with specific Protein Receptors.

BOOKS FOR STUDY:

- The Essentials of Forensic Medicine & Toxicology, 2007. 26th Edition, Narayanareddy K. S.
- Fundamentals of forensic medicine and toxicology. 2009. 2nd Edition, Basu, R.
- Principles of Forensic Medicine, 2005, ApurbaNandy.
- Forensic Medicine, 2003, Hyderabad, Guharaj P. V.

BOOKS FOR REFERENCE:

- Textbook of Medical Jurisprudence and Toxicology,6th Edition 1999,Reprint 2007,Parikh C.K., Parikh's
- Medical Jurisprudence and Toxicology.21st Edition, Franklin, C.A Modi's.
- Forensic Medicine, ELBS. 9th Edition, 1988, Keith Simpson, Bernard Knight.
- Text book of Forensic Medicine, 2009, Pillay V.V
- Forensic Medicine and Toxicology – Volume I and II (combined)-edited by Karmakar, III Edition 2007.JB Mukherjee's
- Medical Jurisprudence &Toxicology, 2004, 11 th Edition, Lyon's
- Textbook of Medical Jurisprundence and toxicology, 22nd edition, 2001, Modi's
- Text book of Forensic Medicine & Toxicology- Principles and Practice, BI Churchill Livingston, New Delhi, 2nd edition, 2002, Dr. KrishanVij

E-BOOKS AND E-RESOURCES:

- http://toxtutor.nlm.nih.gov
- Fundamentals of forensic medicine and toxicology. 2009. 2nd Edition, Basu, R.

LEARNING OUTCOMES:

- Understand the basic principles and have current, cutting-edge knowledge in human health toxicology.
- Assess both acute and chronic toxicity data and evaluate different type of dose – response relationships including effects of mixtures of compounds with similar mode of action.

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M.Sc. - BIOCHEMISTRY

SUPPORTIVE ELECTIVE-II

LIFE STYLE – DISEASE AND PREVENTION

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 3 **SEMESTER:III**

CREDITS: 3 **SUBJECT CODE – 19SG2**

OBJECTIVES:

- **To understand the various modern lifestyle diseases.**
- **To understand the various diagnostic and preventive measures of lifestyle diseases.**

UNIT-I (9 hrs)

Obesity- prevalence –causes, consequences, symptoms- Coronary Heart Disease and type 2 diabetes mellitus- lifestyle and dietary management of obesity.

UNIT-II (9 hrs)

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 (9 hrs)

Cancer-types of cancer, etiology 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 (9 hrs)

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 (9 hrs)

Gallstones- causes, factors, etiology 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.

BOOKS FOR STUDY:

- Biochemistry with clinical correlation – Devlin Thomas M
- Nutritional of Biochemistry – R. Swaminathan
- Medical Biochemistry – Chatterjee
- Human nutrition and dietetics - Davidson and Passmore

BOOKS FOR REFERENCE:

- Clinical Biochemistry – Zilva and Pannell
- Clinical dietetics and nutrition - Anitha

E-BOOKS AND E-RESOURCES:

- A Textbook of Biochemistry by R.Swaminathan.
- Medical Biochemistry- Chatterjee.
- https://www.bookboon.com
- Journals.sagepub.com

LEARNING OUTCOME:

- Acquired knowledge about various diseases due to modern life style.
- Understood the various diagnostic and preventive measures of life style disease.

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M.Sc. - BIOCHEMISTRY

CORE PAPER X – HORMONAL BIOCHEMISTRY

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 6 **SEMESTER:IV**

CREDITS: 5 **SUBJECT CODE – 19MGK**

OBJECTIVES:

- **To understand the biological role of hormones and their mechanism of action.**
- **To understand the disorders associated with hypo and hyper functioning of endocrine glands.**

UNIT-I (18 hrs)

Hormones – classification based on chemical nature and mechanism of action. . Mechanism of hormone action – target cell concept – feedback control concept and regulation. Steroid hormone receptors-mechanism of steroid hormone action. Thymus as an endocrine glands- hormones of thymus-Biological properties. Hormones of hypothalamus and hormones of pituitary – Releasing hormones – anterior pituitary hormones- Growth promoting, lactogenic hormones – secretin, actions, functions and feedback regulation of synthesis. Glycoprotein hormones, the POMC family, endorphins. Posterior pituitary hormones – oxytocin and vasopressin- structure and function.

UNIT-II (18 hrs)

Pancreatic hormones – types of cells of islets of langerhans. Insulin, glucagons, somatostatin – structure, biosynthesis , regulation of secretion, biological action and mechanism of action. Pancreatic polypeptide, insulin like growth factor – structure and biological actions. Gastrointestinal hormones – secretin, cholecystokinin and gastrin-biological action, regulation of secretion.

UNIT-III (18 hrs)

Thyroid hormones – synthesis, secretion, transport, biological function, metabolic fate, mechanism of action and regulation. Antithyroid agents, Thyroid disease-thryrotoxicosis, goitre, hypothyroidism–grave's disease and Hashimotos thyroiditis Parathyroid hormones – biological action, regulation of calcium and phosphorous metabolism and the role of calcitonin. Calcitriol – biosynthesis, transport, biological action and mechanism of action. Hypo and hyper functioning of thyroid and parathyroid glands. Rickets, osteomalacia and osteoporosis.

UNIT -IV (18 hrs)

Adrenal hormone – glucocorticoids and mineralocorticoids – secretion, transport, excretion and biological functions. Adrenal androgens – metabolic effects and functions. Adrenal medulla – catecholamines- storage and regulation of synthesis, biological effects and metabolism of action. Abnormal secretion of Adrenal hormones-Addison's disease, Cushing

syndrome, Congenital adrenal hyperplasia. Phaeochromocytoma prostaglandins chemistry – biosynthesis, metabolism, biological effects and mechanism of action of prostaglandins.

UNIT - V (18 hrs)

Gonadal hormones – chemical nature and mechanism of action of androgens, estrogen and progesterone. Factors involved in the regulation of gonadal hormones. Menstrual cycle its phases – polycystic ovarian syndrome (PCOS) causes symptoms and treatment. IVF - its methodology

BOOKS FOR STUDY:

- Harper's Biochemistry - Murray Robert
- Textbook of Endocrinology- Wilson and Foster
- Biochemistry of Clinical Medicine- Hoffman WS
- Disease of Metabolism - Duncan
- Biochemistry by Clinical correlations – Devlin
- Basic and Clinical endocrinology- Greenspan
- William's Text book of Endocrinology-Wilson and Foster 8th edition

BOOKS FOR REFERENCE:

- Biochemical basis of Medicine – Thomas JH and Gillham
- Essential Endocrinology - John Laycock and peterwise
- Tietz textbook of Clinical Chemistry - Burtes, Edward R.Ashwood
- Lecture notes on Clinical Chemistry – Whitby LG

E-BOOKS AND E-RESOURCES:

- Hormones-2nd edition- Elsevier.
- Hormones and the endocrine system by Bernhard Kleine Winfried G. Rossmanitha
- https://www.elsevier.com
- https://www.springer.com

LEARNING OUTCOME:

- Understood the biological functions and mechanism of action of hormones.
- Understood the various disorders associated with hypo and hyper functioning of endocrine glands.

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M.Sc. - BIOCHEMISTRY

APPLICATION ORIENTED PAPER

ADVANCED CLINICAL BIOCHEMISTRY

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 6 **SEMESTER:IV**

CREDITS: 6 **SUBJECT CODE – 19MGL**

OBJECTIVES:

- **To study the clinical aspects of disease.**
- **To understand the normal and abnormal biochemical constituents.**

UNIT-I (18hrs)

Clinical enzymology, functional and non- functional serum enzymes –Normal levels. Clinical significance of AST, ALT, ALP, CK, Isocitrate dehydrogenase,γ-GT,5'-nucleotidase, amylase, lipase and Glucose-6-phosphate dehydrogenase. Enzyme pattern in diseases-myocardial infarction and liver diseases. Isoenzymes –LDH, CK and ALP. Enzymes as therapeutic agents.

UNIT-II (18hrs)

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 amino acid metabolism-phenyl ketonuria, Albinism, Tyrosinemia, Maple syrup urine disease and alkaptonuria- causes and symptoms.

UNIT-III (18hrs)

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 (18hrs)

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

UNIT-V (18hrs)

Bacterial, Viral and fungal diseases causes and pathology with special reference to Bacterial (TB), Viral (AIDS, Dengue), Fungal (Candidiasis), Sexually transmitted disease (Syphilis). Neurodegenerative diseases- Prevalence, Risk factors, symptoms, Treatment for Alzheimer's and Parkinson's diseases.

BOOKS FOR STUDY:

- Biochemistry with clinical correlation – Devlin Thomas M.
- Textbook of Biochemistry – R. Swaminathan
- Inborn errors of Metabolism – Duncan
- Medical Biochemistry – Chatterjee
- Biochemistry of clinical Medicine.-Hoffman

BOOKS FOR REFERENCE:

- Clinical Biochemistry – Zilva and Pannell
- Lecture notes on Clinical chemistry – L.G. Whitby

E-BOOKS AND E-RESOURCES:

- A Textbook of Biochemistry by R.Swaminathan.
- Medical Biochemistry- Chatterjee.
- https://www.bookboon.com
- Journals.sagepub.com

LEARNING OUTCOME:

- Understood the clinical aspects of diseases.
- Acquired the knowledge about normal and abnormal biochemical constituents.

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M.Sc. - BIOCHEMISTRY

CORE PRACTICAL III

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 4 **SEMESTER:IV**

CREDITS: 4 **SUBJECT CODE – 19MG3**

BLOOD ANALYSIS

1. Collection of blood samples with suitable preservatives and preservation for various analysis.
2. Estimation of glucose by using ortho-toluidine reagent.
3. Estimation of urea by using diacetyl monoxime reagent
4. Estimation of Protein by Lowry's method
5. Estimation of Uric acid
6. Estimation of Creatinine
7. Estimation of lipid peroxides in terms of malondialdehyde
8. Estimation of Iron
9. Estimation of Cholesterol
10. Estimation of phospholipids.
11. Estimation of Calcium
12. Glucose tolerance test
13. Estimation of Glutathione

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CORE PRACTICAL IV

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 4 **SEMESTER:IV**

CREDITS: 4 **SUBJECT CODE – 19MG4**

I. Urine Analysis

A. Quantitative Analysis of normal and abnormal components in urine sample and their clinical significance. Abnormal components-Protein, sugars-Glucose and fructose, ketone bodies, aminoacids, calcium, bilirubin and bile salts.

B. Quantitative determination of

- Calcium
- Uric acid
- Urea
- Creatine and creatinine
- Phosphorus

II. Blood Analysis of

- Alkaline phosphatase
- Lactate dehydydrogenase
- Glutathione peroxidase
- Vitamin C

III. Electrophoretic Techniques

- Separation of LDH/CPK isoenzymes by native PAGE.

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M.Sc. - BIOCHEMISTRY

ELECTIVE PAPER – IV- SIGNAL TRANSDUCTION

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 5 **SEMESTER:IV**

CREDITS: 5 **SUBJECT CODE – 19EG10**

OBJECTIVES:

- **To understand how a cell transduces signal from the plasma membrane to the nucleus.**
- **To study the various mechanisms involved in cell signaling.**

UNIT-I (15 hrs)

Significances of extra cellular signaling. Intracellular signaling, ligands involved in signaling, binding of ligands with effector protein, classification of receptors- cell surface and cytoplasmic receptors, and steroid hormone receptor family. Receptors – tyrosine kinase and cytokine receptors. Role of nitric oxide, growth factors and eicosanoids- their role in signal transduction pathways.

UNIT-II (15 hrs)

G-proteins-structure, functions and their role in signal transduction. Activation of G-proteins, the effect of hormones on G-proteins and function- Effect of bacterial toxins on G-protein functions. Cyclic AMP as secondary messenger- role of adenylatecyclase and phosphodiesterase. Regulation of adenylatecyclase- mechanism of action of cAMP, action of protein kinase A and C. Role of protein tyrosine kinases. Role of cGMP in cell signaling with special reference to the process of vision Biochemical changes in visual cycle and the role of rhodopsin.

UNIT-III (15 hrs)

Phosphoinositide turnover in receptor activation. Phospholipase C- regulation of activity. Inositol triphosphate and diacylglycerol as second messengers. Control of cellular calcium level. Calcium transport, calcium cycling, modulation of cytoplasmic calcium level by hormones. Calcium as a second messenger- role of calmodulin and troponin C. Interaction of calcium - calmodulin complex with target proteins**.**

UNIT-IV (15 hrs)

The molecular basis of the cell cycle- The cyclin and cyclin-dependent kinases- mechanism for timing of cell-cycle transitions, cyclin-dependent kinases, the telomerase life-cycle clock, cell-cycle checkpoints. Ras protein and the mechanism of action.

UNIT-V (15 hrs)

Apoptosis- significance of programmed cell death and its regulation. Signalling process in apoptosis and factors promoting cell death. Oncogenes- Cellular regulatory proteins with oncogenic potential. Tumour- suppressor genes- significance and mode of action of tumour suppressor gene with special reference to p53.

BOOKS FOR STUDY:

- Genes - Lewin 7thedn
- Molecular Biology - Lodish Baltimore
- Biochemistry of cell signalling - Ernst
- Cell – Cooper

BOOK FOR REFERENCE:

- Molecular biology of the cell edn - Alberts, Johnson, Lowis 4th Edition.

E-BOOKS AND E-RESOURCES:

- Signal Transduction 3rd edition Elsevier
- Biochemistry of Cell Signaling-Ernst
- https://www.elsevier.com
- https://www.sciencedirect.com

LEARNING OUTCOME:

- Understood the cell signal transduction from the plasma membrane to the nucleus.
- Understood the various mechanisms involved in cell signaling.

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M.Sc. - BIOCHEMISTRY

ELECTIVE PAPER– IV- RESEARCH METHODOLOGY FOR BIOLOGICAL SCIENCES

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 5 **SEMESTER:IV**

CREDITS: 5 **SUBJECT CODE – 19EG11**

OBJECTIVES:

- **To learn about literature survey and collection**
- **To learn about the improvement in research with latest tools**
- **To learn to write Research Report / thesis.**

UNIT I: (15 hrs)

Basic, Applied, Descriptive, Analytical research. Essential steps in research.

UNIT II: **(15 hrs)**

Review of literature-Research reading, bibliography, index, cards and reference cards, Different system of citing references. Selection of journals for publication- Impact factor – Citation Index – H Index.

UNIT III: (15 hrs)

Meaning and significance of research, characteristics and types of research, the research process, features of good research study. Research applications. Sources of information in journals, e-journals-books, biological abstracts.

UNIT IV: (15 hrs)

Research report - Structure and components of scientific reports, types of report, writing and documentation of research report, developing successful research proposals.

UNIT V: (15 hrs)

Research problem - components of research problem, formulation of research problem, Research Design - Classification of research designs, need for research design, features of good research design, experimental research design.

BOOKS FOR STUDY:

- Research methodology – N. Gurumani
- Research Methodology – Dr. S. Palanichamy and M. Shanmugavelu.
- Research Methodology: Methods and Techniques – Daniel. 2006.

BOOKS FOR REFERENCE:

- Research methodology – C.R. Kothari
- Research methodology – Ranjit Kumar, 3rd Edition, London.

E-BOOKS AND E-RESOURCES:

- www. Researchmethodology.net
- Research methodology – C.R. Kothari
- Research methodology – Ranjit Kumar, 3rd Edition, London.

LEARNING OUTCOME:

- Gained knowledge about the Research process (Reading, Evaluating, and developing)
- Acquired knowledge about the tools used for research.
- Acquired knowledge about the research Report/thesis.

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M.Sc. - BIOCHEMISTRY

ELECTIVE PAPER IV- STEM CELL TECHNOLOGY

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 4 **SEMESTER:IV**

CREDITS: 5 **SUBJECT CODE – 19EG12**

OBJECTIVES

- **To provide thorough information on the basic properties of stem cells and the regulation at molecular level.**
- **It describes the application of stem cell technology for the therapy of different diseases.**

UNIT I: (15 hrs)

Definition, characterization, pluripotency, Adult versus embryonic stem cells, post genomic adult stem cells, stemness, characteristics, hierarchy, stem cell niche. Adult stem cell from amniotic fluid, cord blood. Isolation and maintenance of murine stem cells, primate embryonic stem cells, and human embryonic stem cells.

UNIT II: (15 hrs)

Principle of cell passage, colony formation, techniques for derivation of embryonic stem cells, differentiation and transdiffrentiation. Derivation and maintenance of human embryonic stem cells, derivation and differentiation of human embryonic germ cells, isolation and maintenance of avian embryonic stem cells, Xenopus embryonic stem cells and zebra fish embryonic stem cells.

UNIT III: (15 hrs)

Trophoblast stem cells – Identification and lineage specificity, isolation and maintenance of neural precursors, primitive hematopoietic cells. GF and serum free culture of stem cells, feeder free culture and genetic manipulation of human embryonic stem cells.

UNIT IV: (15 hrs)

Surface antigen markers, lineage markers, microarray, chemical mutagenesis. Hitchhiker effect, gene silencing, epigenetic mechanism, nuclear transfer cloning and parthenogenetic stem cells.

UNIT V: (15 hrs)

Pluripotency of neural and cloned mouse embryo, genomic reprogramming, immunogenicity of stem cells, tolerance in transplantation. Therapeutic application-

neurodegenerative disorders, spinal cord injury, heart diseases, diabetes and tissue engineering.

BOOKS FOR STUDY:

- Kiessling, A.A. Human Embryonic Stem cells. Jones & Barlett Publishers. 2nd Ed, 2006.
- Lanza, R. Essentials of Stem Cell Biology. Academic Press. 1st Ed, 2005.

BOOKS FOR REFERENCE:

- Turksen, K. Adult Stem Cells. Humana Press, Inc. 1st Ed, 2004
- Thomson, J et al. Handbook of Stem Cells: Embryonic/ Adult and Fetal Stem cells (Vol. 1 &2). Academic Press. 1st Ed, 2004.
- Institute of Medicine (Corporate author). Stem cells and the future of regenerative medicine. National Academy Press. 1st Ed, 2002.

E-BOOKS AND E-RESOURCES:

- https://stemcells.nih.gov
- https://stemcellres.biomedcentral.com
- https://www.closerlookatstemcells.org

LEARNING OUTCOMES:

- Understand the importance of growth factors
- Understand the basis of media composition for growth of stem cells.
- Discern out the application of stem cell in therapies.

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M.Sc. – BIOCHEMISTRY

ELECTICVE PAPER V - IMMUNOCHEMISTRY

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 5 **SEMESTER:IV**

CREDITS: 5 **SUBJECT CODE – 19EG13**

OBJECTIVES:

- **To the study the molecular mechanisms underlying the function of the immune system.**
- **To understand the features of antigen, antibody, immune response and autoimmunity.**

UNIT-I (15 hrs)

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 (15 hrs)

Antibodies – classification, structure, properties & biological functions – abnormal immunoglobulins – Monoclonal antibodies – commercial production by hybridoma technique & applications.

Antigens – nature &different types, classification based on epitope. 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 (15 hrs)

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 (15 hrs)

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 surveillance.

UNIT-V (15 hrs)

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.

BOOKS FOR STUDY:

- Immunology - Nandhini Shetty
- Essential Immunology- Ivan Roitt

BOOKS FOR REFERENCE:

- Immunology - Jane S Quby
- Textbook of Microbiology- R. Ananthanarayanan &C. K. Jayaram Paniker

E-BOOKS AND E-RESOURCES:

- Immunohistochemistry: Basics and Methods by B. Buchwalow and Werner Bocker
- https://www.elsevier.com

LEARNING OUTCOME:

- Understood the functioning of immune system
- Understood the features of immune response and autoimmunity.

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M.Sc. – BIOCHEMISTRY

ELECTICVE PAPER V - BASIC BIOINFORMATICS

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 5 **SEMESTER:IV**

CREDITS: 5 **SUBJECT CODE – 19EG14**

OBJECTIVES:

- To study the fields of computer science, data bases, Molecular biology and techniques in Molecular biology.
- To study about the genomics and proteomics.

UNIT I (15 hrs)

Introduction to bioinformatics, Definition of bioinformatics, fields related to bioinformatics, Applications of bioinformatics in various fields.

UNIT II (15 hrs)

Computers, internet, Email, world wide web, web browser, internet explorer, search tools, web server- Hypertext transfer protocol, Hypertext Markup Language(HTML)Role of computer in bioinformatics.

UNIT III (15 hrs)

Introduction to NCBI data model - Various file formats for biological sequences. Databases -Tools and their uses Primary sequence databases - Composite sequence databases - Secondary databases - Nucleic acid sequence databases - Protein sequence data bases - Structural databases –Protein structure visualization tools (RasMol, Swiss PDB Viewer).

UNIT IV (15 hrs)

Sequence alignment, Database similarity searching, BLAST search, improved BLAST, Database available for BLAST search, FASTA, FASTA Format, FASTA search method, PAM units and PAM Matrices.

UNIT V (15 hrs)

Proteomics, methods of studying proteins, proteomics databases, protein sequence databases such as uniport, swiss port, pir-ps Database, protein databank, worldwide protein databank and Application of proteomics.

BOOKS FOR STUDY:

- Bioinformatics – Prakash S Lohar
- Bioinformatic sequence and Genome Analysis – David W.Mount, New Delhi, CBS publisher.2003

BOOKS FOR REFERENCE:

- Principles and Techniques of Biochemistry and Molecular biology by Keith Wilson and John Walker.
- Pennigton S and M.J. Dunn. Proteomics: From Proteins sequence to function.
- Palzkill and Timothy, Proteomics, USA: Kluwer Academic Publishers.

E-BOOKS AND E-REFRENCES:

- Journal of Bioinformatics and Computational Biology
- BMC Bioinformatics
- Genomics, Proteomics and Bioinformatics.

LEARNING OUTCOMES:

- Gained knowledge about the existing software used in the field of basic bio informatics.
- Gained familiarity about genomics and proteomics.

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M.Sc. – BIOCHEMISTRY

ELECTICVE PAPER V - MOLECULAR TOOLS AND TECHNIQUES

(For the students admitted from the year 2019 - 20)

HOURS PER WEEK: 5 **SEMESTER:IV**

CREDITS: 5 **SUBJECT CODE – 19EG15**

OBJECTIVES:

- **To study about the methods in molecular biology**
- **To study about the microscopic technique.**
- **To study about the Endonucleases and vectors used in molecular biology.**
- **To study about DNA finger printing.**

UNIT I (15 hrs)

Organization of genes and chromosomes. Structure of DNA, Operon, interrupted genes, gene family, structure of chromatin and chromosomes. Unique and repetitive DNA, heterochromatin, Euchromatin and transposons.

UNIT II (15 hrs)

Control of gene expression at transcription and translation level. Regulation of phages, viruses, Prokaryotic and Eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing.

UNIT III (15 hrs)

Restriction endonucleases, and vectors, Isolation and separation of Nucleic acids, types of enzymes used in molecular biology and enzymes used in manipulation of Nucleic acids, vectors, types and uses.

UNIT IV (15 hrs)

Molecular techniques, confocal microscopy, Electrophoresis, autoradiography, blotting techniques, fluorescence activated cells, fluroscent insitu hybridization, DNA microarrays and gene sequencing techniques.

UNIT V (15 hrs)

Genetic analysis, inherited genetic disorders, Genetics of aging, DNA fingerprinting, human genome project. Gene transfer for desired human behavior.

BOOKS FOR STUDY:

- Benjamin Lewin, 2008, Genes VIII, First edition. Oxford. Newyork.

BOOKS FOR REFERENCE:

- Principles and Techniques of Biochemistry and Molecular biology by Keith Wilson and John Walker.
- Essentials of Cell biology, Sanjay Kumar Sharma.

E-BOOKS AND E-REFRENCES:

- www.nature.com
- www.britannica.com
- Principles and Techniques of Biochemistry and Molecular biology by Keith Wilson and John Walker.

LEARNING OUTCOMES:

- Gained knowledge about methods and tools involved in molecular biology.
- Acquired knowledge about the microscopic techniques.
- Got through knowledge about DNA Finger printing.