Annexure -III

FRAMEWORK FOR M. PHIL BIOCHEMISTRY (2 YEARS PROGRAM)

One-year course work: 24 Credit Hours
One-year research work: 06 Credit Hours
Total credit hours: 30

SEMESTER I		
Course Code	**Name of Subject**	**Credit hours**
BCH-551	Optional-I	03
BCH-552	Optional-II	03
BCH-553	Optional-III	03
BCH-554	Optional-IV	03
	Total	**12**

SEMESTER II		
Course Code	**Name of Subject**	**Credit hours**
BCH-561	Optional-V	03
BCH-562	Optional-VI	03
BCH-563	Optional-VII	03
BCH-564	Optional-VIII	03
	Total	**12**

SEMESTER III & IV		
Course code	**Subject**	**Credit Hours**
BCH-671	Research Thesis	06

Annexure -III

REVISED COURSES FOR MS/M. PHIL BIOCHEMISTRY

Serial No.	Course Title	Credit hours
1	Metabolism of Drugs and Other Toxic Compounds	3
2	Advances in Molecular Biology	3
3	Advances in Clinical Biochemistry	3
4	Advance Techniques used in Biochemistry Research	3
5	Cancer Biochemistry	3
6	Nutraceuticals in Biochemistry	3
7	Molecular Virology	3
8	Nutritional Neuroscience	3
9	Advances in Endocrinology	3
10	Neurosciences	3
11	Biochemistry of Metabolic Disorders	3
12	Genomics, Proteomics and Metabolomics	3
13	Protein, Structure, Function and Engineering	3
14	Recombinant DNA Technology	3
15	Biochemistry of Natural Products	3
16	Biochemistry and Molecular Biology of Plants	3
17	DNA Techniques and Clinical Applications	3
18	Advances in Food Biochemistry	3
19	Enzymes - Mechanism and Kinetics	3
	Research Thesis	6

Metabolism of Drugs and Other Toxic Compounds (Cr. 3)

The Types of Reactions Involved with Examples. Factors Affecting the Metabolism; Genetic Factors, Physiological Factors, Pharmaceutical Factors and Drug Interactions, Inhibition of Drug Metabolism of Foreign Organic Compounds, Toxic Compounds Present in Biological Materials, Mode of Action of Pesticides, Pesticide Effect on Respiration and Photosynthesis. Inhibition of Acetyl Cholinesterase, Effect on Nervous System, Toxicology of Metals, Mechanisms behind effects of drugs and other chemical substances on large organ systems; chemical carcinogenesis; embryotoxicity and toxicological risk assessment/safety evaluation.

Recommended Books

1. Gorrod J. W. and Beckett A. H, "Drug Metabolism in Man", Taylor and Francis Ltd.
2. Pharmaceutical Toxicology: Safety Sciences of Drugs, Gerard J. Mulder, Lennart Dencker, Pharmaceutical Press, 2006 -
3. Clinical Toxicology: Principles and Mechanisms, Second Edition, Frank A. Barile**,** 2010 by CRC Press
4. A Handbook of Bioanalysis and Drug Metabolism, Gary Evans**,** 2004 by CRC Press
5. Metabolism of Drugs and Other Xenobiotics, 1st Edition, by Pavel Anzenbacher (Editor), Ulrich M. Zanger (Editor) Wiley-VCH; 2012

Advances in Molecular Biology (Cr. 3)

Basics of Genomics; Genes, Pseudogenes, Multiple Genes, the Genetic Codes, Operon, Gene Duplication, Gene Splicing, Cap Structure. Gene Expression In Prokaryotes, Gene Transfer, Gene Mapping, Gene Expression in Prokaryotes And Eukaryotes, Regulation of Gene Expression in Bacteria and Higher Organisms. Mutation Effect of Cyclic AMP on Operon, DNA Recombination and Cloning, Methods Applied for DNA Sequencing, PCR, Gene-Protein Relation.

Recommended Books

1. Albert B. D., Bray J., Lewis M., Raff K., Roberts and Watson J. D., "Molecular Biology of Cell", Mc Graw Hill Book Co. New York.
2. Darnell Jr., Lodish J. H. and Baltimore D., "Molecular Cell Biology", Scientific American Books.
3. Watson J. D., Tooze J. and Kurtz D. T., "Recombinant DNA", Scientific American Books.
4. Walker JM and Rapley J. Molecular Biology and Biotechnology, 4th Edition, The Royal Sciety of Chemistry, Cambridge, UK, 2000.

5. Arthur Lesk, Introduction to Genomics, 1st Edition, Oxford University Press, USA, 2007.

Advances in Clinical Biochemistry (Cr. 3)

Biochemistry of Blood, Biochemical aspects of cardiovascular, neurological, and endocrine disorders. Inborn Errors of Metabolism; Carbohydrates, Lipids, Proteins and Nucleic acids. Immunology of Human Disease, Immunodiagnostics, Interferon; Infection and Antibacterial Agents, Disease due to Infection and Infestation, Genetics and Constitutional Factors in Disease, Disease of Organs. Disease due to Chemical and Physical Agents. Biochemistry of Cancer and its Therapy: Carcinogenesis, Types of Tumors, Characteristics of Cancer Cells. Cancer Causing Agents and their mechanism; Methods for Testing of Carcinogens and tumors, Therapeutic Methods used in the Treatment of Cancer; Chemotherapy, Radiation Therapy and Surgery.

Recommended Books

1. Taylor J. B., and Kennewel P. D., "Introductory Medicinal Chemistry", Ellis Horwood Ltd.
2. Cumings J. N. and Kremer M., "Biochemical Aspects of Neurological Disorders".
3. Hoffman W. S., "Biochemistry of Clinical Medicine".
4. Thomson M. D., "Text Book of Biochemistry with Clinical Correlation", 4th ed., Wiley-Liss.
5. Robbinson and Cotran. Pathological Basis of Disease. 8th Edition, Vol. II, Saunders, Elsevier Inc., 2010.
6. Chatterjea MN and Rana Shindy. Text Book of Medical Biochemistry. 5th Edition, Vol. 5, Japee Brothers Medical Publishers Ltd., New Dehli, India, 2002.
7. Robbinson and Cotran. Pathological Basis of Disease. 8th Edition, Vol. II, Saunders, Elsevier Inc., 2010.

Advance Techniques used in Biochemistry Research (Cr. 3)

Standard Operating Procedure, Quality Control and Quality assurance, Validation of Analytical Methods, Specificity, Selectivity, Linearity, Accuracy, Precision, Quality Control and Reference Standards. Chromatography: TLC, Gel Filtration, Gas Chromatography, HPLC, GC-MS, LC-MS, Agarose and Polysacharide Gel Electrophoresis, Immuno-electrophoresis, Ultrafiltration and Lyophilization, Immunoblotting, Radioimmuno Assay, ELISA, Atomic Absorption Spectrophotometery, NMR, MRI, Electron Microscopy, Use of Isotopes in Biochemistry. Sensors and their Applications.

Recommended Books

1. Boyer, R.F. Modern Experimental Biochemistry. 2nd Edition. The Benjamin/ Cummings Publishing Co., USA. 1993.

2. Christian G. P. Analytical Chemistry, 5th Edition, John Wiley and Sons New York. 1999.
3. Wilson K. and Walker J. Practical Biochemistry. Principles and Techniques. 4th Edition, Cambridge University Press. 1995.

Cancer Biochemistry (Cr. 3)

Disease due to Chemical and Physical Agents. Biochemistry of Cancer and its Therapy: Introduction to Carcinogenesis, Types of Tumors, Characteristics of Cancer Cells. Cancer Causing Agents; Types, Nature, Occurrence, Origin and Exposure of Carcinogens, Mechanism of Carcinogenesis Caused by Physical, Chemical and Viral Mutagens. Molecular and Genetic Basis of Cancer, Methods for Testing of Carcinogens, Methods for the Diagnosis of Tumors, Therapeutic Methods used in the Treatment of Cancer; Chemotherapy, Radiation Therapy and Surgery.

Recommended Books:

1. Taylor J. B., and Kennewel P. D., "Introductory Medicinal Chemistry", Ellis Horwood Ltd.
2. Cumings J. N. and Kremer M., "Biochemical Aspects of Neurological Disorders".
3. Hoffman W. S., "Biochemisty of Clinical Medicine".
4. Thomson M. D., "Text Book of Biochemistry with Clinical Correlation", 4th ed., Wiley-Liss.
5. Robbinson and Cotran. Pathological Basis of Disease. 8th Edition, Vol. II, Saunders, Elsevier Inc., 2010.
6. Chatterjea MN and Rana Shindy. Text Book of Medical Biochemistry. 5th Edition, Vol. 5, Japee Brothers Medical Publishers Ltd., New Dehli, India, 2002.
7. Robbinson and Cotran. Pathological Basis of Disease. 8th Edition, Vol. II, Saunders, Elsevier Inc., 2010.

Nutraceuticals in Biochemistry (Cr. 3)

Introduction to bioactive macromolecules: Protein, Fats, Carbohydrates, glycans, Lipopolysaccharides, Lectins, Bacteriocins; Phospholipids, Relationship of health food and diseases, concepts of balance diet; Recommended daily allowances; Nutrients densities index/nutrient index quality and their role in diseases. Phytochemicals: Phytochemicals in the prevention and control of disease. Antioxidants: role of antioxidants in controlling reactive oxygen species, Structure and properties of some antioxidants present in food, Isolation and purification. Food safety and labeling of processed foods: Food Safety and diseases. Cellular integrity: Relationship of diet components of cells at molecular levels, Major changes in cell in response to diet in diseases. Nutrients and drug interaction: Interaction between components of food and specific drugs, adverse or stimulating effects of diet.

Recommended Books:

1. Handbook of Nutraceuticals and FunctionalFoods, Second Edition October 25, 2006 by CRC Press
2. Nutraceuticals1st EditionEfficacy, Safety and Toxicity. Editors: Ramesh C. Gupta 21st January 2016
3. Antioxidant Nutraceuticals: Preventive and Healthcare Applications By Chuanhai Cao, Sarvadaman Pathak, Kiran Patil, 2018 by CRC Press
4. Handbook of Nutraceuticals Volume I: Ingredients, Formulations, and Applications By Yashwant Vishnupant Pathak, 2009 by CRC Press
5. Functional Food Ingredients and Nutraceuticals: Processing Technologies, Second Edition John Shi, 2015 by CRC Press

Molecular Virology (Cr. 3)

The structure and complexity of virus genomes, Molecular genetics. virus mutants, Genetic interactions between viruses, Non-genetic interactions between viruses, 'Large' DNA genomes, 'Small' DNA genomes, Positive-strand RNA viruses, negative-strand RNA viruses, Segmented and multipartite virus genomes, Reverse transcription and transposition, Evolution and epidemiology, Expression of genetic information, Control of prokaryote gene expression, Control of expression in bacteriophage l , Control of eukaryote gene expression, Genome coding strategies, Transcriptional control of expression, Post-transcriptional control of expression, Satellites and viroids, Prions

Recommended Books:

1. Zuckerman, A.J., Banatvala, J.E., Pattison, J.R., Griffiths, P., Schoub, B., 2004. Principles and Practice of Clinical Virology, 5th Edition. John Wiley and Sons Limited.
2. Cann, A.J., 2005. Principles of Molecular Virology. Elsevier Science & Technology Books
3. Flint, S.J., Racaniello, V.R., Enquist, L.W., and Skalka, A.M., 2003. Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses American Society Microbiology.
4. Wagner, E.K., Hewlett, M.J., 2003.Basic Virology, Blackwell Publishers.
5. Howley, P.M., Roizman , B., Straus, S.E., Martin , M.A., Griffin, D.E., 2001. Fundamental Virology, Lippincott Williams & Wilkins.

Nutritional Neuroscience (Cr. 3)

Introduction to nutritional neuroscience Overview of brain anatomy with special regards food constituents that affect brain development, composition and biochemistry. Central regulation of feeding Diet, brain metabolism and psychological function. Micronutrients, brain function and behavior Vitamins and brain function Minerals and brain function. Foods, supplements and brain behavior. The emerging role of the brain and nutrition in obesity Food preference, food choices,

food marketing, neuroeconomics. Neuroinflammation and neurodegenerative diseases. Eating disorders and disordered eating Types.

Recommended Books:

1. Nutritional Neuroscience (Nutrition, Brain and Behavior) 1st Edition by Harris R. Lieberman (Editor), Robin B. Kanarek (Editor), Chandan Prasad (Editor) by CRC
2. Genius Foods: Become Smarter, Happier, and More Productive While Protecting Your Brain for Life, 2018, by Max Lugavere (Author), Paul Grewal M.D. (Author)
3. Evidence-Based Herbal and Nutritional Treatments for Anxiety in Psychiatric Disorders Dec 1, 2016 by David Camfield and Erica McIntyre
4. Nutritional Genomics: The Impact of Dietary Regulation of Gene Function on Human Disease, Dec 5, 2011 by Wayne R. Bidlack and Raymond L. Rodriguez
5. Brain Food: The Surprising Science of Eating for Cognitive Power**,** Mar 6, 2018by Lisa Mosconi PhD

Advances in Endocrinology (Cr. 3)

General Mechanisms in Endocrinology: Subcellular structure of cells secreting protein hormones; Process of hormone secretion; Transcription factors in developmental organisms in endocrine systems. Recombinant DNA technology and molecular genetics in diagnosis and treatment of endocrine diseases. Measurements of hormones; Mechanisms of Action of Hormones; Properties of hormone receptor interaction; Hormones acting in transcription regulation; Biochemistry and molecular interaction of steroid receptor; gene expression, messenger RNA stability and metabolism in hormone action; Functional Pathology in Endocrine Glands; Neuroendocrine disorder; Pituitary Disorders: Thyroid Diseases; Adrenal cortex and medulla Disorders; Disorders of Ovarian Function; Abnormalities of Testicular Functions and Hormonal Therapy; Glucose Homeostasis and Hypoglycemia; Diabetes Mellitus; Disorders of Lipoprotein Metabolism; Eating Disorders; Development and Growth; Hormones and Cancers; Geriatric Endocrinology: Endocrine and Associated Metabolism in aging; Biochemical probes.

Recommended Books

1. Greenspan, F.S. and Strewler, G.J., 2002. Basic and clinical endocrinology, 5th Edition. Prentice Hall International Inc., London.

2. Wilson, J.D., Foster, D.W., Kronenberg, H.M. and Larsen, P.R., 1998. Williams textbook of endocrinology, 9th Edition. W.D. Saunders Company, Philadelphia

3. Williams Textbook of Endocrinology, 13th Edition

By Shlomo Melmed, MD, Kenneth S. Polonsky, MD, P. Reed Larsen, MD, FRCP and Henry M. Kronenberg, MD, Elsevier

Neuroscience **(Cr. 3)**

Introduction to neuroscience: Nervous system, Sympathetic, Parasympathetic and motor nervous system and their functions, Brain and its functions, Neuron and glia, structure of a neuronal cell, types of glia, Blood brain barriers
Neuronal Circuits: Neuronal circuit in emotional control, Neuronal circuit in reward and addiction, Neuronal regulation of stress
Receptors: Ionotropic and metabotropic receptors, signal transduction pathways, G-proteins, protein phosphorylation, Signaling to the nucleus. regulation of gene expression
Neurotransmitters: Excitatory and inhibitory amino acid neurotransmitters, Functions in the brain, Pain pathways in brain, Role of excitatory neurotransmitter in learning and memory, Diseases associated with the malfunctioning of these neurotransmitters, Neuronal degeneration
Catecholamines: Functions in the brain, Diseases associated with the malfunctioning
Neuroendocrine and motivational systems: Endocrine systems, Feeding behavior, Stress
Diseases of the nervous system: Addiction, Depression, Schizophrenia, Epilepsy, Alzheimer, Parkinson, Prion, Motor Neuron Disease.

Recommended Books:

1. Christophe Habas, The Neuroimaging of Brain Diseases: Structural and Functional Advances (Contemporary Clinical Neuroscience) 1st ed. 2018 Edition
2. Darakhshan Haleem, Neurochemistry, Neuropharmacology and Behavior: Outlines on the mechanism of brain function, 2010
3. Mark F. Bear, Barry W. Connors & Michael A. Paradiso, Neuroscience: Exploring the brain, 2006
4. Jack R. Cooper, Floyd E. Bloom andRobert H. Roth. The Biochemical Basis of Neuropharmacology Oct 17, 2002
5. Progress in Neuroscience, Readings from Scientific American, John Wiley.
6. Philip, G. Strange, Brain Biochemistry and Brain Disorders, 1993Oxford Press.
7. George, J. Siegal, B. W. Agranoff, S. K. fisher, M. D. Uhler, Basic Neurochemistry: Molecular, Cellular and Medical Aspects, Lippincott D. Uhler.

Biochemistry of Metabolic Disorders **(Cr. 3)**

Introduction to Metabolic disorder/ Inborn errors of metabolism. Neonatal presentation: Problems of synthesis and break down of complex molecules, intoxication, energy deficiency

states and seizure disorders. Glycogen storage diseases. Lysosomal storage diseases or Lipidosis. Inborn errors of metabolism related to amino acids. Disorders related to Nucleotide metabolism i-e Lysch-Nyhan syndrome. Diabetes Mellitus. Disorders leading to primary hypercholesterolemia. Biochemical basis of Tangiers disease.

Recommended Books:

1. Textbook of Biochemistry with Clinical Correlation. (1997) 4th edition by Thomas M Devlin. Wiley-Liss.
2. Biochemistry the molecular basis of life. (2012) 6th edition by James R.Mckee and Trudy Mekee. Oxford University Press.
3. Medical Biochemistry. (2012) 3rd Edition .by James W. Baynes and MH Dominiczak,
4. MarksËssential Medical Biochemistry (A clinical Approach). (2007)2ndedition by Micheal L. Lieberman, Allan-D. Marks, Colleen M Smith. Lippincott William & Wilkins.
6. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. (2018) 6th Edition by Carl Burtis, Edward Ashwood, David Bruns.ELESVIER
7. Clinical Biochemistry an Illustrated Colour Text. (2014) 3rdeditionby Allan Gaw.Churchill livinstone
8. Clinical Biochemistry Metabolic and Clinical Aspects. (2014)2nd Edition by William J. Marshall, Stephen K-Bengerl. Elsevier Health Sciences
9. Principles of Biochemistry. (2008) 3rd Edition by Donald Voet Judith GVoet. John Wiley &Sons Ins

Genomics, Proteomics and Metabolomics (Cr. 3)

Introduction to omics and genomics; DNA Databases; Genome Sequencing and Annotation, Next generation sequencing; Human genome project, Genome Mapping and organization; Gene Discovery - Expressed Sequencing Tags (ESTs); Chromosome walking; Structural Variation in the Genomes; Sequence polymorphisms in genomes and SNPs; Techniques: microarrays, Serial analysis of gene expression (SAGE); Proteomics: Introduction to Proteomics; Protein database; Proteomics technologies: 2D-gel electrophoresis, mass spectrometry, yeast 2-hybrid system, Tandem affinity purification, protein microarray; Protein sequencing; Protein linkage mapping.

Recommended Books

1. Fundamentals of Advanced Omics Technologies: From Genes to Metabolites volume 63 (Eds. Carolina Simo, Alejandro Cifuentes, Virginia Garcia-Canas), Elsevier, 2014
2. Lesk A. Introduction to Genomics. 2nd edition. NewYork: Oxford University Press, 2012.
3. Metabolomics: From Fundamentals to Clinical Applications (Ed. Alessandra Sussulini) Springer, 2017

4. Campbell MA, Heyer LJ. Discovering Genomics, Proteomics and Bioinformatics. Pearson education, 2009
5. Gibson G, Muse S. A Primer of Genome Science IRL. 3rd edition. Sinauer Associates Inc; 2009.
6. Batiza AF. Bioinformatics, Genomics, and Proteomics: Getting the Big Picture (Biotechnology in the 21st Century). Chelsea House Publishers; 2006.

Protein, Structure, Function and Engineering (Cr. 3)

Biological and recombinant protein synthesis Protein structure, Function and bioinformatics, Structure determination by X-ray crystallography and NMR spectroscopy, Structure modelling and analysis using molecular graphics. Introduction to protein sequence and structure databases, Protein bioinformatics tools and methods, Prediction and design of protein structures: Homology and ab-initio method for protein structure prediction; Phage display systems , Structure based drug design, Protein Arrays, Strategies for protein engineering; Random and site-directed mutagenesis, Role of low-fidelity enzymes in protein engineering, Gene shuffling and Directed evolution of proteins, Protein backbone changes, Antibody and enzyme engineering.

Recommended Books:

1. Introduction to Protein structure, 2nd Ed by Carl Branden and John Tooze, Garland Press, 1999.

2. Structure and Mechanism in Protein Science, Alan Fersht, Freeman, 1999.Protein engineering in Industrial biotechnology, Ed. Lilia Alberghina, Harwood Academic Publishers, 2002.

3. Donald Voet, Charlotte W. Pratt, Judith G. Voet. Principles of Biochemistry, 4/e, Wiley, 2012.

4. David L Nelson, Michael M Cox, Albert L Lehninger. Lehninger Principles of Biochemistry, 6/e New York: W.H. Freeman, 2013.

5. T Palmer, P L Bonner. Enzymes, 2nd Edition Biochemistry, Biotechnology, Clinical Chemistry. 2/e Woodhead Publishing, 2007.

6. Peter Tompa, Alan Fersht. Structure and Function of Intrinsically Disordered Proteins. CRC Press, 2009.

Recombinant DNA Technology (Cr. 3)

Recombinant DNA Technology; Necessary tools required for recombinant DNA technology; Restriction endonucleases, Types, functions and mode of action of DNA Ligases; Cloning Vectors; Methods for introducing Target DNA and Screening Procedures; Methods of creating and screening the genomic and cDNA Libraries; Molecular Cloning: Strategies and screening assays; Application of Recombinant DNA Technology

Recommended Books:

1 Principles of Gene Manipulation by Sandy Primrose and Richard Twyman
2 A text book of Biotechnology by S. Chand
3 Gene Biotechnology by Shailendra Singh
4 Molecular Biotechnology: Principles & Applications of Recombinant DNA
B. R. Glick., et al. by (ASM Press, 2009)
5 An Introduction to Genetic Engineering by Dr. Desmond S. T. Nicholl

Biochemistry of Natural Products (Cr. 3)

Introduction to natural products in biological system; Common mechanisms in biological chemistry for metabolism of natural products; Biosynthesis of lipids and their catabolic reactions; Fatty acids, steroids and terpenoids biosynthesis; Pathways involved in the biosynthesis fatty acids, steroids and terpenoids; Biosynthesis of thromboxanes, leukotrienes, prostaglandins' biosynthesis and their catabolic mechanism; Carbohydrates transformation to different natural products; Biosynthesis of secondary metabolites (alkaloids) using amino acids as starting material; Synthesis of polyketides in biological systems; Biosynthesis of some representative natural products; Penicillin, cephalosporins, erythromycin, morphine, coenzyme B12 and tetrapyrrols

Recommended Books:

1. McMurryJ. E., Begley T. P., The organic chemistry of Biological Pathways, 2nd Ed., (2016).
2. Goncalves R. E., Pinto M. C., Natural Products: Structure, Bioactivity and Applications (Biochemistry Research Trend), 1st Ed., Nova Biomedical, 2012.
3. Dewick P. M., Medicinal Natural Products: A Biosynthetic Approach, 3rd Ed., Wiley, 2009.
4. Talapatra, Sunil K., Talapatra, Bani, Chemistry of Plant Natural Products, Springer, 2015.
5. Newman D. J., Cragg G. M., Grothaus P. Chemical Biology of Natural Products, CRC Press, 2017.

Biochemistry and Molecular Biology of Plants (Cr. 3)

Introduction and Overview of Plant Biochemistry. Biochemical Processes and Metabolic Pathways that are Specific to Plants, Including Photosynthesis, The Regulation of CO_2 and N_2 Fixation, Photorespiration and Energetic Considerations, Chemiosmotic Hypothesis and H^+ Transport, Nitrate and Sulfate Assimilation. Cell Wall Biosynthesis, Mono and Oligosaccharides, Storage and Structural Polysaccharides, Glycosides, Ascorbic Acid. Synthesis of Fatty Acids, Triglycerides, Waxes, Cutin and Membrane Lipids, Fatty Acid Oxidation; Genome Structure and Organization, modern techniques applied to plants, genetically modified plants; Plant Interaction with the Environment. Plant growth under diverse environmental conditions. Defense mechanisms

in plants, Responses to various kind of biotic/abiotic stresses i.e. insects, phytopathogens, drought stress, salinity stress etc.; Plants Secondary Metabolites: Diversity of secondary metabolites, alkaloids, flavonoids, tannins, terpenes, phenolic compounds, pathways involved in the biosynthesis of the secondary metabolites, medicinally important secondary metabolites, plants derived drugs. Current research in plant biochemistry.

Recommended Books

Bob B. Buchanan, Wilhelm Gruissem, Russell L. Jones. Biochemistry and Molecular Biology of Plants, 2nd EditionJohn Wiley & Sons, 2015.

James Bonner and Joseph E Varner. Plant Biochemistry. 3rd Edition, Academic Press Inc., New York, 1976.

DNA Techniques and Clinical Applications (Cr. 3)

RT-PCR and RFLP; qPCR; Blotting Techniques such as Southern, northern, western, dotblot etc.; Flowcytometry; Karyotyping; Fluorescent *in situ* hybridization (FISH); Chromogenic *in situ* hybridization (CISH); Analysis of amniotic fluids and various DNA tests; Maternal serum testing; Use of Chorionic Villous Sampling for the detection of chromosomal and genetic disorders.

Recommendation Books:

1. Molecular Biology Techniques: An Intensive Laboratory Course by Walt Ream (Author), Katharine G. Field (Author)
2. Molecular Biology Techniques, Third Edition: A Classroom Laboratory Manual 3rd Edition by Heather Miller (Author), D. Scott Witherow (Author), Sue Carson (Author)
Molecular Diagnostics: Fundamentals, Methods and Clinical Applications 2nd Edition by Lela Buckingham PhD MB DLM(ASCP) (Author)

Advances in Food Biochemistry (Cr. 3)

Food selection and meal planning for healthy individuals; Absorption, storage and metabolic function of macro and micronutrients; Balanced diet: recommended dietary allowances for different categories of the human beings; Water's importance in Food Chemistry: Phases of water, the role of water as a solvent in food systems, the concept of water activity Measurement of energy of foods and expenditures; Direct and indirect caloric measurement; Basal metabolism, Obesity, BMR and Factors affecting BMR; Respiratory quotient, Food borne diseases, Nutritional aspects and dietetic treatment of a few important primary nutritional and general diseases (anorexia, Endemic goiter, Idiosyncrasies); Fasting, Starvation, Food intolerance and food allergies, Clinical

surveys, Physical examinations, Laboratory examinations, Dietary surveys, FAO global information and early warning system for food and agriculture; Micronutrients: Sources, Daily allowance, Deficiency diseases; Biological importance of vitamins and minerals; Nutrigenomics (influence of genetic variation on nutrition, effects of nutrition, nourishment or lack of nutrition on the genetic expression and correlating gene expression or SNPs with a nutrient's absorption); Preservation of food by UV-radiation / chemical method.

Recommended Books:

1. E. N. Whitney and S. R. Rolfes .2002. Understanding Nutrition. 9thedition. Wads worth Thomson learning: New York.
2. J. I. Jain. 2008. Fundamentals of Biochemistry. S. Chand & Co. India
3. L. Kathleen and M. S. Escott-Stump. 2009. Krause's Food, Nutrition and Diet Therapy. 11thEdition. Saunders.
4. S. A. Joshi. 2002. Nutrition & Dietetics. 2ndEdition. Tata McGraw Hill Publishers
U. Satayanarayna and U. Chakarapani. 2014. Biochemistry. 4th edition

Enzymes- Mechanism and Kinetics (Cr. 3)

Introduction to chemical kinetics and reaction rates; Types of enzyme catalyzed reactions, rate equations, rate constants and steady states; Free energy of activation, transition state and effect of enzymes; Importance of enzyme kinetics in the study of mechanisms of enzyme catalyzed reactions; Catalytic mechanisms: Lock and Key model and Induced fit model; Catalytic groups in enzyme active sites and their role in catalysis; Factors contributing to catalytic efficiency of enzymes: proximity and orientation; strain and distortion; covalent, general acid-base, concerted acid-base and metal ion catalysis; Derivation of Michaelis-Menton equation for one substrate enzyme catalyzed reactions; effect of substrate concentration on rates of enzyme catalyzed reactions; Transformations of Michaelis-Menton equation: Lineweaver-Burk reciprocal plots; Eddie Hofstee plots; Determination of catalytic parameters like V*max,* Km. and Kcat; Kinetics of competitive, non-competitive, uncompetitive and mixed inhibition; Kinetics of two-substrate and multi-substrate reactions; Non-Michaelis-Menten Kinetics; Kinetics of Allosteric and regulatory enzymes; Types of enzyme activity assays; Types of enzyme activity units and their relationships; Significance of enzyme kinetics in clinical and industrial applications

Recommended Books:

1. Stryer, L. 2012. Biochemistry, 7th Edition, W. H. Freeman and C0.
2. Lab Manual in Biochemistry, Immunology and Biotechnology,
3. Arti Nigram, Archana Ayyagari. Tata McGraw-Hill Publishing Company Limited, New Delhi.

4. Cornish, B. A. 2004. Fundamentals of Enzyme Kinetics. Portland Press, UK.
5. Lehninger, A.L. 1982. Principles of Biochemistry. Worth Publishers, Inc. New York, NY, USA.
6. Lesakovac, L. 2003. Comprehensive Enzyme Kinetics. Kluwer Academic/ Plenum Publishers, New York, NY, USA.
7. Nelson, D.L and M.M. Cox. 2017. Leininger Principles of Biochemistry. 7th ed. Worth Publishers, New York, NY, USA.
8. Voet, D., J. G. Voet and C.W. Pratt. 2013. Fundamentals of Biochemistry, Life at the Molecular Level. 4th ed. John Wiley & Sons. Inc. New York, NY, USA.

Research Thesis **(Cr. 6)**

The student shall submit a thesis on the subject of his/her research work.