SACRED HEART COLLEGE (AUTONOMOUS)

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Ready for Every Good Work

A Don Bosco Institution of Higher Education, Founded in 1951 * Affiliated to Thiruvalluvar University, Vellore * Autonomous since 1987

Accredited by NAAC (4th Cycle – under RAF) with CGPA of 3.31 / 4 at 'A+' Grade

M.Sc. Biochemistry

Sem	Subject Code	Paper	Title of the Paper	Ins. Hrs/ Week	Cr	Exam Hrs	Max. Marks		
							CA	Sem	Tot
I SEMESTER	BC709	Core Paper I	Cell Dynamics	4	4	3	50	50	100
	BC710	Core Paper II	Biomolecules	4	4	3	50	50	100
	BC711	Core Paper III	Human Physiology and Nutrition	4	4	3	50	50	100
	PBC807	Core Practical I	Lab Course – I: Isolation, Quantitative Analysis and Techniques	5	-	-	-	-	-
	PBC808	Core Practical II	Lab Course – II: Industrial and Clinical Enzymology	5	-	-	-	-	-
	PBC809	Core Practical III	Lab Course – III: Microbial Biochemistry	4	-	-	-	-	-
	BC712A BC712B BC712C	Elective Paper I	(to choose 1 out of 3) 1. Bioinformatics 2. Industrial Microbiology 3. Stem Cell Technology	4	4	3	50	50	100
				30	**16**				**400**
II SEMESTER	BC809	Core Paper IV	Instrumentation Biochemistry	4	4	3	50	50	100
	BC810	Core Paper V	Advanced Enzymology	4	4	3	50	50	100
	BC811	Core Paper VI	Intermediary Metabolism	4	4	3	50	50	100
	PBC807	Core Practical I	Lab Course – I: Isolation, Quantitative Analysis and Techniques	5	4	6	50	50	100
	PBC808	Core Practical II	Lab Course – II: Industrial and Clinical Enzymology	5	4	6	50	50	100
	PBC809	Core Practical III	Lab Course – III: Microbial Biochemistry	4	4	6	50	50	100
	BC812A BC812B BC812C	Elective Paper II	(to choose 1 out of 3) 1. Advanced Endocrinology 2. Pharmaceutical Biochemistry 3. Environmental Toxicology	4	4	3	50	50	100
			Summer Training*	-	**2***	-	-	-	-
			Certificate Course- CMLT*	-	**2***	-	-	-	-
				30	**28+4***				**700**

Sem		Paper	Title of the Paper	Ins. Hrs/ Week	Cr	Exam Hrs	Max. Marks		
							CA	SEM	Tot
III SEMESTER	BC911	Core Paper VII	Molecular Biology	6	5	3	50	50	100
	BC912	Core Paper VIII	Immunology	5	4	3	50	50	100
	BC913	Core Paper IX	Research Methodology	5	4	3	50	50	100
	PBC1005	Core Practical IV	Lab Course – IV: Biochemical, Immunological and Molecular Biology Techniques	5	-	-	-	-	-
	PBC1006	Core Practical V	Lab Course– V: Haematological Methods	5	-	-	-	-	-
	BC914A BC914B BC914C	Elective Paper III	(to choose 1 out of 3) 1. Ecology, evolution & biodiversity 2.Food Biochemistry 3.Bionanotechnology	4	4	3	50	50	100
		SSP	**Self-Study Paper*** (CSIR/SET – Objective Type Questions) **OR** **Online Course** **[NPTEL/MOOC]**	-	**2***	-	-	-	-
				30	**17+2***				**400**
IV SEMESTER	BC1009	Core Paper X	Advanced Clinical Biochemistry	5	5	3	50	50	100
	BC1010	Core Paper XI	Biotechnology	4	4	3	50	50	100
	BC1012J	Core Paper XII	Project/Dissertation with Viva-Voce	5	5	-	50	50	100
	PBC1005	Core Practical IV	Lab Course – IV: Biochemical, Immunological and Molecular Biology Techniques	5	5	6	50	50	100
	PBC1006	Core Practical V	Lab Course– V: Haematological Methods	5	5	6	50	50	100
	BC1011A BC1011B BC1011C	Elective Paper IV	(to choose 1 out of 3) 1.Plant :Biochemistry and Molecular Biology 2.Herbal Technology 3.Medical Diagnostic Technology	4	4	3	50	50	100
	VE1004		Human Rights	2	1	3	50	50	100
				30	**29**				**700**
			TOTAL	**120**	**90+6***				**2200**

Sacred Heart College (Autonomous), Tirupattur District

1.2.1 List of New Courses

Department: M.Sc.BioChemistry

S.No	Course Code	Course Name
1.	BC911	Molecular Biology
2.	BC912	Immunology
3.	BC913	Research Methodology
4.	BC914A	Ecology, evolution & biodiversity
5.	BC914B	Food Biochemistry
6.	BC914 C	Bionanotechnology
7.	BC1009	Advanced Clinical Biochemistry
8.	BC1010	Biotechnology
9.	BC1011 A	Plant :Biochemistry and Molecular Biology
10.	BC1011 B	Herbal Technology
11.	BC1011 C	Medical Diagnostic Technology
12.	PBC1005	Lab Course – IV: Biochemical, Immunological and Molecular Biology
13.	PBC1006	Lab Course– V: Haematological Methods

Semester III

Molecular Biology

Semester	Subject Code	Title of the Course	Hours / Week	Credits
III	**BC911**	**MOLECULAR BIOLOGY**	**6**	**5**

Course Objectives

- To learn the basic information about Mendelian genetics and the basic aspects of molecular theories.
- To understand the process of DNA replication involving the roles of various DNA polymerases and other proteins with special reference to the events in prokaryotes and eukaryotes.
- To Gain the insights on the various kinds of DNA repair and major diseases resulting from defective DNA repair
- To acquire the knowledge on various kinds of DNA recombination and a detailed understanding of the process of Holliday recombination

❖ To acquire the knowledge related to major features of chloroplast and mitochondrial DNA.

Course Outcomes

S.No	Description	Cognitive Level (K-Level)
CO-1	Observe the basic information about Mendelian genetics and the basic aspects of molecular theories.	K2
CO-2	Analyse the processes involved in replication and the role of DNA polymerases.	K4
CO-3	Determine the composition, structure and types of RNAs and its mechanisms.	K3
CO-4	Justify the role of peptides and protein molecules produced during translation process.	K5
CO-5	Recognize the role of proteins during gene expression and its regulations.	K1
CO-6	Integrating mol. Bio mechanism with clinical concepts	K6

UNIT-I

Genetics–History, Definition and Scope. Premendelian genetic concepts –Preformation, Epigenesis, Inheritance of acquired characters and germplasm theory. Hereditary and Environment, Genotype and Phenotype; Heredity and Variation. Clones, Pure lines, Inbred lines and Phenocopies. Biography of Mendel and his experiments with Pea plant. Law of Segregation–Monohybrid cross, back and test cross, Dominance and Recessive, Co-dominance and Incomplete dominance. Law of Independent Assortment–Dihybrid crosses in Pea plant.

UNIT-II

Types of Replication, Evidence for Semiconservative replication–Meselson and Stahl experiment. Replication in Prokaryotes, Replication bubble, bidirectional replication, replicon, action of SSB, primase, DNA gyrase, topoisomerases, Telomerases, DNA polymerase I, II, and III, lagging and leading strand synthesis and Inhibitors of replication. Replications in circular chromosomes–Cairns and Rolling circle model. Replication in RNA virus, Plasmid Replication, temporal control of replication. Eukaryotic replication.

UNIT-III

Transcription–Definition, Coding strand, Template strand, Sense strand and Antisense strand. Prokaryotic transcription: Initiation- Promoter region, role of Pribnow box, DNA– dependent RNA polymerase, Foot-printing experiment, Elongation and Termination- Rho–Dependent and independent termination, Post - transcriptional processing in prokaryotes, split genes, over lapping genes, housekeeping genes, biosynthesis of rRNA and tRNA. Eukaryotic transcription, RNA editing. Post-transcriptional modifications in eukaryotic RNAs, RNA splicing–Introns and splicing reactions, Types of introns. Exons, spacer sequences and enhancers. Inhibitors of Transcription.

UNIT-IV

Genetic code–Definition, deciphering of the genetic code, codon dictionary and its salient features. Wobble mechanism and its significance, Structure of tRNA and composition of prokaryotic and eukaryotic ribosomes. Steps - Activation of amino acids, Initiation-Shine-Dalgarno sequence, reading frame-shift, Elongation and Termination. Eukaryotic Protein synthesis–initiation, elongation and termination. Polysomes, Post-translational modifications in Prokaryotes and Eukaryotes. Inhibitors of protein synthesis.

UNIT-V

Gene expression and regulations, Molecular mechanism of regulation, Prokaryotes–Operon model, lac, trp, ara operons, repression and attenuation. Eukaryotes–C value paradox, repetitive DNA, gene dosage and gene amplifications. Mutagenesis and replication fidelity, frame-shift mutagenesis, DNA damage–different types, DNA repair–Direct reversal repair, direct repair of nicks, excision repair, nucleotide excision repair, mismatch repair, long and short patch mismatch repair, recombination error, SOS response and mutagenic repair.

References

1. Biochemistry by D. Voet and J. Voet. John Wiley and Sons Ltd. (1990)
2. Advanced molecular biology by R. M. Twyman (1998).
3. Genes VII by B. Lewin, Oxford University Press, Cell Press, London (2000).
4. Cell and molecular biology by G. Karp, John Wiley & Sons Inc. (2002).
5. Molecular biology by Robert F. Weaver, McGraw-Hill, 4th Edition (2007).

Immunology

Semester	Subject Code	Title of the Course	Hours / Week	Credits
III	**BC912**	**Immunology**	**5**	**4**

Course Objectives

- ❖ To gain acquaintance on the organs involved in the immune system, antigens and different types of antibody.
- ❖ To acquire knowledge on types of immunity, immune response and complement system.
- ❖ To gain knowledge about different vaccines and the importance of different immunological techniques.
- ❖ To acquire knowledge about the MHC complex, transplantation immunology and tumor immunology.
- ❖ To comprehend the complications of hypersensitivity, Autoimmune diseases and Immunodeficiency disorders.

Course Outcomes

S.No.	Description	Cognitive Level (K-level)
CO1	Anatomy of Lymphoid organs, immune cells and its associated theories	K3
CO2	Discuss the Types of Immunity, Immune response and Complement system.	K2
CO3	Focus on different vaccines and the importance of different immunological techniques.	K1
CO4	Compile the MHC complex and Transplantation immunology	K6
CO5	Explores the properties of tumor cells, Immune surveillance and tumor antigens.	K5
CO6	Outline the complications of hypersensitivity, Autoimmune diseases and Immunodeficiency disorders.	K4

UNIT-I

Lymphoid system–Central and Peripheral Lymphoid Organs and Cells involved in immune system. Antigen, haptens, adjuvants, antigenicity, immunogenicity, antigenic determinants. Immunoglobulins - structure, classification, functions, allotypes and idiotypes. Theories of antibody formation–Side chain and clonal selection theory.

UNIT-II

Types of Immunity–Innate and Acquired immunity, antitoxin, antibacterial and antiviral immunity. Immune response–Humoral and Cell mediated immunity. Antigen recognition–T and B cell receptor complexes, antigen processing and presentation. Interaction of T and B cells, Cytokines and Immunological memory. Cytotoxicity– immunotolerance and immunosuppression. Complement system– Components, nomenclature and complement activation pathway.

UNIT-III

Vaccines–Attenuated organisms, toxoid, recombinant vaccines, subunit vaccines–DNA vaccines, synthetic peptide vaccines, antiidiotypic vaccines. Immunization practices–Immune prophylaxis and Immunotherapy. Immunological techniques–Production of polyclonal and monoclonal antibodies. Immunoprecipitation, RIA, ELISA, fluorescent Immunoassay, Avidin–Biotin mediated assay, Immunohistochemistry, Immunoelectrophoresis, immunoblotting, Complement fixation test.

UNIT-IV

MHC Complex–Gene organization. MHC complex class I, II and III molecules, Histocompatibility testing–Lympho cytotoxicty test and cross matching MHC. Transplantation–Types, genetics of transplantation, organ transplantation and graft versus host reactions. Tissue matching and Immunosuppressive agents. Tumor immunology–Types, properties of tumor cells, Immune surveillance, tumor antigens, immune response to tumors, Immunotherapy of tumors, DNA tumor virus and Retro virus.

UNIT-V

Hypersensitivity–Definition and classification–Type I, II, III, IV and V hypersensitivity, mechanism , diagnosis and treatment. Autoimmunity and Autoimmune diseases–Mechanism of development, diagnosis and treatment. Immunodeficiency disorders–B and T cell deficiencies. Secondary Immunodeficiency diseases–Pathogenesis, diagnosis and treatment of AIDS.

References

1. Basic and Clinical Immunology by Daniel P. Stites, John D. Stobo, J. Vivian Wells, Appleton & Lange, 6th Edition (1987).
2. Immunology by Geoffrey Zubay, W.M.C. Brown publisher, 4th Edition (1992).
3. Immunology by Janis Kuby, 4th Edition, W.H. Freeman and Company (2000).
4. Cellular and Molecular Immunology by Abul K. Abbas, Andrew Lichtman, Saunders, 5th Edition (2005).
5. Essential Immunology by Ivon Roitt, Blackwell Publishing, 11th Edition (2006).

Semester III

Research Methodology

Semester	Subject Code	Title of the Course	Hours / Week	Credits
III	**BC913**	**RESEARCH METHODOLOGY**	**5**	**4**

Course Objectives

- ❖ To learn the Importance of Research and Ethics in Scientific research
- ❖ To understand the collection and classification of research data.
- ❖ To know the scope of Bioinformatics, the role of Computers in Biology and Useful search engines.
- ❖ To acquire in-depth knowledge about the Laboratory animals used for Life science research.
- ❖ To explain the Composition of the Institutional Ethical Committee (IEC) and General ethical issues.

Course Outcomes

S.No.	Description	Cognitive Level (K-level)
CO1	Observe the basic concepts of scientific research, types of research and research design.	K1
CO2	Establish the knowledge about scientific writing and research publications	K3
CO3	Generalise the Collection and Classification of Data and its analysis.	K2
CO4	Perceive the Scope of Bioinformatics, and useful search engines for finding scientific articles.	K5
CO5	Point out the Laboratory animals used for Life science research and its ethical issues.	K4
CO6	Develop an understanding of the Composition of the Institutional Ethical Committee (IEC), IPR and Patenting.	K6

UNIT–I

Importance and Need for Research, Ethics in Scientific research, Designing a Research work, Formulation of Hypothesis, Scientific writing–Research and Review article. Logical format for Dissertation–Title, Certificate, Declaration, Acknowledgement, Contents, Abstract, Introduction, Review of Literature, Materials and Methods, Results, Discussion, Summary, Conclusion, Appendix and References–Harvard and Vancouver systems. Antiplagiarism.

UNIT–II

Collection and Classification of Data–Diagrammatic and Graphic representation of data–Measurement of Central tendency–Standard Deviation-Normal distribution-test of significance based on large samples and small samples, Student ‘t’ test, Correlation and Regression, Chi-square test for independence of attributes, ANOVA and SPSS.

UNIT-III

Introduction and Scope of Bioinformatics, Role of Computers in Biology. Useful search engines–Boolean searching, Search engine algorithms. Finding scientific articles in Google scholar, Science Direct, Scopus, Web of Science and UGC-CARE.

UNIT –IV

Laboratory animals used for Life science research. Ethics in animal experimentation. CPCSEA guidelines–Animal care and technical personnel environment, animal husbandry, feed, bedding, water, sanitation and cleanliness, waste disposal, anesthesia and euthanasia. Research funding agencies in India.

UNIT–V

Composition of institutional Ethical Committee (IEC), General ethical issues. Specific principles for chemical evaluation of drugs and human genetics research, Ethics in food and drug safety. Environmental release of microorganisms and genetically engineered organisms. Ethical issues in human gene therapy and human cloning. IPR and Patenting.

References

1. The craft of scientific writing by Alley, Michael, Englewood Cliffs. N.N. Prentice (1987).
2. Molecular and cell biology of human gene therapeutics by Dickson, Series Chapman and Hall (1995).
3. Bioinformatics Computing by Bergeron, B.P. 1st Edition, Printice Hall (2000).
4. Ethical guidelines for biomedical research on human subjects. ICMR, New Delhi (2000).
5. Research methods for biological science by Gurumani, N , MJP Pub., (2007).
6. Statistical methods by S.P Gupta. 41st Edition, S. Chand and co. (2011).

Ecology, Evolution And Biodiversity

Semester	Subject code	Title of the Course	Hours/Week	Credits
III	**BC914A**	**Elective III- Ecology, Evolution And Biodiversity**	**4**	**4**

Course Objectives

- To learn the fundamental principles of evolutionary theory to explore the evolution of biodiversity.
- To make familiar with the major groups of organisms related to one another.
- To learn the basic ecological theory and proposing solutions to the major environmental problems.
- To understand the concepts of genetic variation, Mendelian genetics and recombination**.**
- To gain the knowledge about aquatic biotic production and biodegradation in different ecosystems.

Course Outcomes

S. No.	**Description**	Cognition level (K-level)
CO1	Provide in-depth knowledge about emergency of evolutionary thoughts and Darwin concepts.	K1
CO2	Review the origin of cell, unicellular evolution, Abiotic synthesis and prokaryotic evolution.	K2
CO3	Analyze the population genetics with various types of selection like sexual selection, gene drift and gene flow.	K4
CO4	Establish the ecological interaction between an organism and environment.	K3
CO5	Manage the ecosystem dynamics, stability and complexity by knowing the N, P, C and S cycles.	K6
CO6	Assess the various kinds of aquatic habitat in the eco-management process and biodegradation of different ecosystem.	K5

UNIT-I

Evolutionary Thoughts−Emergency of evolutionary thoughts. Lamarck, Darwin–Concepts of variation, adaptation, struggle, fitness and natural selection. Mendelism, spontaneity of mutations and evolutionary synthesis.

UNIT-II

Evolutionary Theory−Origin of cells and unicellular evolution, Origin of basic biological molecules, Abiotic synthesis of organic monomers and polymers, Concept of Oparin and Haldane, Experiments of Miller (1953), First cell, Evolution of Prokaryotes, Origin of Eukaryotic cells, Evolution of Unicellular Eukaryotes.

UNIT-III

Origin of genetic variation; Mendelian genetics; polygenic traits, linkage and recombination; epistasis, gene-environment interaction; heritability; population genetics; Molecular evolution; molecular clocks; systems of classification: cladistics and phenetics; molecular systematics; gene expression and evolution. Types of selection (stabilizing, directional etc.); sexual selection; genetic drift; gene flow; adaptation; convergence; species concepts

UNIT-IV

Ecology -Interaction between an organism and environment Concept of habitat and ecological niches, Contributing and Limiting factors for population growth, Energy flow, Food web and Tropic levels. Ecological pyramids and recycling, Communities – population dynamics and community level interactions, N, P, C, S cycles in nature, Ecosystem dynamics and management, stability and complexity of ecosystems, Biogeography and Conservation.

UNIT-V

Ecomanagement−Physio–chemical properties of water, kinds of aquatic habitat (fresh water and marine), distribution and impact of experimental factors on the aquatic biotic productivity and biodegradation in different ecosystems, fish and fishes of India with respect to the management of estuarine, coastal water systems and manmade reservoirs, biology and ecology of reservoirs.

References

1. Ecology Environment and Pollution by A. Balasubramanian, First edition, Publisher: Indira Publishers, Mysore (1995).
2. Biodiversity of Microbial Life by Staley Reysenbach, Wiley Publishers (2001).
3. Glimpses of Biodiversity by B. Bhosetti, Daya Publishing House (2002).
4. Text Book of Ecology by Eugene P. Oodum, Brooks/Cole; 5th Revised Edition (2004).

5. Environmental Biodiversity by P.R. Yadav, Discovery Publishing Pvt. Ltd. (2016).

Food Biochemistry

Semester	Subject Code	Title of the Course	Hours/week	Credits
III	BC914B	Elective III - Food Biochemistry	4	4

Course Objectives

- To learn the structure, composition, nutritional value, processing and storage of cereals.
- To understand the importance, composition, classification, processing and toxic constituents of spices and pulses.
- To know the classification of nuts and oils, fat and oils, milk and milk products; nutritive values and significance.
- To understand the composition, classification, importance of vegetables and non-vegetable foods.
- To learn about the sugar, sugar products, baking and beverages of food.

Course outcomes

S.No.	Description	Cognitive Level (K- level)
CO1	Identify the structure and composition, nutritional value, processing, storage and care of cereals.	K1
CO2	Focus the importance, composition, classification of spices, composition, classification, nutritional value, processing and fermentations, toxic constituents of pulses.	K4
CO3	Justify the nutritive value, importance and classification of nuts , oils, milk and milk products.	K5
CO4	Integrate the selection, storage, uses and nutritional aspects of meat, fish and poultry.	K6
CO5	Explain the composition, classification of egg products, storage of fruits and vegetables.	K2
CO6	Determine the sugar products, baking products and processing of beverages.	K3

UNIT-I:

Cereal- Structure and composition, Nutritional value, Processing-Milling, polishing. Parboiling, flaking, parching, roasting, use in variety of preparations selection, storage and care, breakfast cereals.

UNIT-II:

Role of spices in food science - Importance, composition & classification. Pulses: Composition and nutritional value, processing, soaking, germination. Cooking and fermentations: Toxic constituents of pulses, Lathyrism.

UNIT-III:

Nuts and oil seeds: Nutritive value, importance & classification. Fats and oils: Types, role of fat in cookery. Milk and milk products: Composition of milk, properties and effect of heat, nutritional importance, milk processing, milk products.

UNIT-IV:

Flesh foods - selection, storage, uses and nutritional aspects of meat, fish and poultry, spoilage of fish. Egg- composition & classification of egg & egg products, its nutritive value. Fruits and vegetables: Classifications, composition and importance in human nutrition storage, cooking of vegetables, changes during cooking, effect of heat, acid and alkali.

UNIT-V:

Sugar and Sugar products – Form of sugar and liquid sweetness, Caramelization, Hydrolysis, Crystallization, Indian confectionery. Baking- Types of bake products & its nutritive value. Beverages: Coffee, tea, and cocoa, processing composition and preparation.

References

1. Srilakshmi, B. 2005. Food Science, New Age International (P) Ltd., Publishers, New Delhi.
2. Chemists, St. Paul Mimesota, USA. 4. Charley, H.(1982).Food Science, 2nd edition, John Wiley & Sons, New York.
3. Desrosier, N.W. and James N.(2007).Technology of food preservation. AVI Publishers.
4. Meyer, L.H.1974. Food Chemistry, AVI Publishing Co. Inc,
5. Manay, S. and Shadaksha ramasamy, Food: Facts and Principles, New Age International (P) Publishers, New Delhi.
6. Srilakshmi, B. (2010), Food Science, 5th edition, New age international publishers, New Delhi.

Bionanotechnology

Semester	Subject Code	Title of The Course	Hours	Credits
III	BC914C	Elective III - Bionanotechnology	4	4

Course Objectives

- To understand the fundamental principles of nanotechnology and its applications.
- To study about the basic knowledge about nanoparticles and its biological applications.
- To apply engineering concepts and demonstrate a comprehensive understanding of state-of-the-art nano- scale and nano-fabrication methods.
- To evaluate the processing conditions to engineer functional nanomaterials.
- To apply and transfer interdisciplinary approaches to bionanotechnology.

Course outcomes

S.No.	CO Statement	Cognitive Level
CO-1	Demonstrate the fundamental principles of nanotechnology and their application to biomedical engineering.	**K2**
CO-2	Exhibit the state-of-the-art nano-fabrication methods	**K1**
CO-3	Apply the knowledge of assessing nanomaterials and their safety	**K3**
CO-4	Make inferences on handling methods required during characterization	**K4**
CO-5	Justify the usage of nanomaterials in biological applications.	**K5**
CO-6	Compile the information about nanomedicines and their uses.	**K6**

UNIT-I

Bionanotechnology–Concepts, Definitions, Biosystems, Biological networks, Benefits and Applications of Nanotechnology in medicine and agriculture. Nanorobots.

UNIT-II

Biomaterials- Introduction and Types. Biodegradable polymers. Biocompatibility, mechanical properties and Antibacterial Activity. DNA based nanomechanical devices, Biomaterial Nanocircuitry-DNA nanostructures for mechanics, computing and DNA based computation.

UNIT-III

Nanoparticle synthesis using Plants, Bacteria, Fungi and Virus. Metal nanoparticle synthesis and mechanism – Silver, Gold, Copper and Zinc. Magnetic Nanoparticles - Synthesis and Applications.

UNIT-IV

Techniques to construct nanostructures–Scanning probe instruments, nanoscale lithography. Characterisation of nanoparticles: UV -Visible Spectroscopy, FTIR, SEM, TEM, AFM, XRD and DLS.

UNIT V

Nanomedicines, Nanodrug administration. Drug delivery systems and its mechanism–Polymer therapeutics, conjugates, micelles and liposomes. Mechanical testing; elasticity; toughness; effect of fabrication on strength. Dendrimers as nanoparticulate drug carriers.

References

1. Nanotechnology: A Gentle Introduction to the Next Big Idea by Mark Ratner and Daniel Ratner, Pearson Education Publishers (2002).
2. Nanobiotechnology: Concepts, applications and perspectives by Christ M. Niemayer, Chad A. Mirkin, Wiley VCH publishers (2004).
3. Encyclopedia of Nanoscience and Nanotechnology by H.S. Nalwa (Ed.,), American Scientific Publishers, California (2004).
4. Bionanotechnology: Lessons from Nature by David S. Goodsell, Jhonwiley (2006).
5. Lehninger's Principles of Biochemistry by David L. Nelson and Michael M. Cox, 4th Edition (2006).

Semester IV

Advanced Clinical Biochemistry

Semester	Subject code	Title of the Course	Hours/Week	Credits
IV	BC1009	Advanced Clinical Biochemistry	5	5

Course Objectives

- To learn about the specimen: composition, collection and various clinical methods.
- To gain the knowledge about metabolic disorders associated with carbohydrate and lipids.
- To familiarize with the renal disorders linked with protein metabolism and non-protein nitrogenous constituents.
- To understand the functions of liver and its associated disorders.
- To understand the oxidative stress and damage to the macromolecules.

Course Outcomes

S. No.	**Description**	Cognition level (K-level)
CO1	Express the various methods in collection and analysis of clinical specimens like blood and urine.	K2
CO2	Determine the clinical defect of numerous disorders linked to carbohydrate and lipoprotein metabolism.	K3
CO3	Examine the type of renal disorder based on the concentration of blood substances like urea, creatinine and uric acid.	K1
CO4	Categorize the disorder associated with serum enzymes like Acid phosphatase, Streptokinase, Asparaginase, Isocitrate dehydrogenase, Ceruloplasmin, CK and LDH.	K4
CO5	Evaluate the types of jaundice by the level of serum conjugated and unconjugated bilirubin.	K5
CO6	Compile the effect of free radicals and role of enzymatic and non-enzymatic antioxidants on the macromolecules.	K6

UNIT-I

Collection of specimens– Blood collection methods: Vein, Skin and arterial puncture. Collection and analysis of urine samples: Types of urine sample and Physical, Chemical and microscopic examinations, timed urine specimens, preservatives. CSF-Collection, Composition and Analysis. Amniotic fluid-Origin, Collection Composition and analysis.

UNIT-II

Diabetes Mellitus- Insulin receptors, renal threshold value, GTT, Hypo and Hyperglycemia, Galactosemia, Fructosuria, Glycated hemoglobin and Glycogen Storage Disease. Disorders of lipid metabolism- functions, metabolism and abnormalities of Lipoproteins, Lipid storage disease- Sudden infant death syndrome (SIDS), Zellweger's Syndrome, Niemann Picks disease, Gaucher's disease, TaySach's disease, Disorders associated with lipoprotein metabolism – Hyper, Hypo and dyslipoproteinemia.

UNIT-III

Disorders of protein metabolism-Non-protein nitrogenous constituents in blood-Urea, uric acid and creatinine. Plasma protein abnormalities-deficiency, Agammaglobulinemia, Multiple myeloma, Proteinuria, Glomerulonephritis, Nephrotic syndrome. Haemoglobinopathies-Sickle cell anaemia and Thalassemia. Phenylketonuria, Tyrosinosis, Alkaptonuria, Maple syrup urine disease, Hartnup disease, Homocystinuria and Albinism. Serum enzyme activities in diseases- Acid phosphatase, Streptokinase, Asparaginase, Isocitrate dehydrogenase, Ceruloplasmin, γ-Glutamyl transpeptidase, Creatine kinase and Lactate dehydrogenase.

UNIT-IV

Liver function tests, Liver Disorders- Hepatitis types, Non-alcoholic Steatohepatitis, Cirrhosis, Alcoholic liver disease, Hepatic tumor and Biliary tract diseases. Disorders of bilirubin metabolism - Jaundice. Gastric Function Tests. Renal Function Tests and related disorders-Acute and Chronic renal failure, Urinary tract obstruction and analysis of Urinary calculi.

UNIT-V

Free radicals in health and disease-Endogenous and exogenous. Oxidative damages to carbohydrate, protein and fat metabolism. Role of enzymatic and non-enzymatic antioxidants. Cancer-Carcinogenic agents, Morphological and metabolic changes in tumors – Ovarian, breast, GIT, colon, and prostate cancers. Tumor markers- AFP, CEA and hCG.

References

1.Fundamentals of clinical chemistry by N.W. Teitz, W.B. Saunders Company, 2nd Edition (1994).
2.Clinical biochemistry in diagnosis and treatment by Philip. D. Mayne, ELBS Publication, 6th Edition (1994).
3.Clinical Biochemistry–Metabolic and clinical aspects, William J. Marashall and Stephen K. Bangert, Pearson professional Ltd. (1995).
4.Textbook of Medical Biochemistry by N. Chatterjee, 4th edition, Rana Shinde–Jaypee publication (2000).
5.Biochemistry by Zubay, G.L., W.M.C. Brown publishers. New York (2002).

Semester IV
Biotechnology

Semester	Subject Code	Title of the Course	Hours / Week	Credits
IV	BC1010	Biotechnology	4	4

Course Objectives

- To impart knowledge on basic tools in genetic engineering.
- To provide knowledge on cloning vectors and DNA sequencing.
- To create awareness on gene transfer and its applications.
- To understand basics on Industrial biotechnology.
- To develop sound knowledge on Bio-safety and bio-hazards.

Course Outcomes

S.No.	Description	Cognitive Level (K-level)
CO1	Perceive a broad knowledge on gene transfer system, restriction enzymes and hybrid vectors in genetic engineering.	K5
CO2	Explain the gene cloning technique, gene library, PCR and Blotting Techniques.	K2
CO3	Outline the Tissue Culture, protoplast fusion, GM foods and xenografting.	K4
CO4	Describe the basic concepts of fermentation and their industrial applications.	K1
CO5	Determine the biological weapons, gene drain and tangled genes.	K3
CO6	Interpretation of Vaccines with RNA virus and safety of GMOs	K6

UNIT-I

Basic Principles–Mechanism of natural gene transfer by Agrobacterium, Generation of foreign DNA molecules, Restriction enzymes–Types and target sites, Cutting and joining DNA molecules, linkers, adapters, homopolymers, enzymes used in genetic engineering, cloning vehicles and their properties, natural plasmids, *in vitro* vectors, cosmids and T-DNA based hybrid vectors.

UNIT-II

Cloning strategies–Cloning with single strand DNA vectors, cDNA cloning and gene libraries, Recombinant selection and screening methods, Expression of cloned genes, Shuttle vectors, DNA sequencing strategies–Sanger's and Maxam-Gilbert's methods, Applications of PCR and DNA hybridization, Southern, Northern and Western blotting. Chromosome Walking and Jumping, DNA foot printing, DNA finger printing, RFLP, RAPD–Principles, Procedures and Applications.

UNIT-III

Techniques of tissue culture–Culturing explants and haploids, Protoplasts fusion, Methods of gene transfer to plants, animals and bacteria-Ca transfection, electroporation, shotgun, transgenic plants, GM foods, and biopesticides, gene knockouts and transgenic animals and xenografting.

UNIT-IV

Industrial biotechnology- Fermentation, Fermentor-common features and operation for a conventional bioreactor, classification of fermentation, factors affecting fermentation process, media– synthetic and crude media. Industrially important fermentation products.

UNIT-V

Biotechnology–Potential hazards, biological weapons, biosafety of GM foods and GMOs–Substantial equivalence and safety testing, gene drain, the tangled genes. Production of vaccines in animal cells-traditional and recombinant vaccines -subunit vaccines-Hepatitis B, Corona virus, DNA and RNA vaccines.

References

1. Glick R. and J. J. Pasternak. 2002. Molecular Biotechnology (3rd Edition). ASM Press, Washington, USA.
2. Praful. B. Godkar, 2014, Text book of Medical laboratory technology; III Edition, Volume I and II, Bhalani Publishing house.
3. Verma P.S & V.K. Agarwal, 2003, Cytology, Genetics, Evolution and Ecology, S.Chand & Co Ltd., New Delhi.
4. K. G. Ramawat and J. M. Merillon (Eds.), 2010, Biotechnology - secondary metabolites, Oxford & IBH publishing Co. Pvt. Ltd.
5. Basic Biotechnology - Ratledge & Kristianeen, Cambridge University press 2nd ed.
6. Gene cloning - an introduction by TA Brown, Chapman and Hall.
7. Molecular Biotechnology, 2nd ed - Glick & Pasternak, Panima Publications.
8. Gene cloning - an introduction by TA Brown, Chapman and Hall.
9. Molecular Biotechnology, 2nd ed - Glick & Pasternak, Panima Publications.

Semester IV

Plant :Biochemistry and Molecular Biology

Semester	Subject Code	Title of the Course	Hours / Week	Credits
IV	**BC1011A**	**Elective IV - Plant: Biochemistry and Molecular biology**	**4**	**4**

Course Objectives

- To explain and understand the Biochemistry of photosynthetic system.
- To learn and understand the basics of plant cell and its physiology.
- To create awareness on Plant diseases and their metabolism.
- To impart basic knowledge on plant biotechnology.
- To develop sound knowledge on biochemical events associated with growth regulators and herbicide.

Course Outcomes

S.No.	Description	Cognitive Level (K-level)
CO1	Acquire broad knowledge on Photosynthesis, Cyclic and non-cyclic photophosphorylation and Calvin cycle.	K3
CO2	Infer the different types of plant hormones, Symbiotic and Non-symbiotic nitrogen fixation.	K2
CO3	Integrate about stress physiology and secondary metabolites	K6
CO4	Recall the basic concepts of plant physiology, Biochemistry of seed democracy and phytochromes.	K1
CO5	Outline the DNA Polymorphism and plant genetic engineering.	K4
CO6	Provide the information on plant vectors, plasmid, biodegradable plastics and fruit ripening.	K5

UNIT-I

Structure & synthesis of chlorophyll, phycobilins and carotenoids. Photosynthesis: photosystem I & II, Light absorption, Hill reaction, Red drop & Emerson's enhancement effect. Cyclic and non-cyclic photophosphorylation, C2, Calvin cycle, C4 & CAM. Photosynthesis factors and regulation.

UNIT-II

Nitrogen metabolism and plant hormones−Nitrogen cycle Symbiotic and Non-symbiotic nitrogen fixation. Assimilation of ammonium, carbon- nitrogen ratio, Uride metabolism, Nitrate metabolism, genetics of nitrogen fixation, genetic manipulation of nif genes, Biosynthesis, Mode of action, transport, distribution and physiological effects of Auxin, Gibberrilin, Cytokinin, ABA and Ethylene.

UNIT-III

Plant disease and Secondary metabolites. Biochemistry of plant disease, defence mechanism of plants, biosynthesis, distribution and biological functions of industrially important secondary metabolites. Principles of plant disease control.

UNIT-IV

Plant physiology. Water relations of plant, Mechanism of water absorption. Aquaporin Symplast−Apoplast concept. Ascent of sap, Transpiration and Stomatal mechanism. Source and sink relationship, Translocation of Inorganic and Organic substances. Biochemistry of seed dormancy, seed germination, fruit ripening and senescence. Phytochromes− Properties, Photochemicals, transformation, Mode of action and physiological effects.

UNIT-V

DNA polymorphism−Importance of RFLP and RAPD in plant breeding management. Aspects of plant genetic engineering. Tacking, Mapping and Cloning of plant genes and Selectable markers. Reporter genes and promoters used in Plant vectors. Ti plasmids and Crown gall tumor, Genetic engineering of plant for disease resistance, Cytoplasmic Male Sterility, Edible oil, Biodegradable plastics. Delay of fruit ripening.

Reference:

1. Ajoy Paul. 2007. Textbook of Cell and Molecular Biology. Books and Allied, Kolkata
2. De Robertis and De Robertis. 1990. Cell and Molecular Biology. Saunders, Philadelphia.
3. Gerald Karp. 2008. Cell and Molecular Biology. (Ed: 5). John Wiley and Sons, New York.
4. Handbook of medicinal plants by Prajapathi, Purohit and Sharma kumar.
5. Plant Biochemistry by P.M. Dey and J.B. Harborne.
6. David Freifelder, 2008. Molecular Biology. (Ed: 2). Narosa Publications. New Delhi.
7. Modern Plant Physiology by R.K. Sinha, Narosa Publishing House (2004).
8. Plant Physiology by S.N. Pandey and B.K. Sinha, 3rd Edition, Vikas publishing House Pvt., Ltd. (2009).
9. Lewin's. 2017. GENES XII. 12th edition. Jones and Bartlett Publishers, Inc; Burlington, Massachusetts, USA.
10. Introduction to plant physiology, William. G.Hopkins, Norman. P.A. Hunger, 3rd Edition.
11. Biochemistry and Molecular Biology of plants by Buchannan, Grvissem and Jones.

Semester IV

Herbal Technology

Semester	Course Code	Title of the Course	Hours	Credits
IV	**BC1011B**	**Elective IV Herbal Technology**	**4**	**4**

Course Objectives

- To learn about the preparation of drugs.
- To know about Herbal remedies for human ailments.
- To evaluate the propagation of medicinal plants.
- To study the Nutritive and medicinal value of fruits.
- To know the applications of Herbal foods.

Course Outcomes

S.No.	CO-Statement	Cognitive Level (K-level)
CO-1	Discuss the importance of Nutritive and medicinal value of fruits	**K2**
CO-2	Acquire knowledge of Collection of wild herbs and its formulations	**K3**
CO-3	Perceive the knowledge of Systems of Indian Medicines–Siddha, Unani, Ayurveda and Homeopathy.	**K5**
CO-4	Evaluate the Drugs for common disorders and its mechanism of action.	**K1**
CO-5	Analyse the applications of Herbal foods− Food processing and packaging.	**K4**
CO-6	Integrate the biotechnological principles in propagation of medicinal plants.	**K6**

UNIT-I

Pharmacognosy- Definition, History and Scope. Systems of Indian Medicines–Siddha, Unani, Ayurveda and Homeopathy. Crude drugs – Definition, Classification - Pharmacological and chemical. Chemistry of drugs and its evaluation. Preparation of crude and commercial drugs.

UNIT–II

Herbal preparation–Collection of wild herbs–capsules–compresses- Hydrotherapy, Herbal bath, Herbal oils an tincture. Preparation of herbal syrups, herbal oils and herbal salves. Extraction of phytochemicals−Alkaloids, Volatile oils, Resin and Tannins. Herbal dye and perfumes.

UNIT-III

Traditional knowledge and utility of some medicinal plants−*Ocimum sanctum, Solanum trilobatum, Cassia auriculata* and *Aloe vera*. Nutritive and medicinal value of some fruits (*Psidium guajava, Manilkara zapota, Citrus sinensis, Citrus limon and Punica granatum*) and Green Vegetables−*Moringa, Solanum nigrum* and *Brassica oleracea*.

UNIT-IV

Drugs for urogenital disorders- roots of *Withania somnifera*, memory Stimulants – *Centella asiatica*, Kidney stones – *Musa paradisica*, Anticancer drugs – *Catharanthus roseus, Anti-inflammatory drugs – Cardiospermum* and *antipsychoactive drugs - Salvia divinorum* – basic mechanism of action.

UNIT-V

Propagation of Medicinal plants−Micro and macro propagation, Conservation of rare medicinal plants. Role of biotechnology in medicinal plant banks−Cultivation of medicinal and aromatic plants. Herbal foods− Food processing and packaging.

References

1. Indian Materia Medica by Nadkarni Bombay: Popular Prakashan (1976).
2. Glimpses of Indian Ethnobotany by Hemadri, K., Raj, P.V., Rao, S.S. and Rajeswarasarma, C.R., Oxford and IBH, New Delhi (1980).
3. A text book of Pharmacognosy by Shah, S.C. and Qudary, Elsevier India (1990).
4. An Introduction to Medical Botany and Pharmacognosy by Kumar N.C., CBS publishers and Distributors (1993).
5. Pharmacognosy by George Edward Trease and W.C. Evans, 12th Edition, English Language Books Society, (2009).
6. An introduction to medical botany and Pharmacognocy. Kumar . N.C. (1993)
7.

MEDICAL DIAGNOSTIC TECHNOLOGY

Semester	Course Code	Title of the Course	Hours	Credits
IV	BC1011C	Elective IV MEDICAL DIAGNOSTIC TECHNOLOGY	4	4

Course Objectives

- To gain knowledge about good laboratory practices.
- To study the collection and preservation of biological specimens.
- To evaluate the knowledge of Hematological parameters.
- To study about the Microscopic and Macroscopic Examination of Urine and Feces.
- To learn culturing of organisms using microbiological techniques.

Course Outcomes

S.No.	CO-Statement	Cognitive Level (K-level)
CO-1	Understand the knowledge about good laboratory practices.	**K2**
CO-2	Acquire a broad knowledge of collection and preservation of biological specimens.	**K3**
CO-3	Perceive a broad knowledge of haematological parameters.	**K5**
CO-4	Observe the microscopic and macroscopic examination of urine.	**K1**
CO-5	Analyse the microscopic and macroscopic examination of faeces.	**K4**
CO-6	Integrating the safety procedures in microbial culture techniques.	**K6**

Unit- I: Specimens: Collection and preservation of Blood, Urine, Faeces, Sputum, Semen, Throat swab and CSF. Good laboratory practices.

Unit-II: Blood: Blood pressure (BP), Clotting time, Bleeding time, Hemoglobin Estimation, RBC count and WBC count, Differential count, Erythrocyte Sedimentation Rate (ESR), Hematocrit value (Packed cell volume) and platelet counting.

Unit-III: Urine: Composition, Preservation, Microscopic and Macroscopic Examination (Physical and Chemical examination)

Unit-IV: Faeces: Composition, Macroscopic and Microscopic Examination, Chemical examination – occult blood and steatorrhoea.

Unit-V: Culturing of organism from various specimens (Pus, Urine, Blood, Sputum, Throat Swab), Antibiotic sensitivity test and Gram staining (acid fast, base & neutral). Safety procedures in microbiological techniques.

References

1. D.Sahu (1997), Critical approach to clinical medicine, Vikas Publishing, Noida.
2. Devlin, T.M. (2002), Textbook of Biochemistry with Clinical correlations, 5th edition, John Wiley & Sons Inc, Publications.
3. P.D.Mayne (1994), Clinical chemistry in diagnosis and treatment. A Hodder Arnold Publication; 6Rev Ed edition.
4. W.J. Marshall and S.K. Bangeit, (1995), Clinical biochemistry - Metabolic concepts and clinical aspects, Churchill Livingstone.
5. K.V. Krishna Das, Text Book of Medicine, (1996), Jaypee publication, New Delhi.
6. A.C. Guyton and J.E. Hall, (2000), Text Book of Medical PhysiologyHarcourt Asia.
7. Guyton (1996) Human Physiology and Mechanisms of Disease. Saunders Publications; 6th edition.
8. N.Chatterjee and Rana Shinde (2012) Textbook of Medical Biochemistry - eighth edition, Jaypee publication, New Delhi.
9. K. Sampath (1999), Hospital and Clinical Pharmacy, Vikas Publishing. Noida.

SEMESTER– IV

Lab Course – IV: Biochemical, Immunological and Molecular Biology

CORE PRACTICAL–IV

SEMESTER–III & IV **5 Hrs/Week (5 Credits)**

Lab Course IV: Biochemical, Immunological and Molecular Biology Techniques

A. BIOCHEMICAL ANALYSIS OF BLOOD

1. Estimation of Blood Glucose by O-Toluidine method.
2. Estimation of Serum Proteins by Bradford's Method.
3. Estimation of Plasma Fibrinogen.
4. Estimation of A/G ratio in Serum.
5. Estimation of Blood Urea by DAM method.
6. Estimation of Serum Uric acid by Phosphotungstate method.
7. Estimation of Serum Creatinine by Alkaline picrate method.
8. Estimation of Serum Triglycerides.
9. Estimation of Serum Cholesterol by Zlatkis, Zak and Boyle method.
10. Estimation of Serum Phospholipids.
11. Estimation of Serum Calcium.
12. Estimation of Serum Bilirubin by Evelyn Malloy method.

B. IMMUNOLOGICAL AND MOLECULAR BIOLOGY TECHNIQUES

1. Grouping of Blood and Rh typing.

2. Determination of Pregnancy.

3. Widal Test.

4. Agarose gel Electrophoresis.

5. Immuno diffusion/Precipitation Methods.

6. ELISA

7. PCR technique

SEMESTER– IV

Lab Course– V: Haematological Methods

SEMESTER–III & IV **5 Hrs/Week (5 Credits)**

CORE PRACTICAL-V

Lab Course V: HAEMATOLOGICAL METHODS

A. HAEMATOLOGICAL METHODS

1. Collection and Storage of Blood.
2. Total RBC count.
3. Total WBC count.
4. Total Platelet count.
5. Differential WBC count.
6. Absolute Eosinophil count.
7. Determination of Heamoglobin content.
8. Determination of clotting time.
9. Determination of ESR.
10. Pathological examination of Blood film.

B. URINE ANALYSIS

1. Qualitative analysis of Normal and Pathological constituents in urine.
2. Microscopic analysis of Urine.
3. Estimation of Titrable acidity.
4. Estimate of True acidity.
5. Estimation of Protein by Biuret method.
6. Estimation of Urea.
7. Estimation of Uric acid.
8. Estimation of Calcium.