DEPARTMENT OF BIOCHEMISTRY

PREAMBLE

UG : Programme profile and syllabi of courses offered in semester III and IV along with its evaluation components (With effect from 2018 - 2021 batch onwards) and

PG : Programme profile and syllabi of courses offered in semester III and IV along with its evaluation components (With effect from 2018 - 2020 batch onwards) are presented in this booklet

PROGRAMME PROFILE B.Sc. (Biochemistry)

PSO1 : Understand the applications of Biochemistry in various fields such as Clinical Biochemistry, Genetic Engineering, and Molecular biology & Biotechnology.

PSO2 : Acquire practical skills for a future career in the field of Biological Science.

PSO3 : Ability to analyze the various biological components through analytical tools in living cells.

PSO4 : Development of practical laboratory skills and strong speculative foundation in the across discipline of Chemistry, Microbiology & Bioinformatics.

Semester	Part	Category	Course code	Course Title	Hours per week	Credit	
						Min	Max
I	I	Language	UTAL105/ UTAL106/ UHIL101/ UFRL101	Basic Tamil I/ Advanced Tamil I/ Hindi I / French I	4	2	3
	II	English I	UENL107/ UENL108	General English I/ Advanced English I	5	3	4
	III	Core I	UBCM106	Fundamentals of Biochemistry	2	1	1
		Core II	UBCM105/ UBCM201	Cell Biology	6	5	5
		Core practical I	UBCR101	Cell Biology Practical	3	3	3
		Allied I	UCHA102	Allied Chemistry - I	5	4	4
		Allied I practical	UCHR103/ UCHR403	Volumetric and Organic Analysis	3	2	2
	IV	Value education			2	1	1
				TOTAL	**30**	**21**	**23**
II	I	Language	UTAL205/ UTAL206/ UHIL201/ UFRL201	Basic Tamil II/ Advanced Tamil II/ Hindi II/ French II	4	2	3
	II	English II	UENL207/ UENL208	General English II/ Advanced English II	5	3	4
	III	Core III	UBCM202	Biomolecules	5	5	5
		Core practical II	UBCR201	Qualitative analysis of	3	3	3

				Biomolecules			
		Allied II	UMBA201	Microbiology	4	4	4
		Allied II practical	UMBR201	Microbiology Practical	3	2	2
	IV	Non Major elective			4	2	2
		Soft skill			2	1	1
	V	Extension activity/ Physical Education/ NCC			-	1	2
				TOTAL	**30**	**23**	**26**
III	I	Language	UTAL305/ UTAL306/ UHIL301/ UFRL301	Basic Tamil III/ Advanced Tamil III/ Hindi III/ French III	4	2	3
	II	English III	UENL307/ UENL308	General English III/ Advanced English III	5	3	4
	III	Core IV	UBCM304	Biochemical Techniques	6	6	6
		Core practical III	UBCR301	Biochemical Techniques practical I	5	5	5
		Allied III	UMAA305	Biostatistics	5	4	4
	IV	Online courses		NPTEL/Spoken Tutorial	3	1	2
		Value Education			2	1	1
				TOTAL	**30**	**22**	**25**
IV	I	Language	UTAL405/ UTAL406/ UHIL401/ UFRL401	Basic Tamil IV/ Advanced Tamil IV/ Hindi IV/ French IV	4	2	3
	II	English IV	UENL407/ UENL408	General English IV/ Advanced English IV	5	3	4
	III	Core V	UBCM403	Immunology	6	6	6
		Core VI	UIDM401	Pharmaceutical chemistry	6	6	6
		Core practical IV	UBCR401	Biochemical Techniques Practical II	5	5	5
		Core X	UBCP501	Project	2	-	-
	IV	Soft skill			2	1	1
	V	Extension activity/ Physical Education/NCC			-	-	2
				TOTAL	**30**	**23**	**27**
V	III	Core VII	UBCM501	Enzymes & Intermediary metabolism	6	6	6
		Core VIII	UBCM502	Human Physiology	6	6	6
		Core IX	UBCM503	Basics of Bioinformatics	6	6	6
		Core practical V	UBCR501	Enzymology practical	6	3	3

		Core X	UBCP501	Project	4	4	4
		Value education			2	1	1
				TOTAL	**30**	**26**	**26**
VI	III	Core X1	UBCM601	Introduction to Biotechnology	5	4	4
		Core XII	UBCM602	Clinical Biochemistry	5	5	5
		Core XIII	UBCM603	Molecular Biology	5	5	5
		Core XIV	UBCM604	Comprehensive Viva voce	-	1	1
		Core practical VI	UBCR601	Clinical Biochemistry practical	5	3	3
		Core practical VII	UBCR602	Hematology & Urine analysis	3	2	2
		Major Elective	UBCO604	Stem cell Biology	5	4	4
			UBCO605	Molecular Endocrinology			
			UBCO606	Pathobiology of Human Diseases and Disorders			
			UIDM601	Nanotechnology in medicine			
	IV	Soft skill			2	1	1
	V	Extension activity/ Physical Education/NCC			-	-	2
				TOTAL	**30**	**25**	**27**
				GRAND TOTAL	**180**	**140**	**154**

PROGRAMME OFFERED TO OTHER DEPARTMENTS
NON MAJOR ELECTIVES

Semester	Part	Category	Course code	Course Title	Contact Hour/ Week	Credit	
						Min	Max
II	IV	Non Major Elective	UBCE202	Biomedical Techniques	4	2	2
			UBCE401/UBCE203	Nutrition & Health			
			UBCE502/UBCE204	Women's Health, Nutrition & Disorders			
			UBCE304/UBCE208	Mushroom Cultivation			
			UBCE209	Clinical Diagnostics			
			UBCE210	Reproductive Biology			

EXTRA CREDIT EARNING PROVISION (Only for Interested Students)

Semester	Category	Course Code	Course Title	Credit
II	Internship	UBCI201	Summer Internship	1
IV	Internship	UBCI401	Summer Internship	1

UBCM304 BIOCHEMICAL TECHNIQUES

Semester : III **Credit : 6**
Category : Core IV **Hours/ Week : 6**
Class & Major : II B.Sc. Biochemistry **Total Hours : 78**

Objectives
To enable the students

- Gain knowledge on various laboratory techniques.
- Apply the techniques in various biochemical analysis.

UNIT-I ELECTROCHEMICAL PARAMETERS **15 Hrs**

Definition of pOH, pH, Acid-base balance, Hendersons Hasselbach equation. Determination of pH- Hydrogen electrode, Oxygen electrode, Glass electrode, Ion sensing electrode, Buffers in body fluids.

UNIT-II CENTRIFUGATION TECHNIQUES **15 Hrs**

Basic principle of Sedimentation - centrifugal force, sedimentation rate, Svedberg unit. Types of Centrifuge, types of rotors – fixed angle, vertical, swinging bucket, zonal, elutriator rotors. Preparative ultracentrifuge- Differential centrifugation, Density gradient, Rate zonal, Isopycnic centrifugation. Analytical ultracentrifugation - determination of molecular weight by sedimentation.

UNIT-III CHROMATOGRAPHIC TECHNIQUES **17 Hrs**

General principles of chromatography – partition and adsorption chromatography. Paper chromatography – principle, sample application, development – ascending, descending and radial, detection of amino acids and sugars. Thin layer chromatography – principle, instrumentation and applications (separation of alkaloids). Column chromatography – principle, factors affecting resolution. Basic principles and applications of Affinity chromatography and HPLC.

UNIT-IV ELECTROPHORETIC TECHNIQUES **15 Hrs**

Electrophoresis- Principle, Instrumentation and Applications of Paper, Agarose, SDS-PAGE, Cellulose acetate, Immunoelectrophoresis, isoelectric focusing. Blotting techniques – Southern, Northern, Western.

UNIT-V PHOTOMETRY AND DETECTION METHODS **16 Hrs**

Beer-Lambert's law, UV-Visible Spectrophotometry- principle, instrumentation and applications. Flame photometry- Flame emission Spectrophotometry and Atomic absorption Spectrophotometry. ELISA technique and Chemiluminescence immunoassay (CLIA) technique.

Text books

- Upadhyay-Upadhyay Nath., *Biophysical chemistry,* 3rd revised edition, Himalaya publications, 2009.
- Keith Wilson and John Walker, *Principle and techniques of Practical biochemistry,* 7th edition Cambridge press, 2010.

- Keith Wilson and Goulding, K.H. *A biologists guide to principles and techniques of practical biochemistry*, 3rd edition, ELBS, London, 1993.

Reference books

- Hezl & Peck, *Analytical Biochemistry*, 3rd edition, Prentice Hall, 2016.
- Sadasivam S and A.Manickam, *Biochemical methods*, 2nd edition, New Age International (P) Ltd publisher, 2008.
- Subramanian M.A, *Biophysics: Principle and techniques*, 1st edition, MJP publishers, 2006.

e-Resources

- https://www.pdfdrive.com/analytical-biochemistry-3rd-ed-david-holme-hazel-peckpdf-e20263959.html
- http://ecoursesonline.iasri.res.in/mod/page/view.php?id=42656
- https://www.ebooks.com/en-us/95946455/wilson-and-walker-s-principles-and-techniques-of-biochemistry-and-molecular-biology/hofmann-andreas-clokie-samuel/

UBCR301 BIOCHEMICAL TECHNIQUES PRACTICAL I

Semester : III **Credit : 5**
Category : Core Practical III **Hours/ Week : 5**
Class & Major : II B.Sc. Biochemistry **Total Hours : 65**

Objectives

To enable the students

- Understand the principles involved in the study area.
- Attain technical competence in the specific discipline.

VOLUMATRIC ANALYSIS

1. Estimation of iron, oxalates, nitrite and chromates using potassium permenganate.
2. Estimation of calcium from milk and urine.
3. Estimation of copper and potassium dichromate by Iodometry method.

CHROMATOGRAPHY TECHNIQUES

1. Separation and detection of aminoacids and simple sugars by Paper chromatography.
2. Separation of polar and non polar aminoacids by Thin layer chromatography.

Text Books

- David T Plummer, *An introduction to practical biochemistry*, 3rd edition, Tata Mac Graw hill Publication, 2008.
- Keith Wilson, John Walker, *Principles and Techniques of Practical Biochemistry and Molecular Biology,* 7th edition, Cambridge University Press, 2010.

Reference Books

- Jayaraman.J. *Laboratory manual in Biochemistry*, 2nd edition, New Age International Limited publication, 2011.

- Sadasivam.S and Manickam.A *Biochemical Methods*, 3rd edition, New Age International publication, 2008.
- K. Wilson, K. H. Goulding Hodder & Stoughton *Principles and Techniques of Practical Biochemistry*, 3rd edition, 1993.

e-Resources

- http://elte.prompt.hu/sites/default/files/tananyagok/IntroductionToPracticalBiochemistry/book.pdf
- https://www.pinterest.com/pin/746049494494648558/
- https://www.academia.edu/28271882/An_Easy_Guide_for_Practical_Biochemistry

UBCM403 IMMUNOLOGY

Semester : IV **Credit : 6**
Category : Core V **Hours/ Week : 6**
Class & Major : II B.Sc. Biochemistry **Total Hours : 78**

Objectives

To enable the students

- Understand the immunological basis of immune response**.**
- Comprehend about the host defense against infection and over reaction of immune system.

UNIT-I INTRODUCTION **15 Hrs**

Antigen: Property, specificity, cross reactivity, antigenicity, immunogenicity, antigen determinants, haptens, adjuvants, .Antibody: Property, classes & subclasses of Ig: structure specificity & distribution.

UNIT-II LYMPOID ORGANS **16 Hrs**

Primary & Secondary lymphoid organs- Bone marrow, thymus, bursa of fabricus, lymphnode, spleen &MALT. Cells of the lymphoreticular system.

UNIT-III IMMUNITY **16 Hrs**

Types of immunity- Innate & acquired immunity – Active & Passive Immunity, Immune response. Humoral and cell mediated immunity, Immunization schedule, immunity to infection.

UNIT-IV IMMUNE RESPONSE **16 Hrs**

Hypersensitivity reactions- types and mechanism. Autoimmunity.Transplantation-types-allograft rejection mechanism and prevention of graft rejection- immune-suppressive drugs. HLA-immune response genes- HLA molecules.

UNIT-V IMMUNO TECHNIQUES **15 Hrs**

Immunoelectrophoresis, Immunoprecipitation, RIA, ELISA ,Immunoblotting, avidin-biotin mediated immunoassay, immunohistochemistry, monoclonal antibodies & hybridoma techniques.

Text books

- N.Arumugam, *Immunology*, Saras publication, 2007.
- Ananthanarayanan .K &jayaramapanikar, *Text book of microbiology & Immunology*, 8th edition, 2005

Reference books

- RoittIvanna, Jonathan Brastoff, David Nale, *Immunology*, 3rd edition, Blackwel publishing Lit.1993.
- Janis Kuby, *Immunology*, 4th edition, W.H.Freeman and company, 2000
- Peter Delves, Seamusmartin, Dennis burton, Ivanna Rotti, *Essentials of immunology*, 13th edition, wiley Blackwell publication, 2006.

e-Resources

- http://sacema.org/uploads/Essential-Clinical-Immunology.pdf
- http://www.louisbolk.org/downloads/1822.pdf
- https://www.roswellpark.org/sites/default/files/thanavala_9-4 14_innate_immunity_part_1.pdf
- http://www.dphu.org/uploads/attachements/books/books_5451_0.pdf
- http://www.helmberg.at/immunology.pdf

UIDM401 PHARMACEUTICAL CHEMISTRY

Semester : IV **Credit : 6**
Category : Core VI **Hours/ Week : 6**
Class & Major : II B.Sc. Biochemistry **Total Hours : 78**

Objectives

To enable the students

- Understand the ADMET properties of drugs
- Analyze the functional groups responsible for the action of drugs
- Acquire knowledge about drug metabolic pathways, adverse effect and therapeutic value of drugs

UNIT-I INTRODUCTON TO PHARMACEUTICAL CHEMISTRY 15 Hrs

Drugs – definition, source and nature, classification and nomenclature, ADMET - routes of drug administration, absorption and distribution of drugs, factors influencing drug absorption and elimination of drugs. determination of ED50 and LD50 values.

UNIT-II DRUGS AND RECEPTORS 16 Hrs

Drug- Receptor interactions: Receptor- definition, Types of receptor - G-protein coupled receptor, Receptors with intrinsic ion channel and Enzymatic receptors .Forces in drug, receptor theories. Agonist and antagonist of drugs.

UNIT-III DRUG METABOLISM 15 Hrs

Phase I reactions - role of Cytochrome P450.Microsomal and Non microsomal reactions. Phase II reactions-Conjugation reactions. Physiological importance of xenobiotic metabolism.

UNIT-IV DRUGS ACTING ON VARIOUS SYSTEMS **16 Hrs**

Drugs acting on various systems: Respiratory system – cough, bronchial – asthma, pulmonary tuberculosis. CNS-sedative- hypnotic, GI tract drugs for peptic ulcer, diarrhea and constipation. Adverse drug reactions and drug induced side effects, biological effects of drug abuse and drug dependence, drug tolerance and intolerance.

UNIT-V DRUG TESTING **16 Hrs**

Biological testing and bioassays – Invitro and invivo. In-silico using SWISS-PDB. New Biological Targets for Drug Development. Novel Drug Screening Strategies.

Text Books

- K. D. Tripathi, *Essentials of Medical Pharamacology*, 7th edition, Jaypee Publishers, 2010.
- Jayashree Ghosh. *A Textbook of Pharmaceutical Chemistry*, 3rd edition, Jayashree Ghosh, S.Chand & Company Ltd., New Delhi, 2010.
- Donald Cairns ,*Essentials of Pharmaceutical Chemistry*, 4th edition, Pharmaceutical Press, 2012

Reference Books

- Satoskar R.S and Bhandar S.D, *Pharmacology and Pharmacotherapeutics*, 14th edition, 1995.
- Gary Waish, *Biopharmaceuticals: Biochemistry & biotechnology*, 1st edition, John wiley Sons, New York, 1998.
- Bertram Katzung, *Basic and Clinical Pharmacology,* 12th edition, Lange Publishers, 2012.

e- Resources

- www.eso.sankaranethralaya.org/pdf/course_content/pharmacology.pdf
- https://www.omicsonline.org/conference-proceedings/2161-0444-C1-031-010.pdf
- www.meddean.luc.edu/lumen/meded/therapy/homepage/IntroCourse2015_2016.pdf

UBCR401 BIOCHEMICAL TECHNIQUES PRACTICAL II

Semester : IV **Credit : 5**
Category : Core Practical IV **Hours/ Week : 5**
Class & Major : II B.Sc Biochemistry **Total Hours : 65**

Objectives

To enable the students

- Apply the principles of volumetric and electrophoretic techniques in biochemical analysis.
- Develop technical competence.

VOLUMETRIC ANALYSIS

1. Estimation of amino acids by Sorenson formal titration method.
2. Estimation of ascorbic acid by Titrimetric method
3. Determination of Saponification value, Iodine value and Acid number using edible oil.
4. Estimation of reducing sugar by Benedict's method.
5. Estimation of chloride by Mohr's method.

ELECTROPHORETIC TECHNIQUE (DEMONSTRATION)

1. Separation of proteins by SDS PAGE.

Text Book

- David T.Plummer, An *introduction to practical biochemistry*, 3rd edition, Mc Graw Hill, London, 1987.

Reference Books

- J.Jayaraman, *Laboratory mamual in biochemistry*, 2nd edition, New Age international limitated publication.
- Sadasivam.S and a.manickam, *Biochemical methods,* 3rd edition, New Age International Limited publication, 2008.

e-Resources

- http://elte.prompt.hu/sites/default/files/tananyagok/IntroductionToPracticalBiochemistry/book.pdf
- https://www.pinterest.com/pin/746049494494648558/
- https://www.academia.edu/28271882/An_Easy_Guide_for_Practical_Biochemistry

UBCP501 PROJECT

Semester : IV **Credit : 1**
Category : Core XV **Hours/ Week : 2**
Class & Major : III B.Sc Biochemistry **Total Hours : 26**

Objectives

To enable the students

- Acquire knowledge in life science research.
- Develop problem solving and decision making skills.

Guidelines

- Mini project is offered for final year B.Sc Biochemistry students in semester VI.
- Project can be done according to area of interest outside the class hours.
- Project should done either as individual or as group with maximum of three /four students.
- Project can be field study, survey, experimentation, extraction of components from medicinal plants and waste water treatment.
- Evaluation scheme for the project will be Internal 60 and External 40.

Assessment

S.No	Internal		External	
	Component	**Marks**	**Component**	**Marks**
1	Review of the Literature	10	Dissertation	10
2	Area of Research	10	Presentation	20
3	Methodology	10	Viva - voce	10
4	Accuracy of result	10		-
5	Result and Discussion	10		-
6	Report preparation	10		-
	Total	**60**		**40**
	Maximum marks	**100**		

III & IV EVALUATION COMPONENTS OF CIA

Semester	Category	Course Code	Course Title	Component III	Component IV
III	Core IV	UBCM304	Biochemical Techniques	Model preparation	Seminar
	Core Practical III	UBCR301	Biochemical Techniques Practical I	DPA	Viva Voce
IV	Core V	UBCM403	Immunology	Poster presentation	Seminar
	Core VII	UIDM401	Pharmaceutical Chemistry	Assignment	Seminar
	Core Practical IV	UBCR401	Biochemical Techniques Practical II	DPA	Viva Voce

PROGRAMME PROFILE M.Sc. (Bio Chemistry)

PSO1: Acquire the scientific basis of life process and orientation towards the application of knowledge in solving clinical problem.

PSO2: Enhance student's skills & employability through academic, research and internship opportunities (PG service learning).

PSO3: Exposure to basic research through the provision of PG research project.

PSO4: Development of analytical and cognitive skills in Biochemistry that allow independent exploration of biological science through research methods.

PSO5: Explore the impact of life science in society.

PSO6: Analyse & interpret the investigation data in life science.

Semester	Category	Course code	Course title	Contact Hours / Week	Credit	
					Min	Max
I	Core I	PBCM101	Bimolecular Chemistry	6	4	4
	Core II	PBCM102	Cell Biology	6	4	4
	Core III	PBCM203/105	Microbiology	6	5	5
	Core IV	PBCM204/106	Molecular Biology	6	4	4
	Core Practical I	PBCR201/102	Microbiology and Molecular Biology Practical	6	5	5
			TOTAL	**30**	**22**	**22**
II	Core V	PBCM201	Metabolism & Regulation	5	4	4
	Core VI	PBCM202	Human Physiology	5	4	4
	Core VII	PBCM103/205	Analytical Biochemistry	5	4	4
	Core VIII	PBCM104/206	Endocrinology	4	4	4
	Core Practical II	PBCR101/202	Analytical Biochemistry Practical	6	5	5
	Core IX	PBCX201	Mushroom cultivation (Service Learning)	-	1	1
	NME			5	4	4
			TOTAL	**30**	**26**	**26**
III	Core X	PBCM301	Enzymology and Enzyme Technology	6	5	5
	Core XI	PBCM303	Immunology	6	5	5
	Core XII	PBCM304	Research Methodology in Biochemistry	5	4	4
	Core Practical III	PBCR301	Enzymology & Clinical Diagnostics	6	5	5
	Core XVI	PBCP401	Project	2	-	-
	Core XIII	PBCI301	Plant Biochemistry& Pharmaceutical chemistry	5	4	4
			TOTAL	**30**	**23**	**23**
IV	Core XIV	PBCM401	Genetics & Genetic Engineering	6	5	5
	Core XV	PBCM402	Clinical Biochemistry	6	5	5
	Core XVI	PBCP401	Project	18	9	9
			TOTAL	**30**	**19**	**19**
			GRAND TOTAL	**120**	**90**	**90**

COURSES OFFERED TO OTHER DEPARTMENTS

NON MAJOR ELECTIVES

Semester	Category	Course code	Course Title	Contact Hours/ Week	Credit	
					Min.	Max.
II	Non major elective	PBCE101/201	Pharmaceutical Biochemistry	5	4	4
		PBCE102/202	Reproductive Biology & Disorders			
		PBCE103/203	Modern Life style associated diseases			

PBCM301 ENZYMOLOGY & ENZYME TECHNOLOGY

Semester : III **Credit : 5**
Category : Core X **Hours/ Week : 6**
Class & Major : II M.Sc. Biochemistry **Total Hours : 78**

Objectives
To enable the students

- Understand the properties and importance of enzymes and its action in biochemistry
- Interpret the role of enzymes in disease diagnosis and therapeutic measures.

UNIT - I ENZYME AS BASIS OF LIFE **15 Hrs**

Enzyme as biocatalyst, Properties, factors affecting enzyme activity, Types of Specificity, Enzyme turnover. Fundamentals of enzyme assay – enzyme Units, coupled kinetic assay, Enzyme localization. Nomenclature and classification of enzymes according to IUB. Monomeric enzyme – chymotrypsin, Typsin and carboxy peptidase. Oligomeric enzymes – Isoenzymes – LDH.

UNIT - II MECHANISM OF ENZYME ACTIVITY **16 Hrs**

Active site, Lock and key theory, induced fit model. Collision & transition state theories. Mechanism of catalysis: Proximity and orientation effects, general acid-base catalysis, concerted acid - base catalysis, nucleophilic and electrophilic attacks, catalysis by distortion, metal ion catalysis. Theories on mechanism of catalysis. Coenzymes - mechanism and action of TPP, coenzyme A, NAD, FAD.

UNIT – III KINETICS OF ENZYME ACTION **15Hrs**

Definition and Importance, quantitative analysis of Single substrate - Michaelis-Menten equation. Determination & significance of Km & Vmax. Importance of Kcat/Km. Determination of Ki. Line – Weaver Burk Plot, Edie Hoftee and Hanes plot. Ping pong and random ordered mechanisms.

Inhibition**-** Competitive, non – competitive and uncompetitive and mixed inhibition, their kinetic differentiation. Determination of inhibition constant from MM equation.

UNIT - IV ENZYME REGULATION **16 Hrs**

Enzyme Regulation–General mechanisms of enzyme regulation, Homologous interaction – Oxygen – haemoglobin interaction, Heterologous interaction – aspartate carbonyl transferase. Co-Operativity and Non- Cooperativity Significance of positive and negative kinetic Co-Operativity. Regulation of allosteric regulation – feedback regulation, sequential and concerned feedback, Enzyme induction and Repression. Enzyme multiplicity.

UNIT - V ENZYME TECHNOLOGY **16 Hrs**

Isolation and fractionation of enzymes – classical methods of purification and crystallization - separation based on molecular size, electric charge, solubility difference and selective adsorption. Enzyme Immobilization- properties,method and its applications . Advantages and disadvantages of immobilized enzyme. Application of Immobilized enzyme. Enzyme engineering – artificial enzyme and its synthesis. Industrial, diagnostic and therapeutic

applications of enzymes. Biosensors - glucose oxidase, cholesterol oxidase, urease and antibodies as biosensors. Abzymes and ribozymes.

Text books

- Trevor Palmer, Philip Bonner *Enzymes: Biochemistry, Biotechnology, Clinical Chemistry* 2nd edition, Horwood Publishing Limited, 2007
- Dixon and Webb, *Enzymes*, 3rd edition, Academic Press, New York, 2000.

Reference books

- E.S. West, W.R. Todd, H.S. Mason and J.T. van Bruggen, *A Text Book of Biochemistry,* 4th edition*,* Oxford and IBH Publishing Co., New Delhi, 2000
- Nicholas C. Price, Lewis Stevens, and Lewis Stevens, *Fundamentals of Enzymology: the Cell and Molecular Biology of Catalytic Proteins*, 3rd edition, Oxford University Press, USA, 2000.
- David L. Nelson Michael M. Cox Lehninger *Principles of Biochemistry*, W. H. Freeman; 4th edition, 2004.

e-Resources

- https://storeiyta.firebaseapp.com/.../enzymes-biochemistry-biotechnology-clinical-che.
- https://quacktradition4ahz.files.wordpress.com/.../fundamentals-of-enzymology-the-ce.

PBCM303 IMMUNOLOGY

Semester : III **Credit : 5**
Category : Core XI **Hours/ Week : 6**
Class & Major : II M.Sc. Biochemistry **Total Hours : 78**

Objectives

To enable the students

- Understand the structure, functions and integration of immune system.
- Obtain knowledge about the antigen-antibody interactions.
- Illustrate the engineered antibodies used for treating most of the human diseases.

UNIT –I INTRODUCTION **15 Hrs**

Introduction: Terminologies –History of Immunology –Immunohematology, Blood groups, Blood transfusion –Rh –incompatibilities –immunity –types of immunity –innate and acquired. Immune systems: Anatomy of lympho-recticular system –Primary lymphoid organ. Secondary lymphoid tissue –cells of the immune system –detailed aspects of T and B cells – receptors –activation and function.

UNIT –II ANTIGEN –ANTIBODY REACTIONS **16 Hrs**

Antigens: Types, properties, haptens – adjuvants, toxoids antitoxins, Immunoglobulins – structure types and properties. Theories of antibody production. Antigen –antibody reactions – in vitro methods; Agglutination –Precipitation, Complement fixation, Immuno fluorescence, ELISA, RIA, in vivo methods.

UNIT –III IMMUNOLOGICAL DISORDERS **16 Hrs**

Autoimmunity - Autoimmune diseases – pathogenesis - treatment. Immunodeficiency disorders-B cell deficiencies, T cell deficiencies, secondary immunodeficiency diseases-pathogenesis, diagnosis and treatment of AIDS. Immunization practices- active and passive immunization.

UNIT –IV HYPERSENSITIVITY REACTIONS **15 Hrs**

Hypersensitivity reactions –antibody mediated, Type I anaphylaxis, Type II –Antibody dependent cell cytotoxicity, Type III – immune complex reactions –respective diseases and immunologic methods of diagnosis –cell mediated immune responses –Lymphokines, Cytokines. Type IV –Hypersensitivity reactions, MHC and transplantation.

UNIT –V HYBRIDOMA TECHNOLOGY **16 Hrs**

Basic principles of Hybridoma technology. Monoclonal antibody (MoAb) production and application. Purification and characterization of of MoAbs. Characterization of MoAbs. Labeling of Antibodies. Complement system -components-classical and alternative pathway.

Text books

- Kuby, Richard A, Goldsby et al. *Immunology*, 4th ed., WH Freeman & Co. 2003.
- Abul Abbas, Andrew Lichtman, and Jordan Pober *Cellular and molecular immunology*, W. B. Saunders, fourth edition, 2000.
- Ivan Roitt, Jonathan Brostoff, and David Male *Immunology* Mosby, London. 6th edition, 2001.

Reference books

- Charles Janeway, Jr. and Paul Travers, *Immunobiology - the immune system in health and disease,* 5th edition, Garland Publishing, Inc. 2001.
- H. C. Gooi & Helen Chapel, *Clinical Immunology:* A PRACTICAL APPROACH. IRL Press at Oxford University, 1991.

e-Resources

- https://www.mh-hannover.de/.../manipulating_the_immune_system_for_therapeutic.p..
- sacema.org/uploads/Essential-Clinical-Immunology.pdf
- www2.nau.edu/~fpm/immunology/lectures/Chap.03-09.pdf

PBCM304 RESEARCH METHODOLOGY IN BIOCHEMISTRY

Semester	**: III**	**Credit**	**: 4**
Category	**: Core XII**	**Hours/Week**	**: 5**
Class & Major	**: II M.Sc. Biochemistry**	**Total Hours**	**: 65**

Objectives

To enable the students

- Understand about basic tools and techniques involved in research.
- Introduce the concept of statistical tools for data analysis in scientific research.

UNIT- I FUNDAMENTALS OF RESEARCH 13Hrs

Research-Meaning, Objectives & Motivation. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method –Understanding the language of research –Concept, Construct, Definition, Variable. Research Process. Problem Identification & Formulation –Research Question–Investigation Question –Measurement Issues –Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing –Logic & Importance.

UNIT- II RESEARCH AND EXPERIMENTAL DESIGN 13 Hrs

Research Design: Concept and Importance of Research – Features of a good research. Types and concepts of research design – Exploratory, Descriptive, Qualitative and Quantitative.

UNIT- III MEASUREMENT SAMPLING AND DATA ANALYSIS 13 Hrs

Measurement: Concept & Problems in research –Validity and Reliability. Levels of measurement (Nominal, Ordinal, Interval, Ratio). Sampling – Types and statistics of Simple, Random, Systematic, Stratified Random & Multi-stage. Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association. **ANOVA and Duncan's multiple range tests*.**

UNIT- VI TOOLS / TECHNIQUES FOR RESEARCH 13 Hrs

Databases for Biological Science Discipline.FASTA, BLAST ,EMBL net, DDBJ and NCBI. Protein sequence databases; primary databases SWISS – PROT, TrEMBL, NRL-3D. Secondary Databases; PRO SITE, PROFILES, PRINTS, Pfam, BLOCKS and IDENTITY. Composite protein databases.

UNIT- V THESIS WRITING AND PAPER PUBLICATION 13 Hrs

Thesis writing-Introduction, Review of literature, materials and methods, Interpretation of results, Summary and Conclusion, Bibliography, Acknowledgement. Interpretation of Data and Paper Writing –Layout of a Research Paper, Journals in biological science, Impact factor of Journals, Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

Text Books

- Panneerselvam, *Research Methodology*, 1st edition R, Prentice hall of India, New Delhi, 2004.
- Kothari CR, *Research Methodology – Methods and techniques*, 2nd edition, New Wiley Eastern ltd., Delhi, 2009.

Reference Books

- Donald Cooper & Pamela Schindler, *Business Research Methods*, TMGH, 9th edition, 2013
- Alan Bryman & Emma Bell, *Business Research Methods*, 4th edition, Oxford University Press, 2015.
- P.Saravanavel, *Research Methodology*, 14th edition, JBA publishers, 2003.

e-Resources

- gent.uab.cat/diego_prior/sites/.../02_e_01_introduction-to-research-methods.pdf

- https://www.heacademy.ac.uk/system/files/msor.3.1s.pdf
- 164.100.133.129:81/econtent/Uploads/Research_Methods.pdf

PBCR301 ENZYMOLOGY & CLINICAL DIAGNOSTICS

Semester	**: III**	**Credit**	**: 5**
Category	**: Core Practical III**	**Hours/Week**	**: 6**
Class & Major	**: II M.Sc. Biochemistry**	**Total Hours**	**: 78**

Objectives

To enable the students

- Acquire knowledge on various biochemical tests involved in clinical diagnosis.
- Examine marker enzymes during pathological conditions.

ENZYMOLOGY

1. Assay of Salivary Amylase enzyme.
2. Effect of substrate concentration on enzyme activity (Salivary Amylase) and determination of Km value.
3. Effect of inhibitor on activity of Salivary Amylase.
4. Assay of lactate dehydrogenase (LDH).
5. Effect of pH on enzyme activity (Acid phosphatase/Alkaline phosphatase).
6. Effect of temperature on enzyme activity (ACP/ALP)

CLINICAL DIAGNOSTICS

Estimation of: (from blood/plasma/serum/urine)

1. Glucose by GOD-POD Method
2. Protein estimation by Biuret method
3. Triglycerides GPO/POD by kit method
4. Cholesterol by Zak and Zaltsky Method
5. HDL estimation
6. Calcium (Ca) by OCPC Method
7. Iron (Fe) by Dipyridyl Method
8. Copper (Cu) by Dithiocarbonate Method
9. Phosphorus (P) by Fiske- Subbaraow Method
10. ELISA

Text Books

- David T. Plummer, *An Introduction to practical Biochemistry,* 3rd edition, 1999.
- J.Jayaraman, *Laboratory Mannual in Biochemistry*, 4th edition, New Age international limited publication, 1992.
- Subodh, R, Saxena, *Medical Biochemistry*, 8th edition, Black printers, New Delhi, 2014.

- Shaun C A Anderson, Suncokayne S A, *Clinical Chemistry concepts and applications*, revised edition, CBS Publishers New Delhi, 2015.
- Ambika shanmugam, *Fundamentals of Biochemistry for Medical Students*, 8th edition, LWW India publishing house. 2012.

Reference Books

- Pattabiraman, Laboratory *Mannual in Biochemistry*, 2nd edition, 1994.
- Singh .S.P. *Practical Mannual of Biochemistry,* 6th edition, CBS Publication 2006.
- Harold Varley, *Practical Clinical Biochemistry*, 4th edition, CBS Publishers, New Delhi, 2005.

e-Resources

- https://www.worldcat.org/title/practicalenzymology/oclc/827358447/
- https://www.worldcat.org/title/practical-enzymology/oclc/1080648481/
- https:// Ferris-Clinical-Advisor-2020-Book ebook/dp/B07VM97C5X/
- https:// Ferris-Clinical-Advisor-2019-Solutions-ebook/dp/B07DL6VH6J/
- https:// Ferris-Clinical-Advisor-Elsevieron-VitalSource ebook/dp/B00Z5KE8T4/

PBCI301 PLANT BIOCHEMISTRY & PHARMACEUTICAL CHEMISTRY

Semester : III **Credit : 4**
Category : Core XIII **Hours/Week : 5**
Class & Major : II M.Sc. Biochemistry **Total Hours : 65**

Objectives

To enable the students

- Identify the Biochemical pathways in plants.
- Analyze the emerging problems in the development on innovative practices
- Stimulate individual creativity and work in multidisciplinary teams

UNIT- I PLANT CELL AND PHOTOSYNTHESIS 13 Hrs

Structure of plant cell. Photosynthesis: Chloroplast- structure and function; Photosynthetic pigments and light harvesting complexes .Photo system I & II. Photosynthetic electron transport and photophosphorylation. Calvin cycle (C3 plants), Hatch slack pathway (C4 plants), Crassulacean acid metabolism.

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UNIT – II PLANT RESPIRATION AND METABOLISM 13 Hrs

Plant respiration: Cyanide sensitive and insensitive respiration., Nitrogen metabolism: Physical and biological nitrogen fixation, Ammonification, Nitrification, Denitrification Symbiotic nitrogen fixation and its regulation. nitrogenase system, nitrate reductase . Sulphur metabolism : Sulphate activation, Reduction of active sulphate, Oxidation of inorganic sulphur, incorporation of sulphur into amino acids.

UNIT- III PLANT TISSUE CULTURE AND HORMONES 13 Hrs

Plant tissue culture: Plant cell organs and embryo culture, anther culture, somaclonal variation, protoplast isolation, fusion and culture of protoplasts, Application of plant tissue

culture. Plant Hormones: Biosynthesis, Physiological effects and mechanism of action of Auxins, Gibberellic acids, Cytokinins, Abscisic acid, Ethylene, Brassinosteroids and Polyamines.

UNIT- IV PHARMACEUTICAL CHEMISTRY - I **13 Hrs**

Introduction to Pharmaceuticals, Historical development, Classification and Nomenclature of drugs, Sources of drugs, Dosage forms and routes of administration, mechanism of action, Combined effect of drugs, Factors modifying drug action, tolerance and dependence, Pharmacogenetics. Absorption, Distribution, Metabolism and Excretion of drugs.

UNIT – V PHARMACEUTICAL CHEMISTRY - II **13 Hrs**

Principles of Basic and Clinical pharmacokinetics, Adverse Drug Reactions and treatment of poisoning, ADME drug interactions, Bioassay of Drugs and Biological Standardization, Discovery and development of new drugs. Agonist & antagonists, Anesthetics, Narcotic and Synthetic non-narcotic drugs.

Text books

- Taiz & Ziger, *Plant physiology,* 5th edition, Sinauer associates, 2012.
- Donald J. Abraham, *Burger's Medicinal Chemistry*, John Wiley & Sons N.Y., 6th edition, 2010.
- Slater A, NW Scott, MR Fowler. *Plant biotechnology*, 2nd edition, Oxford University Press, 2008
- Wilson and Gisvold's *Text Book of Organic Medicinal and Pharmaceutical Chemistry*, 12th edition, EdBeale Jr., J.M., Block, J.H. 2012.

Reference books

- William Hopkins & Norman P. A. Huner, *Introduction of Plant Physiology*, Wiley 4th edition, 2008.
- Buchanan, *Biochemistry and molecular Biology of plant*, Wiley 2nd edition, 2015.
- Wilson and Griswold, *Text book of organic medicinal and pharmaceutical chemistry,* 12th edition, J.B. Lippincoff cam, 2010.

e-Resources

- www.routeetvies.fr/medias/.../1-plant-biotechprinciples-techniques-and-applications1.pd...
- https://faculty.psau.edu.sa/filedownload/doc-10-pdf-9e7f111f15db1aa3830cd806660.
- https://downloads.lww.com/wolterskluwer_vitalstream_com/.../frontmatter.pdf
- https://www.researchgate.net/publication/304284875_organic_medicinal_chemistry

PBCM401 GENETICS AND GENETIC ENGINEERING

Semester : IV **Credit : 5**
Category : Core XIV **Hours/ Week : 6**
Class & Major : II M.Sc Biochemistry **Total Hours : 78**

Objectives
To enable the students

- Understand the concept of Mendelian genetics and applications of genetic engineering.
- Acquire knowledge about all basic techniques of gene cloning right from DNA in plants and animals.
- Provide knowledge about intellectual property rights across the world

UNIT – I BASICS OF GENETICS **16 Hrs**

History of Genetics Mendelian principles of inheritance – Dominance, codominance, incomplete dominance, segregation, Multiple alleles, Multiple genes.

UNIT – II GENE INHERITANCE **15 Hrs**

Interaction of genes.Patterns of Inheritance – Autosomal inheritance, Sex-linked inheritance, Cytoplasmic inheritance.

UNIT – III VECTORS AND GENE CLONING **16 Hrs**

Enzyme uses in genetic engineering – Restriction endonucleases, restriction digestion, mapping, ligation, Cloning vectors -- Desirable properties of vectors – Prokaryotic & Eukaryotic Expression Systems (Constitutive & Inducible). Plasmid Vectors - Phage Vectors - Cosmids -- Phagemids - BACs - Yeast Vectors - YACs - Lentiviral Vectors -- Adenoviral Vectors – Plant Vectors - Insect Vectors.

UNIT – IV GENE TRANSFER METHODS **16 Hrs**

Methods of gene recombination - Bacterial Conjugation, Transformation, Transduction. Gene transfer methods - Microinjection, Electroporation, Microprojectile, Shot Gun method, Ultrasonication, Liposome fusion. Competence, identification of transformed colonies/clones – Blue white screening, DNA sequencing. cDNA Library

UNIT – V APPLICATIONS OF GENETIC ENGINEERING **15 Hrs**

Genetic engineering in animals - Production of transgenic mice, Therapeutic products produced by genetic engineering- plasma proteins, human hormones, Genetic engineering in plants: Use of *Agrobacterium tumefaciens* and *A.rhizogenes*, Ti plasmids, Strategies for gene transfer to plant cells – Herbicide resistant, Drought tolerant, pest resistant, salt tolerant transgenic plants and related ethical issues.

Text books

- Satyanarayana U, *Biotechnology*, 2nd edition, Books & Allied (P) Ltd, 2008.
- Bernard R. Glick, Jack J. Pasternak, and Cheryl L. Patten, *Molecular biotechnology: Principles and applications of recombinant DNA,* 4th edition, By ASM press. 2010
- Singh. K., "*Intellectual property rights on Biotechnology*", Springer, 7th edition, 2015
- R.C.Dubey, *A text book of Biotechnology*, 5th revised edition, S.Chand Publications, 2014

Reference books

- J. Sambrook, E.F. Fritsch and T. Maniatis, *Molecular Cloning: a Laboratory Manual,* , 3rd edition, Cold Spring Harbor Laboratory Press, New York, 2000
- Brown, T.A, "*Gene Cloning and DNA Analysis*- An Introduction, 6th edition, John Wiley & Sons, 2010
- Strickberger. M.W., "*Genetics"*, 3rd edition, Pearson India, 2015.

e-Resources

- https://www.academia.edu/.../Molecular_BiochemistryBernard_R._Glick_Jack_J._Paste
- https://edisciplinas.usp.br/.../1/MolecularBiologyOfTheCell5th.Ed-pag579+37.pdf
- datalake.neurai.io/biotechnology_and_intellectual_property_rights_legal_and_social_...
- https://en-us.technetix.com/molecular_cloning_a_laboratory_manual_download.pdf

PBCM402 CLINICAL BIOCHEMISTRY

Semester : IV **Credit : 5**
Category : Core XV **Hours/ Week : 6**
Class & Major : II M.Sc Biochemistry **Total Hours : 78**

Objectives

To enable the students

- Acquire in-depth knowledge on diseases and disorders.
- Interpret the causes to identify the diseases at early stage.
- Identify target oriented therapies.

UNIT- I GOOD CLINICAL LAB PRACTICES **15 Hrs**

Importance of automation in clinical biochemistry. Good Clinical Practices: Basics and principles. Selection of Instruments, Quality assurance, maintenance of quality control programme.

UNIT- II ACID BASE BALANCES **16 Hrs**

Acid base balance - coagulation of blood pH within normal range disturbances in acid base balance - acidosis, alkalosis, mixed disturbances - laboratory parameters - blood gas analysis. Fluid and electrolyte balance - regulation - disturbances of fluid and electrolyte balance - laboratory parameters in the diagnosis and management of fluid and electrolyte disorders - oral rehydration therapy.

UNIT - III METABOLIC DISORDERS **16 Hrs**

Diabetes mellitus, Hypo & Hypercholesterolemia. Inborn errors of metabolism: a) Disorders of amino acid metabolism- Tyrosinemia, phenylketonuria, alkaptonuria b) Disorders of nucleic acid metabolism- Disorders in purine/ pyrimidine metabolism. Bone marrow disorders.

UNIT- IVEVALUATION OF ORGAN FUNCTION TESTS & PRENATAL DIAGNOSIS **15 Hrs**

Gastric function tests, Liver function tests, renal function test, lung, heart and pancreatic disorder.

UNIT - V CLINICALLY IMPORTANT HORMONES & MARKERS **16 Hrs**

Thyroid diseases – hormones and markers, Menstrual disorders – hormones and markers, Tumor markers.

Text books

- C.A.Burtis & Ashwood Teitz, *Fundamentals of Clinical Chemistry,* 6th edition, W. B. Saunders company, 2005

- David Plummer, *Practical Biochemistry,* 3rd edition, Tata McGraw- Hill, 2000.
- Harrison T.R. Fauci, Braunwald, Isselbacher*, Principles of Internal Medicine*, 14th edition, MC-graw hill, Newyork. Volume I and II 2015

Reference books

- Thomas Devlin, Text book of *Biochemistry with clinical correlation,* 7th edition, John Wiley and Sons, 2000.
- William J. Marshall & Stephen K. Angert, *Clinical Biochemistry – Metabolic concepts and Clinical aspects,* 3rd edition, Churchill Livingstone, 2002.
- P. D. Mayne, A. Hodder, *Clinical chemistry in diagnosis and treatment,* Arnold publication, 6th revised edition, 1994.

e-Resources

- www.raftmaster.org/tietz_textbook_of_clinical_chemistry_and_molecular_diagnostics.
- https://www.academia.edu/35117679/_U_Satyanarayana_Biochemistry

III & IV EVALUATION COMPONENTS OF CIA

Semester	Category	Course Code	Course Title	Component III	Component IV
III	Core X	PBCM301	Enzymology & Enzyme Technology	Poster presentation	Seminar
	Core XI	PBCM303	Immunology	Poster presentation	Seminar
	Core XII	PBCM304	Research Methodology	Assignment	Seminar
	Core XIII	PBCI301	Plant Biochemistry & Pharmaceutical Chemistry	Assignment	Seminar
	Core Practical III	PBCR301	Enzymology & Clinical Diagnostics	DPA	Viva Voce
IV	Core XIV	PBCM401	Genetics And Genetic Engineering	Assignment	Seminar
	Core XV	PBCM402	Clinical Biochemistry	Case study	Seminar